ENVIRONMENTAL ASSESSMENT

SOUTHEAST LOUISIANA (SELA)
URBAN FLOOD CONTROL PROJECT

W-14 DRAINAGE CANAL, SLIDELL AREA

ST. TAMMANY PARISH, LOUISIANA

EA # 409

INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, New Orleans District (CEMVN), has prepared this Environmental Assessment # 409 (EA # 409) to evaluate the potential impacts associated with the proposed design modifications and maintenance of flood damage reduction features described in the St. Tammany Parish, Louisiana Reconnaissance Study dated July 1996. The proposed action is located near New Orleans, Louisiana, in the City of Slidell, along the W-14 Canal drainage basin, which is north of Lake Pontchartrain, south of Interstate Highway 12, east of U.S. Highway 11, and west of Interstate Highway 10 (figure 1).

EA #409 has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality's Regulations (40 CFR §1500-1508), as reflected in the USACE Engineering Regulation, ER 200-2-2. The following sections include a discussion of the purpose and need for the proposed action, the authority for the proposed action, alternatives to the proposed action, important resources affected by the proposed action, and the environmental consequences of the proposed action.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action is to reduce the risk of flooding to human life and economic infrastructure within the W-14 Canal drainage basin, in the City of Slidell, in southeast Louisiana. The western portion of the Slidell area floods primarily from heavy rainfall and the inability of the existing drainage network to handle the resulting flows. The eastern portion of the Slidell area floods primarily from high water stages in the nearby Pearl River. Major flooding has occurred in the Slidell area due to heavy rainfall events, tropical storms, hurricanes, and high water stages on the Pearl River. On 29 August 2005, Hurricane Katrina caused major damage to the Federal and non-Federal flood control and the Hurricane and Storm Damage Risk Reduction System (HSDRRS) in southeast Louisiana. Hurricane Rita followed this storm on 24 September 2005, and made landfall on the Louisiana-Texas state border, causing major damage to the HSDRRS in south Louisiana. Since these hurricanes, the CEMVN has been working with state and local officials to restore the Federal and non-Federal flood control and HSDRRS projects and related works in affected areas.

Figure 1. Slidell, Louisiana and vicinity

AUTHORITY FOR THE PROPOSED ACTION

The Southeast Louisiana (SELA) Flood Control project was authorized by the Fiscal Year 1996 Energy and Water Development Appropriations Act, Public Law 104-46 (Section 108) and the Water Resources Development Act of 1996, Public Law 104-303 (Section 533). The Acts states that the Secretary shall proceed with engineering, design, and construction of projects to provide for flood control and improvements to rainfall drainage systems in Jefferson, Orleans, and St. Tammany Parishes, Louisiana.

PRIOR REPORTS

A report entitled, "St. Tammany Parish, Louisiana, Reconnaissance Study," was prepared by the CEMVN in July 1996. This document presents the findings of a reconnaissance-level investigation of rainfall flooding associated with storm water runoff and high tides in St. Tammany Parish, Louisiana. The study investigated possible solutions to prevent flooding in St.

Tammany Parish, including diversion of flood waters; retention/detention basins; channel enlargement; removal of channel obstructions; flood control structures; and other non-structural measures such as raising houses. This report is herein incorporated by reference.

PUBLIC CONCERNS

Prevention of flood and damage caused by heavy rainfall and the inability of the existing drainage network to handle the resulting flows is a great concern to the public in St. Tammany Parish, Louisiana. Hurricanes Katrina and Rita forced most St. Tammany Parish residents from their homes and, due to extensive flooding, made returning to their homes in a timely manner unsafe.

Additional concerns have been expressed about impacts to wetlands and aquatic ecosystems as well as noise impacts to nearby residents from construction activities.

DESCRIPTION OF THE PROPOSED ACTION

The project includes improving approximately 4.1 miles of the existing W-14 Canal by widening the existing canal and lowering its existing invert elevation to improve flood flow capacity, excavating two new detention ponds with overflow weirs, expanding an existing pond, installing culverts, replacing three existing bridges, and constructing a new pump station (figure 2, with detailed maps in the appendix). A detailed description of each project feature follows:

- Improvements to the existing canal would include the installation of a 30-foot wide, rectangular concrete "U" framed channel from the downstream side of the North Boulevard bridge to the upstream side of the Robert Road box culvert (approx 4,700 feet in length).

- Improvements to an existing detention pond located on the west side of Robert Road that receives water from the W-14 Canal during high water. Improvements to this existing pond include deepening it to an invert elevation of +1.5 feet and enlarging it from 19.6 acres to 31.3 acres. A lateral broad-crested weir would be constructed to connect the W-14 Canal to the pond. The weir would have a top elevation of 10.5 feet and a length of 100 feet. The pond would be drained by one 24-inch reinforced concrete pipe (RCP) that would be approximately 25 feet in length with an invert elevation of +1.5 feet. The excavation required for the pond would be approximately 217,400 cubic yards.

- Excavation of a 3.1 acre detention pond on the east side of Robert Road, deepening it to an invert elevation of +0.5 feet. A lateral broad-crested weir would be constructed to connect the W-14 Canal to the pond. The weir would have an approximate top elevation of 9.5 feet and a length of 50 feet. The pond would be drained by one 24-inch RCP that would be approximately 35 feet in length with an invert elevation of +0.5 feet. The excavation required for the pond would be approximately 60,800 cubic yards.

- Improvements to the existing canal would include the installation of a 45-foot wide, rectangular concrete "U" framed channel from the downstream side of the Robert Road box culvert to the upstream side of Fremaux Avenue (approx 6,435 feet in length).

- Replacement of the existing Independence Drive bridge would include the removal of the existing bridge and installation of a new clearspan bridge with vertical wall and a 45-foot wide opening.

- Replacement of the existing Florida Avenue bridge would include the removal of the existing bridge and installation of a new clearspan bridge with vertical wall and a 45-foot wide opening.

- Improvements to the existing canal would include the clearing and de-snagging of the existing canal of vegetation, trees, and debris (figures 3 and 4) and reshaping the existing canal to a trapezoidal section having a 10-foot bottom width with 3H:2V side slopes from the downstream side of Fremaux Avenue to the upstream side of the Daney Street bridge (approx 2,960 feet in length).

- Replacement of the existing Cousin Street bridge would include the removal of the existing bridge and installation of a new clearspan bridge. The channel type is a trapezoidal section having a 10-foot bottom width with 3H:1V side slopes. The new bridge construction would include concrete wingwalls from the bridge to the channel.

- Excavation of an 18 acre detention pond just north of Daney Street and east of the existing W-14 Canal, thus deepening it to an invert elevation of -3.5 feet. A lateral broad-crested weir would be constructed to connect the W-14 Canal to the pond. The weir would have a top elevation of +4.5 feet and a length of 100 feet. The pond would be drained by one 24-inch RCP that would be approximately 65 feet in length with an invert elevation of -3.5 feet. The excavation required for the pond would be approximately 182,600 cubic yards.

- Two new detention ponds to be located south of the existing Daney Street bridge, known as the Upper and Lower Ponds, as part of a current property development proposal by Slidell Development Company, LLC. A Section 404 Regulatory permit dated 8 April 2008, issued to Slidell Development Company, LLC, includes these two ponds as part of a multi-commercial and residential development. The ponds would provide storage areas for the overflow of the W-14 Canal during high water events.

- Improvements to the existing canal would include the clearing and de-snagging of the existing canal of vegetation, trees, and debris and reshaping the existing canal to a trapezoidal section with a 20-foot bottom width with 3H:1V side slopes from the downstream side of the Daney Street bridge to the upstream side of the Interstate Highway 10 bridge (approx 6,400 feet in length).

- Installation of a gated pump station located approximately 1 mile east and downstream of the Interstate Highway 10 bridge. The pump station would allow the passage of ordinary flows

- Restoration measures would be implemented to reduce visual impacts by replanting trees and other vegetation to as near pre-project conditions as practicable.

Material removed during excavation operations to modify the shape of the W-14 Canal, detention ponds, and the pumping station would be beneficially used to create approximately 100 acres of brackish marsh at the Big Branch Marsh National Wildlife Refuge (NWR) in St. Tammany Parish, Louisiana (figure 5). Approximately 750,000 cubic yards of material would be excavated and hauled by trucks to an offloading site off of U.S. Highway 11. Two options are available for the off-loading site, one of which would be selected during the project design phase. In option 1, a board access road would be installed and removed after construction. In option 2, the existing access road would need some improvement with rock placement to accommodate the heavy equipment.

Approximately 1 acre of brackish marsh would be mechanically cleared and grubbed to construct an off-loading site in order to provide an area for heavy equipment operations and for stockpiling the excavated material. In addition, approximately 5 to 6 acres of Big Branch Marsh NWR would be cleared and grubbed for the temporary pipeline corridor. This corridor is predominantly open water area, to minimize disturbing existing marsh. Some excavation may be necessary along the pipeline route to float or drag it through the corridor area. An earthen containment dike would be constructed to restrict the material from free-flowing into the open water area. The material would be deposited via hydraulic dredge into shallow open water areas designated within Big Branch Marsh NWR at an elevation conducive to marsh establishment. At the marsh development site, the material would be placed at an initial elevation of +5 feet NAVD 88 (North American Vertical Datum of 1988, 2004.65). The pumped sediments would consolidate to a final design elevation between +1 to +3 feet NAVD 88. Seed planting of smooth cordgrass (*Spartina alterniflora)* and wiregrass (*S. patens)* would be conducted after construction to increase the establishment period for marsh creation. Once established, the brackish marsh would be nourished and maintained by natural processes.

The development of the marsh creation plans and specifications would be coordinated with the natural resource agencies and Big Branch Marsh NWR. This project would require a Refuge Special Use Permit and a compatibility determination.

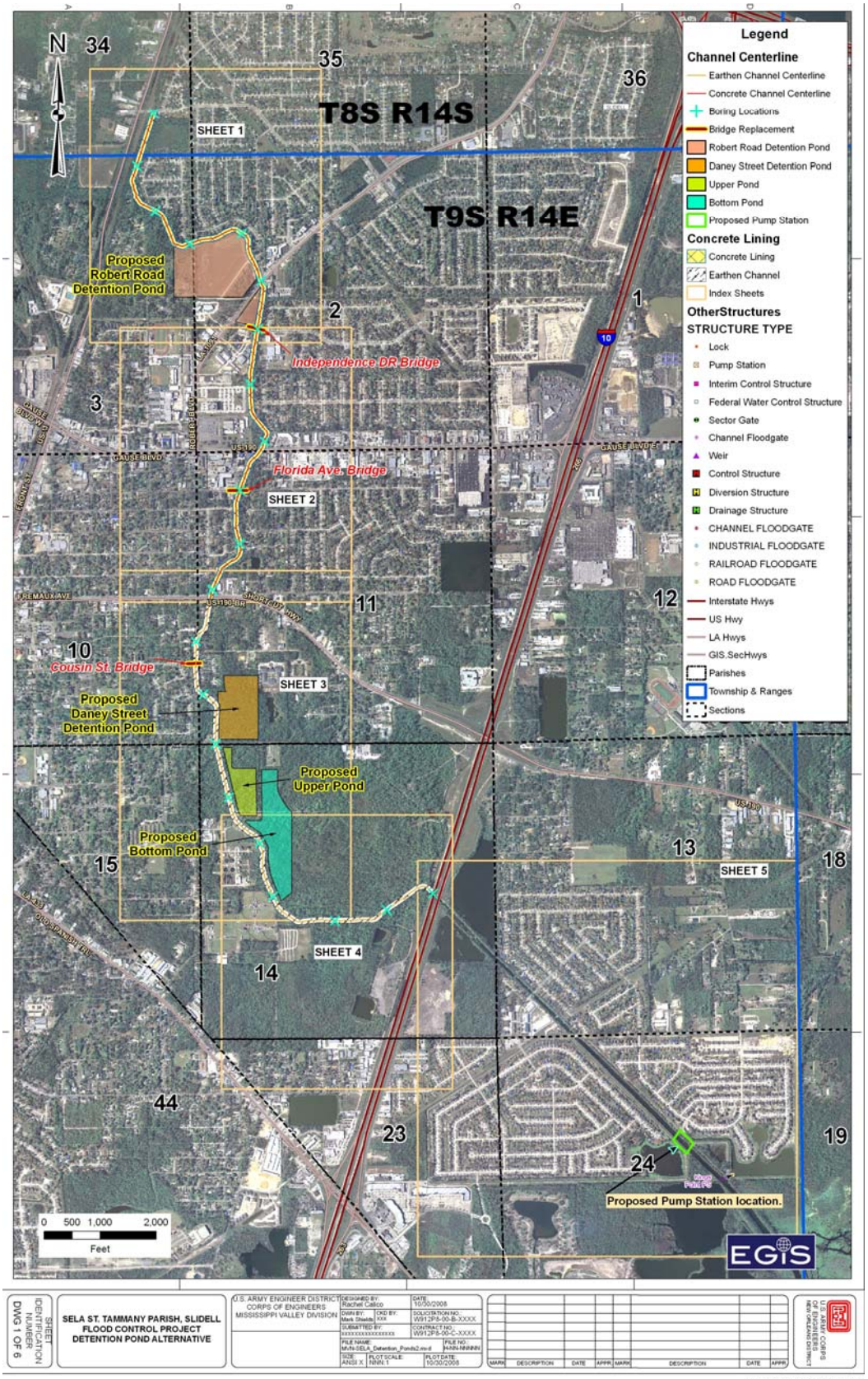


Figure 2. W-14 canal in Slidell, Louisiana

Figure 3. Photo of the W-14 Canal, looking north from the Daney Street Bridge. Proposed Daney Street detention pond is on the right side of the photo.

Figure 4. Photo of the W-14 Canal, looking south from the Daney Street Bridge.

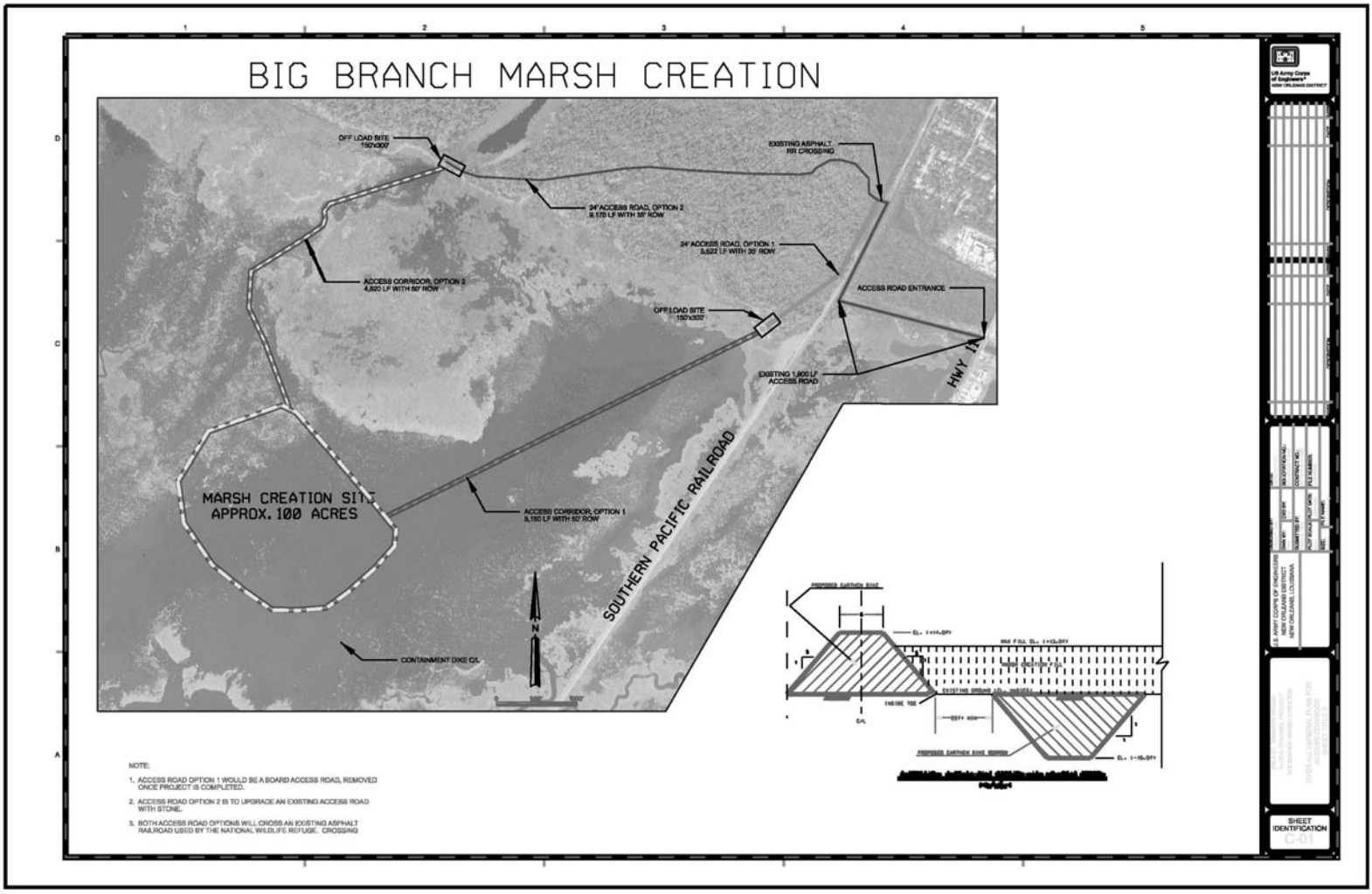


Figure 5. March creation site on Big Branch NWR, approximately 100 acres

Detailed planning and design specifications are scheduled to begin in approximately October 2009. Construction is estimated to begin in fiscal year 2011 with an estimated duration of five years. Eight construction contracts would be awarded for the project. Multiple construction equipment staging areas along the project route would be utilized, due to the length of the project, which is 4.1 miles. None of these staging areas would be located in jurisdictional wetlands. Traffic along streets affected by construction would likely be reduced to one lane, with only private home access, or completely closed to traffic. Normal traffic on the affected streets would be detoured to adjacent streets during the construction period. All street closures would be coordinated with the City of Slidell, Department of Public Works, to ensure city services and public safety are maintained at all times.

Construction would occur mainly within existing rights-of-way, or within St. Tammany Parish street or property rights-of way. For areas requiring access outside of existing rights-of-way, permission would be obtained from affected parties.

DATA GAPS AND UNCERTAINTY

The analysis covered in EA # 409 has been performed prior to formal design and is based on concept level design and reasonable assumptions regarding the proposed actions. While the alternatives described in this evaluation are preliminary, the basic function of their features and the footprint for their construction should remain substantially the same as the project progresses through actual design. Estimates of materials necessary to construct the project were developed from best professional judgment. The alternative features, and associated numbers developed, were used to quantify the magnitude of the proposed actions and not to prescribe detailed materials, quantities, or design specifications. Comprehensive project costs have not yet been determined.

The estimated environmental impacts have been developed to create an envelope of effects within which design may proceed without compromising the integrity of the assessment. As such, the description of the features does not represent any formal commitment to final design, equipment for use, vendors for supply of materials, or methods of construction, but gives an approximation of how the features could be constructed and the associated impacts thereof.

ALTERNATIVES TO THE PROPOSED ACTION

NEPA requires that in analyzing alternatives to the proposed action, a Federal agency consider an alternative of "no action." Likewise, Section 73 of the Water Resources Development Act of 1974 (PL 93-251) requires Federal agencies to give consideration to non-structural measures, such as structure raising or buyouts, to reduce or prevent flood damage.

The economic feasibility of a nonstructural option within a risk-based framework was analyzed. It took the form of structure raising for all residential structures within the 100-year floodplain. This analysis assumes raising these structures to the elevation of the stages associated with the existing condition 100-year storm event. The benefits associated with this option were defined as the reduction in damages that would occur from the rainfall associated with various storm events. For this analysis, uncertainty was quantified for critical variables (stage-frequency relationships, depth-damage relationships, structure and content values, and first floor elevations) through the development of probability distributions. An expected value of 907 structures to be raised was identified in this analysis. The total first costs of these structures were $108,740,000 with an average annual cost $5,615,000. The average annual benefits were $21,480,000. The net benefits were $15,865,000 with a benefit-cost ration of 3.8. These results assume 100 percent participation on the part of property owners identified as being below the 100-year storm event elevation.

Although structure raising is shown by this analysis to be economically feasible, the net benefits associated with such a project are less than the net benefits for the structural plan ($15,865,000 per year as opposed to $16,886,600 per year). It is possible to increase the net benefits for the non-structural plan by raising only those structures for which the ratio of benefits to costs exceeds unity. Such a project has estimated net benefits of $17,736,300 per year; however, the implementability of a selective structure-raising project is subject to question. Given two neighboring structures, one with a favorable B:C ratio and the other with a B:C ratio less than unity, an issue of equity arises should the Government offer to raise the one but not the other, as flood risk reduction benefits would be experienced by both homeowners if both structures were raised. Complications associated with an accurate analysis of a selective non-structural plan call into question the accuracy of the assumptions made (i.e., 100 percent participation in the project and the social and political acceptability of a selective plan) make this plan less desirable, in spite of the nominally higher net benefits. The full economic analysis is contained in the appendix.

A preliminary screening was conducted to identify alternatives that would proceed through further analysis. The criteria used to make this determination included engineering effectiveness, economic efficiency, and environmental and social acceptability. Those alternatives that did not adequately meet these criteria were considered infeasible and were therefore eliminated from further study in this EA. Where different alternative scales (i.e., type/size of channel, smaller or larger detention/retention area, etc.) could be implemented at a location, the increased cost differences typically led to the preferred action when alternative techniques were all feasible. The CEMVN Project Delivery Team considered a “no action” alternative in this EA, which is discussed further in this EA.

Engineering Manual 1110-2-2007, dated 30 April 1995, was utilized to determine the type of design of channel linings for flood control projects. The two basic channel shapes are described, as follows:

1) Trapezoidal channels have sloped sides and are formed by excavating earthen material. They may require slope pavement to protect against erosion, depending on the stability of the sides and the resistance stability of the materials (figure 6).
2) Rectangular channels have vertical or near vertical sides that are formed with reinforced concrete retaining walls, I-walls, or U-frame structures. The channel bottom may be paved or unpaved, depending on the resistance of the earthen material to erosion (figure 7).

The proposed action was developed by analyzing economic considerations, including costs of design and construction, rights-of-way, required relocations, and maintenance and operation. Generally, a trapezoidal channel is the most economical channel when rights-of-way are available and is the more commonly used channel shape. A rectangular channel may be required for channels located in urban areas where the rights-of-way are severely restricted or available only at a high cost.

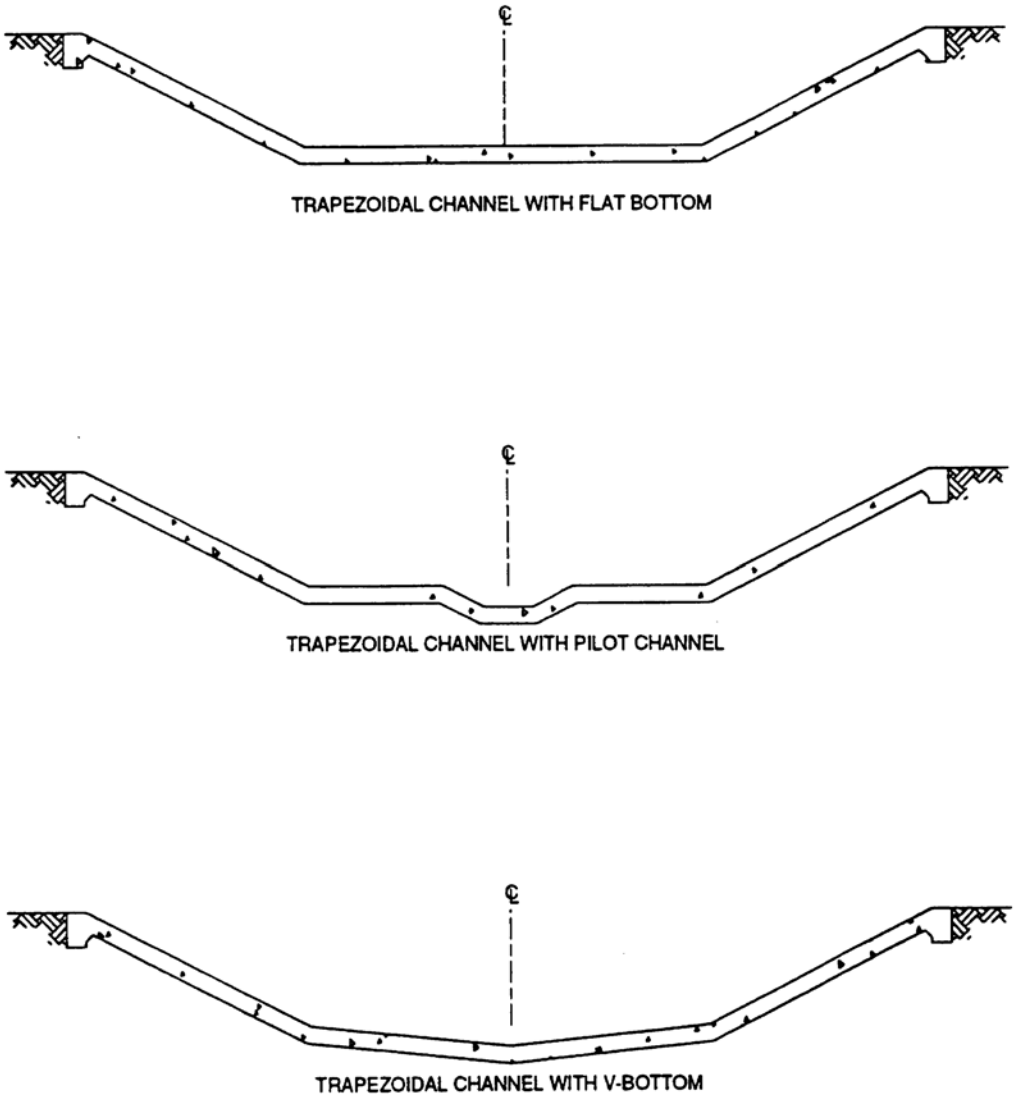


Figure 6. Typical trapezoidal channel profiles.

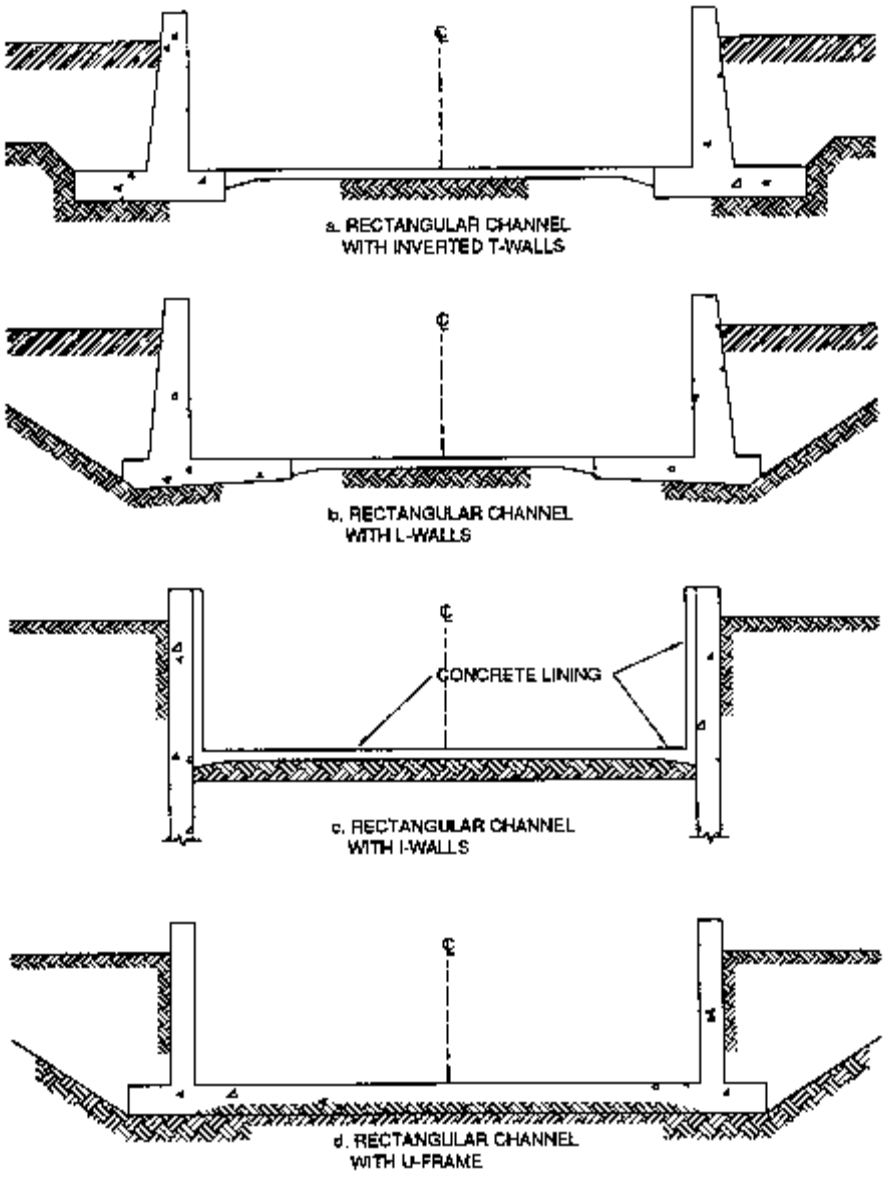


Figure 7. Typical rectangular channel profiles.

No Action Alternative: Under the no action alternative, the proposed action would not be constructed by the CEMVN. However, the existing W-14 Canal would require routine maintenance operations.

ENVIRONMENTAL SETTING

GENERAL

The study area is located in southeast Louisiana and is encompassed by the W-14 Canal drainage basin within the City of Slidell. The project area is along and adjacent to the W-14 Canal, north of Lake Pontchartrain, south of Interstate Highway 12, east of U.S. Highway 11, and west of Interstate Highway 10. The study area consists primarily of high-density residential and commercial development, although a few stands of mixed pine/bottomland hardwoods remain. The wooded areas along and adjacent to the W-14 Canal primarily consist of mixed pine and bottomland hardwood forests. Portions of these areas contain wetland vegetation. The W-14 Canal drainage basin is the most developed basin in the area and drains most of the incorporated area of Slidell. The canal extends approximately 20,000 feet in length and intersects bridges at the following streets: North Boulevard, Robert Road, Independence Drive, Gause Boulevard, Florida Avenue, U.S. Highway 190 (aka Fremaux Avenue or Shortcut Highway), Cousin Street, and Daney Street. The W-14 Canal is hydrologically connected to Lake Pontchartrain. Storm water runoff from the study area flows into the W-14 Canal via natural gravity drainage, and drains southeasterly into the Fritchie Marsh, along the northeast shore of Lake Pontchartrain. Wildlife populations are moderate in these areas, including various resident and migratory avian species, songbirds, game birds, raptors, reptiles, amphibians, small game mammals, small rodents, and other mammals. The canal also provides habitat and feeding areas for certain aquatic species.

The W-14 Canal drains most of the incorporated area of the City of Slidell, as well as a small area north of the city limits. The canal was built in the 1940s by the Louisiana Office of Public Works (now part of the Louisiana Department of Transportation and Development). The lower portion of the W-14 Canal was enlarged to a 60-foot bottom width canal in the mid-1970s. The upper reach, where most of the local flooding occurs, has never been enlarged; however, residential and commercial development has increased exponentially since the canal was originally excavated. The W-14 Canal currently bears little resemblance to its original conditions.

CLIMATE

The climate of the area is humid subtropical, with short, generally mild winters and hot, humid summers. Precipitation in winter usually accompanies the passing of a cold front. Prevailing southerly winds create a strong maritime character. This movement from the Gulf of Mexico helps decrease the range between hot and cold temperatures and provides a source of abundant moisture and rainfall.

Temperature

Records of temperature are available from "Climatological Data" for Louisiana, published by the National Climatic Data Center. The study area can be described by using the normal temperature data observed at the Slidell Weather Station. Table 1 shows the monthly and annual

average normals at the Slidell Weather Station from 1971-2000. This station is shown in table 1 with the monthly and annual average normals, which are based on the period 1971-2000. The annual mean normal temperature is 67.5°F, with monthly mean temperature normal varying from 82.1°F in July to 50.7°F in January.

Table 1. Mean Monthly and Annual Temperature (°F)

30-Year Normals (1971-2000) (National Climatic Center)													
Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Slidell	50.7	53.6	60.6	66.8	74.4	80.0	82.1	81.7	78.0	68.6	60.0	52.9	67.5

Precipitation

Records of precipitation taken at the Slidell Weather Station were used to show the rainfall data for the study area. The Slidell Weather Station is operated by the National Weather Service and has records from 1971-2000. Table 2 contains the average monthly and annual precipitation at this station for the period 1971-2000. It has an average annual rainfall of 62.66 inches with July being the wettest month with an average of 6.55 inches. October is the driest month, averaging 3.10 inches. The maximum monthly rainfall occurred in May 1995 with measurements of 25.93 inches.

Table 2. Average Precipitation (inches)

Average Precipitation (inches) (1971-2000) (National Climatic Center)													
Station	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Slidell	6.42	5.03	5.94	4.76	5.76	4.27	6.55	5.85	5.16	3.10	5.13	4.69	62.66

GEOLOGY

Within the vicinity of the W-14 Canal, most of the soil types are classified as Myatt-Stough-Prentiss complex (USDA SCS 1990). These soils are described as level and very gently sloping, poorly drained to moderately well-drained soils that are loamy throughout. The Myatt series soils have a dark gray fine sandy loam surface layer, which is approximately 4 inches thick. The subsurface layer contains a gray, mottled fine sandy loam, which extends to a depth of 12 inches. The subsoil is a gray, mottled loam and extends to a depth of 50 inches. The underlying material is a light brownish gray, mottled clay loam and extends to a depth of 64 inches. In addition, Myatt series soils are described as being well suited for use in wetland plant habitats and shallow open water areas.

The Stough series consists of coarse-loamy soils, which are moderately poorly drained and moderately slowly permeable. They are formed in loamy marine and fluvial sediments. Stough soils have moderate potential for use in wetland plant habitats and shallow water areas. The Prentiss series are coarse-loamy soils that are moderately well-drained and form in loamy marine

and fluvial sediments. Prentiss soils are poorly suited for use in wetland plant habitats and shallow open water areas. Soil types found within the offloading site, west of U.S. Highway 11, consist of Guyton Series and Prentiss. Guyton series are described as fine-silty soils that are poorly drained, and are slowly permeable. These soils are formed in loamy alluvium. Soils at the marsh creation site consist of Clovelly Series and Lafitte Muck. Clovelly Series are described as clayey soils that are very poorly drained, slightly saline, and organic. Lafitte Muck is described as very poorly drained, brackish, organic soils. These soils are usually found in brackish coastal marshes, and are either ponded or flooded most of the time.

IMPORTANT RESOURCES

This section identifies the important resources located in the vicinity of the proposed action, and describes in detail those resources that would be impacted, directly or indirectly, by the alternatives. Direct impacts are those impacts that are caused by the action taken and occur at the same time and place (40 CFR §1508.8(a)). Indirect impacts are those impacts that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR §1508.8(b)). Cumulative impacts include past, present, or future impacts on the environment.

The resources described in this section are those recognized as important by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations, technical or scientific agencies, groups, or individuals, and the general public.

The important resources described in this section include: air quality, water quality, aquatic resources, wetlands, pine/mixed bottomland hardwood forest, wildlife, essential fish habitat, threatened or endangered species, human urban environment, transportation, noise, cultural resources, recreational resources, aesthetic (visual) resources, and hazardous, toxic, and radioactive waste.

AIR QUALITY

Existing Conditions

This resource is considered institutionally important because of the Louisiana Environmental Quality Act of 1983, as amended, and the Clean Air Act of 1963, as amended. Air quality is technically important because of the status of regional ambient air quality in relation to the National Ambient Air Quality Standards (NAAQS). It is publicly important because of the desire for clean air expressed by virtually all citizens.

The U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, set NAAQS for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (Particulate Matter (PM)-10 and PM-2.5), and sulfur dioxide. Ozone, the only parameter not directly emitted into the air, forms in the atmosphere when three atoms of oxygen (0_3) are combined by a chemical reaction

between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of NO_x and VOC, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air.

The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved State Implementation Plan (SIP) for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the SIPs; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the NAAQS. Federal agencies make this demonstration by performing a conformity review when the actions they are planning to carry out will be conducted in an area designated as a non-attainment or maintenance area for one of the criteria pollutants.

For St. Tammany Parish, all six parameters are currently in attainment of all NAAQS in accordance with 40 CFR 81.320 (1999 edition). A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any SIP. Because the project area is designated as an attainment area, no conformity review would be required for the proposed action. The proposed area consists of residential and commercial development. Direct emissions are primarily due to the industrialized developed surrounding areas of the City of Slidell.

Future Conditions with No Action

With no action, potential air quality impacts associated with the construction and operation of new storm damage reduction measures would not occur. Air quality would not be predicted to change from existing conditions, where periodic flooding can lead to temporary deterioration in air quality during and after flooding. Floods typically result in the contamination of surface waters from sewage and other contaminants that can contribute to poor air quality. In addition, sediment clean up can lead to temporary increases in fugitive dust from street sweeping of sediment. Also, transportation of debris and rubble from the clean up of storm damages contributes to local emissions and decreases air quality.

Future Conditions with the Proposed Action

Sources of project-related direct emissions would include construction activities associated with the proposed action and equipment used to facilitate the action (e.g., construction vehicles).

To be counted as an indirect emission, the Federal proponent for the action must have continuing control over the source of the indirect emissions. Sources of indirect emissions include commuter activity to and from the construction site (e.g., employee vehicle emissions). Both stationary and mobile sources must be included when calculating the total of direct and indirect emissions, but this project would involve only mobile sources.

No detailed conformity assessment would be required because St. Tammany Parish is designated as an attainment area for the designated priority pollutants. Direct significant environmental effects to air quality would not be likely to occur as a result of the proposed action. The total volatile organic compound emissions for this project during construction is anticipated to be well below the *de minimis* level of 100 tons per year. Therefore, this action conforms to the Louisiana State Implementation Plan.

WATER QUALITY

Existing Conditions

Any existing water quality problems are most likely due to urban waste such as oil, grease, and trash, or sanitary wastewater contamination of the drainage system. Raw or partially treated wastewater is often combined with stormwater runoff as the result of bypasses and overflows and infiltration and inflow from the sanitary wastewater conveyance system into the storm water conveyance system. Stormwater runoff also contributes urban pollution to the canal system.

The W-14 Canal is not utilized for the purpose of swimming. Any pathogenic bacteria in the water could be exposed to humans through major flooding or storm events. Organisms that are discharged from the intestinal tracts of humans or animals in fecal material may be harmful to humans. Alternatively, these organisms may serve as useful indicators of fecal pollution and the probable presence of pathogens. The most commonly employed pathogenic indicators are in the coliform group of bacteria, which consist predominantly of harmless organisms. Fecal coliform bacteria are not ideal indicators of fecal pollution since they do not always exist in the same proportions to the pathogens. However, for practical reasons, they are usually measured to monitor for the presence of human and/or animal fecal pollution in water.

Biological Oxygen Demand (BOD) is an indicator of biodegradable organic material related to wastewater as well as synthesized organic materials. The primary importance of biodegradable materials in water quality is that their decaying process can deplete oxygen in the water column. This can be detrimental to aquatic species and can cause undesirable anaerobic conditions. No known testing has been performed to analyze BOD in the W-14 Canal or the waters in Big Branch Marsh NWR.

Future Conditions with No Action

With no action, routine maintenance of the existing canal could release undesirable materials into the surface water. The effects of these releases would be temporary and localized in the immediate work area.

Future Conditions with the Proposed Action

Clearing, grubbing, and re-grading the canal would likely cause some temporary, construction-related direct effects to water quality. No permanent decreases in water quality would be anticipated. With best management practices in place during construction, the temporary effects to water quality should be confined to isolated localized events. These localized effects to water quality would result from an increase in turbidity and suspended sediments, a mobilization of nutrients and detritus from the bottom, leading to a localized reduction in dissolved oxygen, and a potential for the mobilization of contaminants sequestered in bottom sediments.

Earth-moving activities during construction disturb soils and can create indirect water quality effects in the event of uncontrolled runoff or poor sediment control practices during construction. Minor cumulative effects would be expected, as there would be no significant decreases in water quality with the implementation of the proposed action.

In order to construct the pumping station in dry conditions, a cofferdam would likely be built and the interior would continually be dewatered with dewatering wells or well points. The duration of operation of the dewatering pumps, and therefore the quantity of effluent water that would be generated is unknown at this stage of design. However, many thousands of gallons of discharge water could be pumped daily from the open excavation into the adjacent W-14 Canal until construction is completed. The quality of the discharge water would be expected to be substantially the same as the receiving water with some suspended sediments or organic material adding turbidity in the vicinity of the discharge pipe.

A Water Quality Certification (WQC 081015-04/AI 161334) dated 21 November 2008, was received from the Louisiana Department of Environmental Quality.

AQUATIC RESOURCES

Existing Conditions

This resource is institutionally important because of the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended, and the Fish and Wildlife Coordination Act of 1958, as amended. Aquatic resources are technically important because they are a critical element of many valuable freshwater and marine habitats, they are an indicator of the health of various freshwater and marine habitats, and many aquatic species are an important component of recreational and commercial resources. Aquatic resources are publicly important because of the high priority that the public places on their aesthetic, recreational, and commercial value.

The W-14 Canal does not support important aquatic resources due to artificial drainage, dense vegetation, poor water quality, and inadequate water depths. Runoff from nearby developed areas has reduced the habitat value of aquatic resources by introducing various urban pollutants (e.g., oil, grease, fertilizers, pesticides, etc.). However, some freshwater fish species such as bowfin, spotted gar, and mosquito fish may be found in the canal. Invertebrates, such as crawfish, and grass shrimp may inhabit portions of the canal. Aquatic species that survive are those able to tolerate low dissolved oxygen levels and various contaminant levels.

The area within the Big Branch Marsh NWR where the proposed marsh creation would occur provides important nursery habitat and food resources for many commercial and/or recreational species of fish and shellfish. Estuarine fish associated with brackish and saline marsh types include red drum, black drum, spotted sea trout, striped mullet, menhaden, croaker, flounder, spot, and sea catfish. Shellfish associated with these marsh habitats are blue crabs, brown and white shrimp, mussels, snails, and oysters.

Future Conditions with No Action

With no action, the value of aquatic resources within the W-14 Canal would continue to be very low due to the high ephemeral flows and the constant introduction of urban runoff. Oil and grease from inflow and infiltration from urban runoff, storm sewers, and septic tanks, fertilizers, pesticides, and various urban waste products are some examples of contaminants that may enter the canal.

Future Conditions with the Proposed Action

Direct and permanent effects to existing aquatic resources from implementation of the proposed action would result from the excavation of approximately 289,200 cubic yards of earthen material to construct the improved W-14 Canal. The total area of aquatic habitat disturbance within the W-14 Canal is estimated to be approximately 9.2 acres and within the existing Robert Road pond is approximately 19.6 acres. Upon completion of the project, aquatic resources would be expected to regenerate in these areas and flourish.

Indirect effects to aquatic resources from construction (e.g., increased local turbidity, decreased dissolved oxygen, vibration, and subsurface noise) would have only temporary effects to the aquatic habitat and would not be considered significant. There would be minimal cumulative effects to aquatic habitat regionally, because there would be no significant loss of habitat projected by implementation of the proposed action.

Within Big Branch Marsh NWR, the areas designated for the offloading site, temporary pipeline installation, and confinement dikes would be directly impacted, as shallow water bottoms that support aquatic resources would be covered by the dredged material. The pipeline is needed to transport liquefied dredged material from the offloading site to its final destination as a substrate conducive to marsh establishment. Motile aquatics and fish species would vacate the area during construction operations but would return after completion of the work. Existing benthos communities would be destroyed due to deposition and compaction of earthen material. However, benthic communities are expected to re-establish in newly created aquatic areas after

the work is completed. The recovery time depends on the biology of the affected benthos. Indirect effects to aquatic resources from the discharge of dredged material include increased local water turbidity, decreased dissolved oxygen levels, vibrations, and subsurface noise in the area. These effects would be temporary during construction and would not be considered significant. Minimal cumulative effects to aquatic resources would be anticipated as no significant loss of habitat is proposed with this action.

Expanding the marsh/water interface, increasing the detrital food material, and slowing the conversion of shallow water habitats to deeper water areas by marsh restoration provides positive impacts to fish and shellfish. Fish and shellfish utilize marsh areas for habitat and nursery areas. Additionally, utilization of the proposed sites for these purposes would help offset land loss in coastal Louisiana. Marsh establishment would beneficially affect biological productivity in the area.

WETLANDS

Existing Conditions

This resource is institutionally important because of the Clean Water Act of 1977, as amended; Executive Order 11990 of 1977, Protection of Wetlands; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968. Wetlands are technically important because they provide necessary habitat for various species of plants, fish, and wildlife, they serve as ground water recharge areas, they provide storage areas for storm and flood waters, they serve as natural water filtration areas, they provide protection from wave action, erosion, and storm damage, and they provide various consumptive and nonconsumptive recreational opportunities. Wetlands are publicly important because of the high value the public places on their functions and values.

Wetlands provide valuable habitat for an abundance of wildlife species. The marsh and forested wetlands provide feeding, resting, nesting, hunting, and escape habitat to numerous species of game and non-game mammals and recreationally and commercially important furbearers, as well as songbirds, raptors, migratory and resident waterfowl, wading birds, woodpeckers, and many species of amphibians and reptiles.

The vegetation within the general project area is classified as moderate to low quality mixed pine/bottomland hardwoods, with some saturated areas that support wetland plants. Wetland vegetation can be found at the proposed 18-acre detention pond located on and north of Daney Street, along the lowermost fringes of the W-14 Canal, and the proposed detention ponds at Robert Road. The shallow areas of the existing Robert Road pond support submerged and floating aquatic vegetation such as water hyacinth, alligator weed, water primrose, duckweed, and pickerelweed. The vegetation found on the upper reaches of the W-14 Canal banks are of less ecological value, since these areas have undergone severe alteration by residential and commercial development, and are regularly maintained by mowing. It is estimated that approximately 4.4 acres of mixed pine/bottomland hardwood wetlands would be impacted by the proposed action.

Existing wetland areas at Big Branch Marsh NWR consists of intertidal brackish and saline marsh supporting plant species such as smooth cordgrass (*Spartina alterniflora*), wiregrass cordgrass (*Spartina patens*), and black needlerush (*Juncus roemerianus*).

Future Conditions with No Action

With no action, the functions and values of the existing wetlands would continue to be influenced by periodic flooding and rainfall events. Routine maintenance of the existing W-14 Canal would have no effect on wetlands because these actions take place within previously disturbed areas. There would be no direct wetland impacts under this alternative.

Future Conditions with the Proposed Action

Any existing wetland vegetation within the project area, including the forested buffer along the W-14 Canal, pond locations, the offloading site off of U.S. Highway 11, and the temporary pipeline area would be directly impacted by mechanical clearing and grubbing operations. The offloading site would be needed in order to stockpile the dredged material, and would be utilized for a work area, pumping area, and truck ingress and egress area.

Some wetland species would naturally re-vegetate in shallow and saturated areas within the Robert Road and Daney Street ponds, on the W-14 Canal side slopes (below US Highway 190), and within the Big Branch Marsh NWR after construction activities are completed.

A total of 4.4 acres of mixed pine/bottomland hardwood wetlands would be directly impacted in the pond areas and on the W-14 Canal banks. Brackish marsh would be impacted at the offloading site (1.0 acre) and in the pipeline corridor (< 1.0 acre), but these impacts would be greatly offset with the marsh creation project. Sessile and benthic organisms utilizing the marsh within the construction corridor would be permanently impacted due to project construction. Indirect impacts would include the relocation of motile organisms to nearby habitats, and noise, vibrations, fugitive dust, etc., associated with construction. Without the proposed mitigation (discussed later in this document), cumulative impacts to this resource would contribute to overall wetland losses in southeast Louisiana.

The marsh impacts would be necessary to allow access for a hydraulic pipe and a marsh buggy in order to transport the dredged material, which would first be blended with water to form a slurry mix. The beneficial use of dredged material would allow the conversion of shallow open waters to about 100 acres of brackish marsh at the Big Branch Marsh NWR. Beneficial use of the material would result in a total gain of 52.52 AAHUs.

MIXED PINE/BOTTOMLAND HARDWOOD FOREST

Existing Conditions

This resource is institutionally important because of Section 906 of the Water Resources Development Act of 1986 and the Fish and Wildlife Coordination Act of 1958, as amended.

Mixed pine/bottomland hardwood forests are technically important because they provide necessary habitat for a variety of species of plants, fish, and wildlife. They provide a variety of wetland functions and values, are an important source of lumber and other commercial forest products, and they provide various consumptive and non-consumptive recreational opportunities, such as hunting, camping, hiking, photography, bird watching, etc. Mixed pine/bottomland hardwood forests are publicly important because of the high priority the public places on their aesthetic, recreational, and commercial values.

Historically, this area would be classified as a pine savannah. The open, park-line character of the original savannahs was principally attributable to low-intensity, lightning-started ground fires that frequently swept the region throughout pre-historic times. In pine flatwoods, these fires interacted with soil conditions and a seasonally high water table to restrict development of most trees and shrubs other than scattered longleaf pine. This created a very open forest with a prominence of herbaceous plants, mostly grasses and sedges, in the ground layer.

Southeastern Louisiana's pine flatwood savannahs support more state-rare plant species than any other habitat in the state. The diversity of plant species per unit area in this habitat, and in closely allied hillside seepage bogs, is unequalled by any other in Louisiana. Savannahs are noted for their extreme degree of plant species richness. The community is most often dominated by numerous types of grasses and sedges, but is perhaps best known for various species of insectivorous plants and showy orchids (LDWF, 1990).

Approximately 80 percent of the vegetation found within the project area is slash pine. The remaining 20 percent is comprised of species such as loblolly pine, several species of oak, southern magnolia, sweetbay magnolia, Drummond red maple, sweet gum, black gum, American sycamore, Chinese tallow, and persimmon. The average diameter at breast height of these species ranges from 6 inches to16 inches. Understory species found within the area include poison ivy, fern, muscadine, wax myrtle, Chinese privet, pepper vine, honey suckle, yaupon, smilax, and elderberry.

By excavating the ponds at Robert Road and Daney Street, floodwater detention areas for the W-14 Canal would be created. Two retention ponds south of Daney Street, identified as the "Upper Pond" and "Lower Pond," would be excavated by a private developer in connection with a large private development. These two areas are presently wooded with similar mixed pine/bottomland hardwoods habitat. An individual Section 404 permit was issued to Slidell Development Company, LLC, dated 8 April 2008, for the development that included these two ponds.

Future Conditions with No Action

With no action, routine maintenance of the W-14 Canal is expected to continue. As the maintenance activities occur within mowed rights-of-ways and do not extend into the surrounding forests, these actions would have no effect on mixed pine/bottomland hardwoods.

Future Conditions with the Proposed Action

Direct impacts of the proposed action include approximately 27.7 acres required for canal improvements, 11.7 acres required for the Robert Road west side pond expansion, 3.1 acres for the Robert Road east side pond expansion, 18 acres for the Daney Street pond, and 0.9 acres for the construction of the pump station. The areas designated for the detention ponds would be mechanically cleared, grubbed, and excavated using heavy equipment. The pond areas would be shaped to become low, flat, open fields, dry most of the time, and ready to accommodate floodwaters during high rain or storm events. Of the 27.7 acres required for construction easement along the canal banks, approximately 10.7 acres is expected to be temporarily affected, and would be allowed to regenerate naturally after project construction. The direct total loss of mixed pine/bottomland hardwoods for the entire project would be 61.4 acres, using the MCM variable justification model, this comes to 486.1 credits required for mitigation (analysis is included in the appendix).

Indirect impacts to mixed pine/bottomland hardwood forests would include construction noise, fugitive dust, and temporary decreases in air quality if trees and brush are windrowed and burned in place. Minor cumulative effects would occur from the loss of moderate quality mixed pine/bottomland hardwood forest resources.

All efforts have been made to avoid, minimize, and reduce adverse impacts to mixed pine/bottomland hardwoods by designing the project to affect the minimum dimensions necessary for construction equipment access. All unavoidable project impacts would be mitigated through the acquisition, rehabilitation, and maintenance of properties adjacent to or withholdings in Big Branch NWR, in cooperation with the United States Fish and Wildlife Service (USFWS). As there are insufficient pine-savannah mitigation bank credits available, a mitigation plan centered on land acquisition and rehabilitation of that property would be required to meet project mitigation requirements. Currently four properties are under consideration, with a total acreage of 145.1 acres, but due to differences in quality of habitat and the amount of work necessary to restore the land to pine savannah function, the credits come to 486.4 which is slightly higher (by 0.3 credits) than necessary for mitigation. The full discussion for the mitigation plan is in the Mitigation Section of this document (pg 40).

WILDLIFE

Existing Conditions

This resource is institutionally important because of the Fish and Wildlife Coordination Act of 1958, as amended, and the Migratory Bird Treaty Act of 1918. Wildlife resources are technically important because they are a critical element of many valuable aquatic and terrestrial habitats, they are an indicator of the health of various aquatic and terrestrial habitats, and many species are important commercial resources. Wildlife resources are publicly important because of the high priority that the public places on their aesthetic, recreational, and commercial value.

Avian species likely to occur in the W-14 Canal area for occasional feeding and/or loafing include wood ducks, great egret, snowy egrets, and green herons. The W-14 Canal also provides habitat for various species of frogs, turtles, and snakes, including the bronze frog, green tree frog, red-eared turtle, Mississippi mud turtle, speckled king snake, broad-banded water snake, and western cottonmouth. Mammals likely to occur in these areas are the Virginia opossum, northern raccoon, and nine-banded armadillo.

The larger tracts (e.g. the Daney Street, Upper, and Lower Pond areas) provide higher quality habitat for a variety of wildlife species. These tracts provide greater vegetation diversity and screen out urban-associated disturbances. Migratory and non-migratory songbirds, game birds, and raptors use the larger forested tracts for feeding, roosting, and or nesting. Species that are likely to occur include wood thrush, red-headed woodpecker, Carolina chickadee, brown thrasher, Carolina wren, yellow-rumped warbler, American woodcock, mourning dove, red-shouldered hawk, and barred owl. Small game mammals include the eastern cottontail, swamp rabbit, gray squirrel, and fox squirrel. Numerous species of small rodents, bats, and other mammals such as the short-tailed shrew, eastern mole, southern flying squirrel, red bat, eastern pipistrelle, Virginia opossum, northern raccoon, and nine-banded armadillo, also inhabit the larger forested tracts.

The Big Branch Marsh NWR provides habitat for wildlife such as swamp rabbit, turkey, and a variety of neo-tropical species, deer, squirrel, migratory waterfowl, wading birds, raccoons, muskrats, nutria, opossums, alligators, snakes, frogs, deer, mink, otters, rats, and mice.

To quantify anticipated project impacts to fish and wildlife resources, the U.S. Fish and Wildlife Service (USFWS) used the Habitat Assessment Methodology for bottomland hardwoods. Target years selected for this analysis were 0 (baseline), 1, 10, 25, and 50 for both future with project and future without project scenarios. Baseline values for model variables were obtained from site visits, communications with CEMVN staff, and review of aerial photography.

Future Conditions with No Action

With the no action alternative, habitat values and biological diversity in this ecological community would continue to be adversely impacted due to increased residential and commercial development. Routine maintenance of the existing canal would continue, causing temporary adverse impacts to wildlife and their habitats. Noise related to heavy equipment usage would cause wildlife to relocate, but they would be expected to return upon completion of maintenance operations.

Future Conditions with the Proposed Action

With the proposed action, wildlife inhabiting the area would flee during construction activities and may permanently relocate to adjacent undeveloped tracts of land. The direct effects to wildlife from construction would be the permanent destruction of 50.7 acres (excluding temporary impacts) of habitat by mechanical clearing and grubbing activities.

Direct, permanent impacts would include the loss of 4.32 Average Annual Habitat Units (AAHUs) (14.8 acres) of moderate to low quality wildlife habitat for the expansion of the Robert Road detention pond and the construction of the new detention pond, a loss of 6.42 AAHUs (18 acres) for the creation of the Daney Street detention pond, and a total loss of 8.98 AAHUs (28.6 acres) for the drainage improvements to the W-14 Canal and construction of the pump station. Therefore, the total loss of habitat units for the entire project would be 19.72 AAHUs (61.4 acres).

Indirect impacts would include noise and fugitive dust from construction activities. These impacts would be temporary and not significant. The loss of wildlife habitat due to project construction would contribute cumulatively to habitat losses in southeast Louisiana.

The marsh creation project would result in the direct creation of 52.52 AAHUs or 100 acres of fish and wildlife habitat. The newly created marsh would provide improved water quality for waterfowl, shorebirds, avian species, and fur-bearing animals, and additional habitat for wildlife that utilize the marsh for hunting, resting, and foraging.

ESSENTIAL FISH HABITAT

Existing Conditions

This resource is institutionally important because of the Magnuson-Stevens Fishery Conservation and Management Act of 1976, amended in 1996 and 2007. Essential Fish Habitat (EFH) is technically important because, as the Act states, EFH is “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." EFH is publicly important because of the high value that the public places on the seafood industry and the recreational and commercial opportunities EFH provides.

Specific categories of EFH in the project area include all estuarine emergent marsh, water column, and mud substrate, as well as submerged aquatic vegetation. The Gulf of Mexico Fishery Management Council, through the 2005 generic amendment of the Fishery Management Plans for the Gulf of Mexico, provides detailed information on Federally managed species and their EFH as required by the Magnuson-Stevens Fishery Conservation and Management Act (P.L. 104-297). Portions of the project located in tidally-influenced areas on Big Branch Marsh NWR are located in areas identified as EFH for post larval, juvenile life stages of white shrimp, brown shrimp, and red drum (see table 3). Coastal wetlands provide nursery and foraging habitat that support economically important marine fishery species such as spotted sea trout, southern flounder, Atlantic croaker, gulf menhaden, striped mullet, and blue crab. These species serve as prey for other Federally-managed fish species, such as mackerels, snappers, groupers, billfishes, and sharks. EFH is necessary for the continued survival of fisheries resources.

Table 3. Life-stages of Federally-managed species that commonly occur within the tidal portions of the project area.

Species	Life Stage	System	EFH
Brown shrimp	Post larvae	Estuarine	Sand/shell/soft bottom, SAV, emergent marsh, oyster reef
	Juvenile	Estuarine	SAV, sand/shell/soft bottom, SAV, emergent marsh, oyster reef
White shrimp	Post larvae	Estuarine	Soft bottom, emergent marsh
	Juvenile	Estuarine	Soft bottom, emergent marsh
Red drum	Larvae / post larvae	Estuarine	All estuaries planktonic, SAV, sand/shell/soft bottom, emergent marsh
	Juvenile	Estuarine	SAV, sand/shell/soft/hard bottom, emergent marsh

Future Conditions with No Action

With no action, EFH in the area of the proposed marsh creation site may be temporarily or permanently adversely impacted by physiochemical factors influencing the habitat stability and suitability for fishery resources. Examples include periodic high rain, storm events, temperature variation, shoreline erosion, subsidence, and resulting wetland loss rates and temporary water quality conditions. The extent of impacts is due largely upon the degree to which these factors occur and the associated time lapses between each event. For instance, a periodic high rain followed by a storm event within a few weeks' time would not allow this resource a chance to recover from the first event, before experiencing the second one.

Future Conditions with the Proposed Action

With the proposed action, no impacts would occur to Federally-managed species in the W-14 Canal, as this waterway does not support the habitats of such species. The proposed marsh creation on Big Branch Marsh NWR would convert habitat from water bottom and column to marsh. Temporary and permanent losses to some types of EFH may result from this conversion or overfilling to supratidal wetlands, or degrading wetlands or aquatic vegetation along temporary construction access corridors. Further, it is possible that some Federally-managed species in post-larval or juvenile stages may be displaced or buried in the immediate vicinity during the dredged material placement; however, larger species could escape by upward burrowing. Dissolved oxygen levels may decrease in the immediate vicinity, and there may be temporary reductions in primary productivity as a result of increased turbidity levels. These conditions would be considered short-term and expected to return to normal following the construction period. However, by creating intertidal brackish marsh in the Big Branch Marsh NWR, Federally-managed fisheries would benefit by increased nutrients and detritus to the existing food web and a substantial net gain in marsh. As a result of these actions, the CEMVN believes that adverse impacts to some types of EFH may occur, but the marsh creation would compensate for these impacts and the overall productivity of Federally-managed species would be benefitted.

THREATENED OR ENDANGERED SPECIES

Existing Conditions

This resource is institutionally important because of the Endangered Species Act of 1973, as amended, and the Marine Mammal Protection Act of 1972. Threatened or endangered species are technically important because the status of such species provides an indication of the overall health of an ecosystem. These species are publicly important because of the desire of the public to protect them and their habitats.

Species listed as threatened or endangered in the area include the Louisiana quillwort, brown pelican, Gulf sturgeon, gopher tortoise, red-cockaded woodpecker, and ringed sawback turtle. Although these species of Federally-listed plants and animals occur within St. Tammany Parish, preliminary evaluations suggested that the proposed project area may provide suitable habitat for only the gopher tortoise and red-cockaded woodpecker. After having been severely damaged by Hurricane Katrina in 2005, the offloading site and surrounding area in Big Branch NWR was recently rehabilitated by refuge personnel, to provide future habitat for red-cockaded woodpeckers. Rehabilitation efforts included reseeding with long-leaf pines, which are now 1 to 3 years old and are far too small for immediate use as foraging or nesting habitat for these endangered birds. In approximately 30 years, the area would be potential quality habitat.

Future Conditions with No Action

With no action, no threatened or endangered species would be affected.

Future Conditions with the Proposed Action

The CEMVN determined that the proposed action would not be likely to affect gopher tortoises or red-cockaded woodpeckers**.** Two biologists from the USFWS made an inspection and gathered field data on 15 October 2008. In their letter dated 31 October 2008, the USFWS concurred with the CEMVN's determination that the project, as currently proposed, would not be likely to affect gopher tortoises or red-cockaded woodpeckers, or their critical habitat.

Furthermore, the CEMVN determined that no threatened or endangered aquatic marine species are likely to occur within the project area. No species under the purview of National Oceanic and Atmospheric Administration (NOAA) Fisheries would be likely to be found within the proximity of the project action; therefore, no threatened or endangered aquatic marine species would be likely to be adversely affected.

HUMAN URBAN ENVIRONMENT

Existing Conditions

This resource is institutionally important because of Section 22 of NEPA, Section 40 CFR 1508.14. The human environment is technically important according to NEPA because it is based on harmony between man and his environment. It is publicly important because the public desires to protect and maintain their property from potential damage or destruction due to construction activities.

The project area is surrounded by either wooded areas or adjacent existing developed sites, including single-family and multi-family residential structures and commercial buildings. One school and one hospital are located nearby. The majority of the developed sites are single-family structures. Some of these property owners mow their backyards to the canal. Typical urban activities include backyard barbeques and other family gatherings, yard maintenance, children playing, bird watching, and nature photography.

Future Conditions with No Action

With the no action alternative, no potential would exist to damage buildings or homes from near surface soil movement and vibrations related to pile driving and extraction activities.

Future Conditions with the Proposed Action

With the proposed action, minimal potential would exist for vibration damage associated with construction activities for the 287 structures identified within the zone of construction impact. There is no specific way of determining how much damage would or would not occur during the construction of the proposed action. The most probable causes of damage are near-surface soil movement and the vibrations resulting from pile driving and extraction. Near-surface soil movement may occur in both the horizontal and vertical directions as a result of pile driving and extraction. The movement of the soil may be miniscule or it may be inches depending on the soil conditions. All construction contracts require that vibrations, as a result of pile driving and extraction, be monitored at the nearest structure to make sure that the vibrations are kept within the threshold of 0.25 inches per second. By limiting the vibration levels to less than 0.25 inches per second, there should be no damage to a structurally sound building. Near-surface soil movement and/or vibrations may induce new cracks or propagate existing cracks in flat work (e.g., concrete floors, finished slabs, sidewalks, driveways) or brick veneers. If impacts were to occur, they would be expected to occur during and/or immediately after construction. Minimal, if any, impacts would be expected to occur long after construction. A construction right-of-way would be acquired for this project.

A zone of construction impacts (ZOCI) was calculated for the drainage improvements to the W-14 Canal. Site inspections were conducted to determine whether there were improvements located within the ZOCI. The approximate widths of the ZOCI for the proposed action and alternatives are found in table 4. These zones were used as the delineator of the project boundaries for impact analysis. The ZOCI impact is measured from the centerline of the street or canal.

Table 4: Zone of Construction Impacts for the Proposed Action

Table 4: Zone of Construction Impacts for the Proposed Action	
Location	**Zone of Construction Impacts**
From North Boulevard to Robert Road	40 ft in each direction measured from the centerline of the canal or street.
From Robert Road to Fremaux	47 ft in each direction measured from the centerline of the canal or street

TRANSPORTATION

Existing Conditions

Transportation infrastructure within the vicinity of the construction alignment primarily consists of Interstate Highway 12, Gause Boulevard, U.S. Highway 190, Interstate Highway 10, U.S. Highway 11, and municipal thoroughfares. Railroad lines parallel U.S. Highway 11, and a municipal airport is located just north of Interstate Highway 12 in the vicinity of the study area. The project area has waterborne access via Lake Pontchartrain.

Future Conditions with No Action

With the no action alternative, construction activities necessary to reduce the risk of flooding damages to protect human life and economic infrastructure would not be undertaken. The current flood damage risk would persist without the construction of this project. There are substantial traffic effects prior to, and after, large-scale flooding events in this area with the current level of risk reduction. Community evacuation in preparation for storms leads to major traffic delays. When flooded, roads are impassable until floodwaters recede and residual sediments and debris are cleaned up. Removal of debris created by flooding damages (building materials, appliances, furniture, etc.) also causes substantial increases in local traffic. Chronic flooding could also accelerate deterioration of bridges, culverts, and road surfaces for which longer-term traffic problems would exist until the infrastructure was repaired or replaced.

Future Conditions with the Proposed Action

With the construction of the proposed action, the direct, temporary effects on transportation would result from increased vehicular congestion along collector and local roads leading to and from the construction sites. Direct beneficial impacts to local transportation include the replacement of the three bridges at Independence Drive, Florida Avenue, and Cousin Street. Indirect, temporary effects including vehicle emissions, decreases in level of service (e.g., longer waits at intersections), and decreases in road surface quality would be expected. No impacts to rail transportation systems would be anticipated. Some impacts to waterborne transportation systems may occur if construction materials would be delivered via marine plant or a temporary

work platform located over water, but these impacts would be temporary in nature. No cumulative impacts would be anticipated as a result of the proposed action.

NOISE

Existing Conditions

Noise impacts within the project area include those typically caused by residential and commercial activities within a large urban area, such as noises generated by vehicles, garbage trucks, delivery trucks, mowers, construction trucks, emergency vehicles, and power tools. Changes in noise are typically measured and reported in units of decibels (dBA), a weighted measure of sound level. The primary sources of noise within the area include everyday vehicular traffic along nearby roadways (typically between 50 dBA and 60 dBA at 100 feet), maintenance of roadways, bridges, and the other structures (typically between 80 dBA and 100 dBA at 50 feet), and the ongoing construction of various commercial and industrial establishments. Noise from occasional aircraft crossing is typically indistinguishable from the natural background noise of the city. Noise ranging from about 10 dBA for the rustling of leaves to as much as 115 dBA (the upper limit for unprotected hearing exposure established by the Occupational Safety and Health Administration) is common in areas where there are sources of industrial operations, construction activities, and vehicular traffic.

The U.S. Federal Transit Administration (FTA) has established noise impact criteria founded on well-documented research on community reaction to noise based on change in noise exposure
by using a sliding scale (USFTA, 1995). The FTA Noise Impact Criteria groups noise sensitive land uses into the following three categories:

- Category 1: Buildings or parks where quiet is an essential element of their purpose,
- Category 2: Residences and buildings where people normally sleep (e.g., residences, hospitals, and hotels with high nighttime sensitivity), and
- Category 3: Institutional buildings with primarily daytime and evening use (e.g., schools, libraries, and churches).

Lands adjacent to the project area do not include any category 1 properties. The residences, businesses, and hospital near Florida Avenue are adjacent to the W-14 Canal and classified as category 2 properties. There is one known category 3 property, which is a school near Independence Drive.

Future Conditions with No Action

With no action, noise within the area would remain unchanged from existing conditions. Routine maintenance of the existing canal would occasionally create temporary sources of noise and vibration within previously disturbed areas.

In the event of wide-scale hurricane-induced flooding, the noise generated would be associated with the heavy equipment used for cleanup and reconstruction efforts. The effects of these noise sources would include annoyance and community disturbance.

Future Conditions with the Proposed Action

Project construction would require the use of earth-moving equipment (dozers, rollers, excavators), trucks to haul materials to and from the site (dump trucks, concrete trucks, and flatbed haul trucks), cranes (for pile driving), and equipment for the demolition and removal of existing bridges. Given the quantity of pilings to be driven, the building of the concrete drainage channel, and the duration of the construction period, the local residents and businesses would be expected to experience temporary noise effects during construction. Post-construction noise impacts to nearby residents would include the operation and maintenance activities associated with the new pump station.

The construction contractor would be expected to keep construction activities under surveillance and control to minimize environmental damage by noise. Techniques for abating construction noise vary from simple, inexpensive, easily implemented measures (e.g., ensuring that all engines are equipped with a properly operating muffler) to more expensive, elaborate methods, such as constructing temporary noise barriers.

CULTURAL RESOURCES

Existing Conditions

This resource is institutionally important because of the National Historic Preservation Act of 1966, as amended, the Native American Graves Protection and Repatriation Act of 1990, and the Archeological Resources Protection Act of 1979, as well as other statutes. Cultural resources are technically important because of their association or linkage to past events, to historically important persons, and to design and/or construction values, and for their ability to yield important information about prehistory and history. Cultural resources are publicly important because preservation groups and private individuals support their protection, restoration, enhancement, or recovery.

A cultural resources investigation of the project area was conducted in 2008 by R. Christopher Goodwin and Associates, Inc (Moreno, et al. 2008). This study states that the prehistoric and historic residents of St. Tammany Parish and the project vicinity would have exploited the natural resources from both the longleaf pine and marsh environments of this area. Of seven previous cultural resources investigations conducted within 1.l6 km (1 mile) of the project area, only five cultural resources sites were within 1.6 km of the current project area, indicating a general lack of cultural resources potential in the project vicinity until the growth of Slidell during the modern era.

The cultural resources investigation located no prehistoric or historic cultural resources within the project area. A determination of no impacts to cultural resources was submitted to the

Louisiana State Historic Preservation Officer on 9 September 2008. A letter of concurrence was received on 7 October 2008.

Future Conditions with No Action

With the no action alternative, cultural resources would not be affected. The current state of any known or unknown resources in the project vicinity would be unaffected. However, if lack of modification to the W-14 Canal allows increased flooding in the City of Slidell, cultural resources could be adversely affected by these flood situations.

Future Conditions with the Proposed Action

With the proposed action, there would be no impacts to cultural resources. A cultural resources study was conducted to identify cultural resources, and testing and research determined that no cultural resources exist within the project area. This conclusion of no impacts to cultural resources was coordinated with the Louisiana State Historic Preservation Officer in correspondence as stated previously.

RECREATIONAL RESOURCES

Existing Conditions

This resource is institutionally important because of the Federal Water Project Recreation Act of 1965, as amended, and the Land and Water Conservation Fund Act of 1965, as amended. Recreational resources are technically important because of the high economic value of recreational activities and their contribution to local, state, and national economies. Recreational resources are publicly important because of: the high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Louisiana, and the large per-capita number of recreational boat registrations in Louisiana.

In the proposed area of study, there are no developed recreational areas adjacent to the channel. The closest recreation site is a baseball field located within 1,000 feet. Within the City of Slidell, there is an abundance of recreational features. Presently there are 12 parks, 3 wildlife areas (1 state, 1 national, and 1 local), 3 golf courses, 4 tennis areas, 5 swamp tour establishments, and 3 campgrounds offering recreational vehicle and tent camping along with related facilities. Land use of the upper ¾ of the area within the project boundaries is largely urban with some industrial use. The lower ¼ of project land traverses wooded areas. Along the channel, recreational walking, nature/ecological study, and birding are activities in which residents and visitors may participate. Recreational sport fishing and boating in the canal is not encouraged. The canal is narrow, numerous snags restrict access, and the water quality is not conducive to a healthy sport fishing resource.

Future Conditions with No Action

With the no action alternative, the recreational environment within the City of Slidell and, more specifically, the project areas would continue to flourish and expand with the anticipation of population growth.

Future Conditions with the Proposed Action

Recreational use within the canal corridor is minimal and would not be significantly directly affected by canal work. Present activities such as walking, nature study, and birding along the canal banks would be temporarily impacted during project work. These activities would return, possibly in an improved condition, after completion of the project. In portions of the canal where upper bank vegetation has been cleared, an open easement space for maintenance vehicles could be created. Within this linear open canal bank, recreational activities, such as mountain bike riding, walking, and nature/ecological study, could occur. The canal improvement project could improve recreational use along its course. Within the areas designated for detention pond development, the Robert Road site would increase in open land thru the additional clearing proposed and the Daney Street detention pond would be totally cleared of its existing wooded character. These areas would be developed into relatively flat open "field" areas, dry most of the time and ready to accommodate floodwaters. These large tracts of land have recreational potential and can be used by the City of Slidell for flood prone recreation development. Activities that require open fields for participation, but no facilities, are activities such as cross country running, golf ball driving, soccer practice, baseball batting practice, and others. These types of activities could occur on these areas when dry.

Direct impacts to the recreation environment along the marsh creation project would include the clearing of an 1-acre parcel of land to be used as a holding area for placement of earthen material from construction and use of a corridor for the dredging pipeline for transferring stock piled earthen material hydrologically to the Big Branch Marsh NWR marsh creation site. Clearing of land at these two staging sites would impose an indirect impact on recreational hunting opportunity in the area. With less habitat available there, hunted species would transfer to adjacent lands that are undisturbed. However, with creation of many new acres of marsh within the Big Branch Marsh NWR, hunting losses would be replaced in time within the new marsh development. Once consolidated, the new brackish marshland would be seeded with smooth cordgrass (*Spartina alternaflora*) and wiregrass (*S. patens*. Volunteer vegetation would also populate the area. This new marshland would return and increase the small game and duck-hunting habitat lost due to staging area development.

No adverse cumulative effects would be anticipated to this resource.

AESTHETIC (VISUAL) RESOURCES

Existing Conditions

This resource is institutionally important because of the laws and policies that affect visual resources, most notably the 1969 National Environmental Policy Act. Visual resources are publicly and technically important because of the high value placed on the preservation of

unique natural and culture landscapes.

In January 2008, the City of Slidell commissioned the Tulane Regional Urban Design Center (TRUDC) to create a set of Design Guidelines that would govern Slidell's Olde Towne Preservation District and the Fremaux Avenue Corridor. This request was made in an effort to reinforce the important efforts of the Olde Towne District Advisory Commission, and to address the expected development pressures brought by the connection of Fremaux Avenue and Interstate 10. The City of Slidell has identified a need to promote quality design practices within the Olde Towne Preservation District, in order to maintain and improve the urban environment and economic viability of this area, while simultaneously focusing on the Fremaux Avenue Corridor in order to help control the appearance and quality of construction along this commercial corridor as development pressure continues to rise. The City of Slidell and its citizens seek to recognize, preserve, and protect the cultural and historic architecture and urban design within Olde Towne and along the Fremaux Avenue corridor.

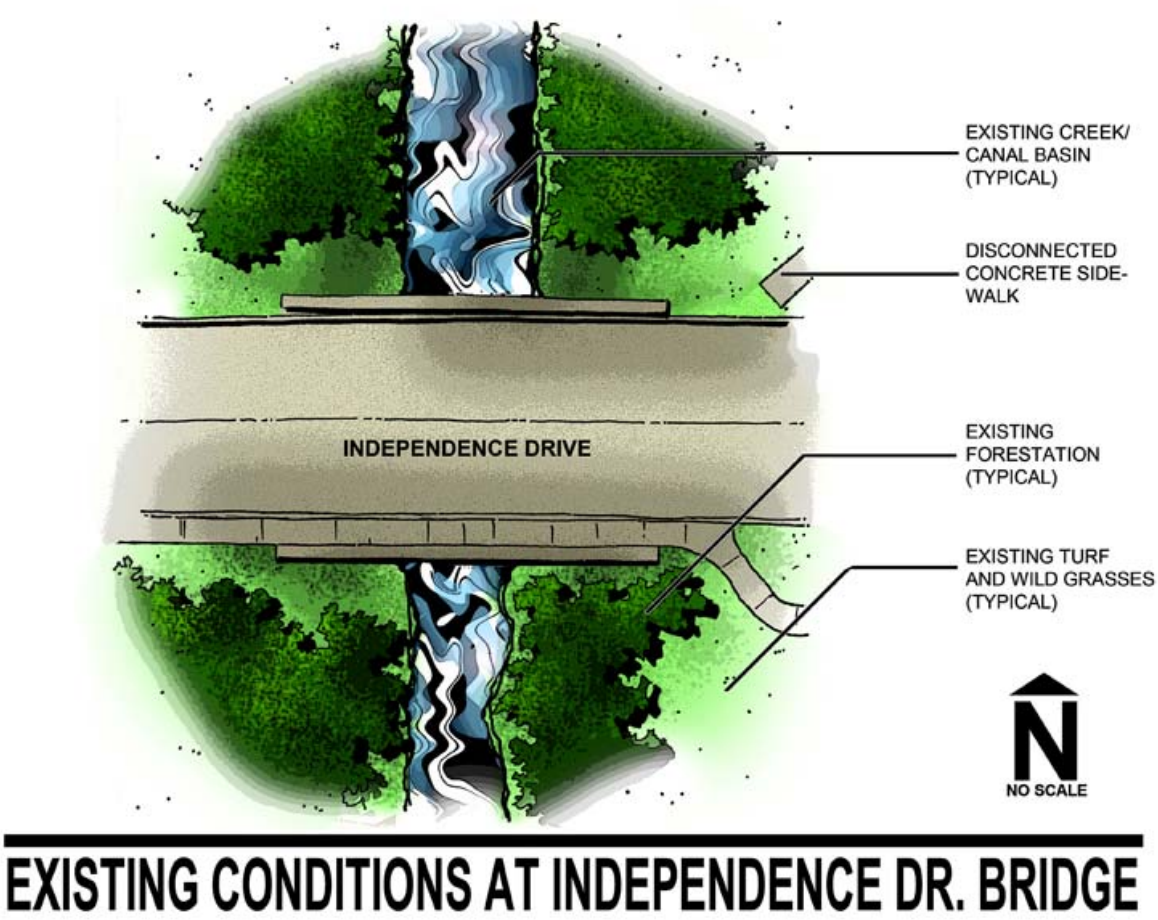


Figure 8

The project area is highly visible from the bridge crossing for vehicles and pedestrians at Fremaux Avenue (Hwy 190), Gause Blvd, Independence Blvd, Florida Ave, Robert Rd, and to a lesser extent, Daney St, Cousins St. and North Blvd. Viewpoints highlight a meandering stream

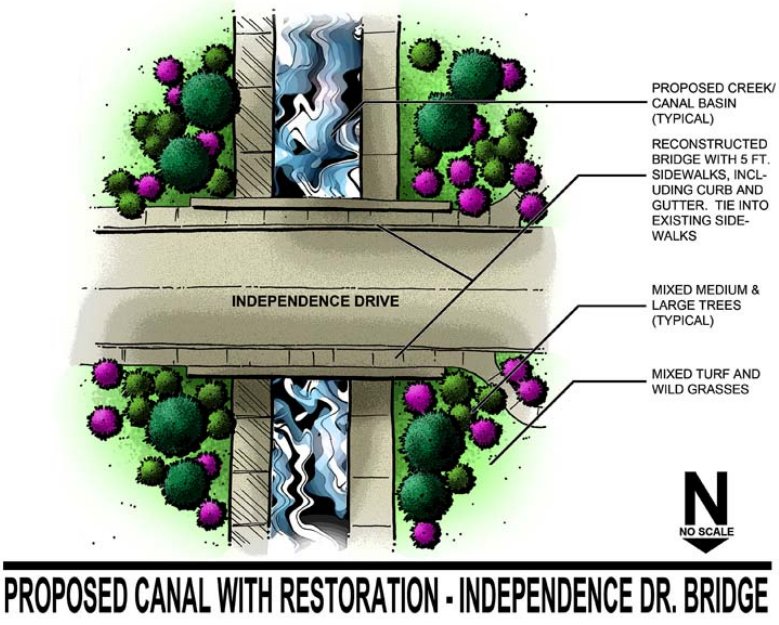
lined with trees that act as a visual screen for adjacent land use (figure 8). Land use primarily consists of residential subdivisions occasionally broken up by civic or commercial facilities. Civic uses include the school adjacent to the Independence Blvd bridge crossing, the hospital adjacent to the Florida Ave bridge crossing, and the storm water detention pond near the Robert Rd bridge crossing. Commercial uses include the NASA Computer Center and customer service conveniences near the Gause Blvd Crossing.

Future Conditions with No Action

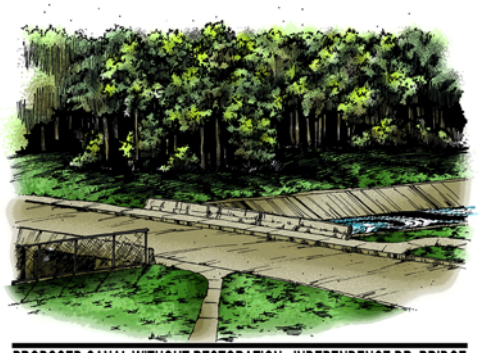
With the no action alternative, the proposed action would not be constructed by the CEMVN. However, the existing W-14 Canal would require routine maintenance operations. Visual resources would either change from existing conditions in a natural process, or change as dictated by future W-14 canal or other land-use maintenance practices.

Future Conditions with the Proposed Action

With implementation of the proposed action, impacts to visual resources would occur. The visual attributes of the project corridor would be temporarily impacted by construction activities at the project sites and by transport activities needed to move equipment and materials to and from the sites. However, these impacts would last only through the period when the flood control project is under construction. The long-term direct and indirect impacts on visual resources would be negligible. Restoration measures would be implemented to reduce visual impacts by replanting trees and other vegetation to as near pre-project conditions as practicable (figure 9).



PROPOSED CANAL WITH RESTORATION - INDEPENDENCE DR. BRIDGE


PROPOSED CANAL WITHOUT RESTORATION - INDEPENDENCE DR. BRIDGE

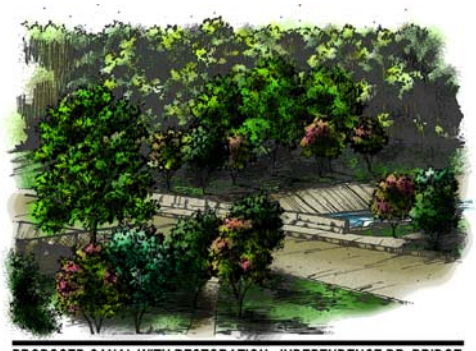

PROPOSED CANAL WITH RESTORATION - INDEPENDENCE DR. BRIDGE

Figure 9. Independence Drive Bridge reconstruction with and without landscaping.

Cumulatively, the visual impacts caused by flood control channel projects regionally and nationwide may be considered significant. Landscapes converted to unnatural visual conditions similar to the proposed project may be considered visually distressing based on the significance and complexity of lost cultural or natural elements.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The CEMVN is obligated under Engineer Regulation 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all Hazardous, Toxic, and Radioactive Waste (HTRW) contamination within the vicinity of the proposed action. A Phase I HTRW Environmental Site Assessment (ESA), and a Limited Phase II ESA have been completed for the proposed action and are on file in the CEMVN. There is a moderate probability of encountering HTRW during the proposed action, based upon the Phase I ESA and the Phase II ESA.

The Phase I ESA (SELA W-14 Canal, Slidell, Louisiana), indicated that there was a possibility of contamination in some canal sediments; therefore, a Limited Phase II Environmental Site Assessment was conducted as part of "Southeast Louisiana (SELA) Flood Control, Stormwater Drainage Canal, and Retention Ponds in Slidell, Louisiana" to investigate marsh creation using dredged material from canal improvement work. The areas were the W-14 drainage canal, Robert Road retention pond, Daney Street retention pond, the Proposed Upper and Lower retention ponds, and the pumping station. The excavated material would be used to create approximately 100 acres of brackish marsh at the Big Branch National Wildlife Refuge.

CEMVN contractors, Strategic Planning Associates and Materials Management, collected a total of twenty samples at six sites of interest. The sample locations are shown on the maps on pages 41 through 46 in the Final Phase II report, labeled B1, B2, etc. Total Petroleum Hydrocarbon-Diesel (TPH-D) was present at concentrations exceeding the Louisiana Department of Environmental Quality's Risk Evaluation/Corrective Action Program (RECAP) standards at sample locations B4 and B6 in the drainage canal. Total Petroleum Hydrocarbon-Oil (TPH-O) was present at elevated concentrations at sample point B6 in the canal, and methylene chloride exceeded the standard at sample point B7 only. All these elevated concentrations were detected in the drainage canal south of Shortcut Highway.

Methylene chloride is a very common laboratory contaminant. Lack of other contaminants associated with the use of methylene chloride (metal cleansing or paint removal contaminants) indicates that it is most likely an artifact of laboratory contamination. In addition, a split sample showed no methylene chloride. Therefore, the methylene chloride concentration at B7 does not require further consideration.

The presence of elevated Total Petroleum Hydrocarbons (TPHs) may be due to runoff from nearby residential/industrial activities. The sample interval for the sediment samples south of Shortcut Highway (B3, B4, B5, B6, B7) was 0-1 foot into the surface of the sediment. The

RECAP screening standards are intended for larger sample intervals (i.e. 0-3 feet). Once the sediment is dredged and mixed with deeper sediment (likely uncontaminated), the overall sediment contamination would be below RECAP screening standards.

Mitigation for aspects of the project required the addition of four properties in the project area to the Big Branch NWR. Field investigation and searches of government databases did not reveal any Recognized Environmental Conditions (RECs) in any of these four properties.

Future Conditions with No Action

With no action, there would be little probability of increased HTRW exposure, because any contaminated sediments would remain in the canal bottom. The four additional properties would not be added to Big Branch NWR, because no additional mitigation would be required.

Future Conditions with the Proposed Action

Additional testing of possibly contaminated sediments would be needed, in order to establish the extent of the contamination that was detected in Limited Phase II sampling. Most of the dredged material could probably be used for marsh creation without special treatment; however, some sediment may need to be disposed of at an approved landfill; other sediment may be slightly contaminated, but if the material is mixed with material deeper than the 1 foot sampling depth the resulting composite would not exceed RECAP standards.

It is the opinion of subject matter experts in the CEMVN, Engineering Division-Foundations Branch (CEMVN-ED-F) that reuse of dredged material for marsh creation is feasible. They recommend more sediment sampling where high TPHs were detected, to further delineate the contaminated area. The material dredged from areas with TPH-D and TPH-O contamination can be stockpiled during dredging activities and re-sampled for TPH-D, as well as oil and grease, for confirmation of acceptable concentrations prior to reuse. If further elevated concentrations are detected, the sediment from these areas will be sent for disposal, with the remaining dredged materials used for the marsh area. If the four additional properties were added to Big Branch NWR, the probability of encountering HTRW during the course of the project would be low.

CUMULATIVE IMPACTS

The Counsel on Environmental Quality Regulations define cumulative impacts 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)."

The proposed project is part of a larger Orleans, Jefferson, and St. Tammany Parish project, (SELA), designed to reduce adverse effects of the risk of flooding in residential, commercial, and industrial development in the metropolitan New Orleans area. Providing the City of Slidell area with the proposed project would contribute to the reduced risk of flooding, resulting in a reduced risk to life and the reduction of physical and environmental damage.

Major flooding often results in contamination of drinking water supplies, dispersion of HTRW, and dispersion of large quantities of solid waste that require clean up and disposal. Experience has shown that vast quantities of debris (e.g., homes, vehicles, mobile homes, etc.) and sediment must be collected and hauled away after a flooding event. Hauling the collected debris to a local municipal landfill requires a great deal of transportation and involves large quantities of solid waste that fill available landfill space. Providing the improved urban drainage project would significantly reduce the probability that the risk of environmental consequences of flooding would be incurred.

Negative effects associated with implementation of the proposed action that could contribute cumulatively with the effects of other projects would include temporary construction-related increases in truck traffic, noise and vibration, vehicle and equipment emissions, and degradation of water quality. Permanent loss of 61.4 acres of moderate to low quality mixed pine/bottomland hardwoods habitat would also be required. The positive cumulative effects of implementing the proposed action would include the temporary expansion of the local economy through the influx of construction-related expenditures.

COORDINATION

Preparation of this EA is being coordinated with appropriate Congressional, Federal, state, and local interests, as well as environmental groups and other interested parties. The following agencies, as well as other interested parties, are receiving copies of this EA:

U.S. Department of the Interior, Fish and Wildlife Service
U.S. Environmental Protection Agency, Region VI
U.S. Department of Commerce, NOAA Fisheries
U.S. Natural Resources Conservation Service, State Conservationist
Advisory Council on Historic Preservation
Governor's Executive Assistant for Coastal Activities
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Natural Resources, Coastal Management Division
Louisiana Department of Natural Resources, Coastal Restoration Division
Louisiana Department of Environmental Quality, PER-REGC
Louisiana Department of Environmental Quality, EP-SIP
Louisiana State Historic Preservation Officer

MITIGATION

The unavoidable loss of 61.4 acres of mixed pine/bottomland hardwood habitat would be compensated through the acquisition, management, maintenance, and monitoring of a mitigation site, which has been coordinated with the interagency team and the non-Federal sponsor. As there were insufficient pine-savannah mitigation bank credits available, a mitigation plan

centered on land acquisition and rehabilitation of that property was required to meet project mitigation requirements.

The Modified Charleston Method of habitat assessment was used to determine the number of credits/acres that would be required at the mitigation site to compensate for unavoidable project impacts. The results of this assessment indicated that 486.2 credits/146 acres of pine savannah/bottomland hardwoods habitat would need to be acquired, managed, maintained, and monitored to appropriately mitigate for the project impacts. The proposed 146-acre mitigation area occurs on four tracts (*i.e.*, the Blossman #1, Blossman #2, Elmwood, and a portion of the Mentab tract), which are adjacent to or inholdings within Big Branch Marsh NWR. The non-Federal sponsor would purchase the properties, which are located within the acquisition boundary of the Big Branch Marsh NWR (USFWS). The ownership of the properties would then be transferred to the USFWS for incorporation into the boundaries of Big Branch Marsh NWR. A 50-year management and monitoring plan has been prepared for long-term success of the mitigation site and is discussed below (the full mitigation plan can be found in the appendix):

The 52-acre Blossman #1 tract is currently comprised of a slash/loblolly pine stand with a herbaceous understory and sparse midstory due to frequent fire. It is estimated that it would take no more than 5 years to return to pine savannah function because large pine trees currently exist on site. A hardwood drain is present and Chinese tallow trees are found intermittently throughout the site.

The 41.6-acre Blossman #2 tract is currently comprised of an immature stand of slash/loblolly pine after having been logged approximately 15 years ago. It would take 10 years to 20 years to replace pine/savannah functions on this tract than other tracts (Blossman #1, Elmwood, or Mentab). This site is also bisected by a slough, which would have more bottomland hardwood species in the immediate vicinity.

The 36-acre Elmwood tract is comprised of longleaf, loblolly, and slash pine stand, and would take 0 to 5 years to return to pine savannah function because large pine trees currently exist on site. A portion of the tract contains an herbaceous understory with sparse midstory while other areas contain a moderate hardwood midstory approximately 5 feet to 10 feet in height. Chinese tallow trees are found intermittently throughout the site.

The 322-acre Mentab tract (of which 33.5 acres is included in the subject mitigation proposal) was clearcut approximately 12 years ago and subsequently bedded and replanted with loblolly pine. Because large pine trees currently exist on the tract, it is estimated that it would take a reduced time (0 to 5 years) for this tract to replace pine/savannah function.

Existing drains, dams, plowed fire lanes, and other surface feature alterations (i.e., bedding, disking, logging ruts, or placement of fill) on tracts to be planted would be degraded prior to planting so as to restore natural surface contours to the maximum extent practicable. Resultant ground surface elevations would be made conducive to the establishment and support of wetland vegetation.

Drainage and roadside ditches, which enhance the removal of water from planted tracts, would be plugged, backfilled, or otherwise made ineffective. Roadways that are to be maintained for access would be culverted as needed to insure that surface flow is not impeded, and to minimize creation of the roadway as a surface flow dam. Structures installed for the purposes of restoring natural hydrology would be maintained in good repair and would be functional at all times.

Monitoring the response of pine savannah to restoration and management actions (including appropriate fire management), would be necessary to ensure the success of the mitigation project. The non-Federal sponsor would acquire data in years 3 and 5 following implementation of initial restorative actions and submit collected data to the Chief of CEMVN Environmental Branch (Chief CWMVN-PM-R). Reports would be submitted as follows: baseline data (prior to beginning site restoration), a planting and hydrologic restoration report (upon completion of the work; may be included with the baseline if occurring in the same year), an initial success criteria report (three years after planting), an interim success criteria report (two years after successfully meeting the initial success criteria). Long-term success criteria reports (five years after successfully meeting the interim success criteria and every fifth year thereafter). The reports would include a summary of where, when, and percent coverage of burns that have occurred since the previous monitoring report. Data collected for initial, interim, and long-term monitoring would be the same as for baseline conditions using the same sample plots.

Funding for management, maintenance, and monitoring purposes would be achieved through the use of an escrow account, set up by the non-Federal sponsor, and implemented by refuge personnel (under a separate agreement with the non-Federal sponsor).

While it is the intent of the CEMVN to utilize the mitigation plan to compensate for unavoidable project impacts, an alternative plan may be substituted, if necessary. In this case, members of the interagency team, which is composed of representatives from the CEMVN and the natural resource agencies, would meet and decide on appropriate alternate mitigation for this project.

COMPLIANCE WITH ENVIRONMENTAL LAWS AND REGULATIONS

Environmental compliance for the proposed action would be achieved upon coordination of this EA with appropriate agencies, organizations, and individuals for their review and comments; USFWS and NOAA Fisheries confirmation that the proposed action would not be likely to adversely affect any endangered or threatened species; Louisiana Department of Natural Resources concurrence with the determination that the proposed action is consistent, to the maximum extent practicable, with the Louisiana Coastal Resources Program; receipt of a Water Quality Certification from the State of Louisiana; public review of the Section 404(b)(1) Public Notice; signature of the Section 404(b)(1) Evaluation; receipt of the Louisiana State Historic Preservation Officer Determination of No Affect on cultural resources; receipt and acceptance or resolution of all USFWS Coordination Act recommendations; receipt and acceptance or resolution of all Louisiana Department of Environmental Quality comments; and receipt and acceptance or resolution of all NOAA Fisheries EFH recommendations.

CONCLUSION

The proposed action consists of improving approximately 4.1 miles of the existing W-14 Canal by widening the existing canal and lowering its existing invert elevation to improve flood flow capacity, excavating two new detention ponds with overflow weirs, expanding an existing pond, installing culverts, replacing three existing bridges, and constructing a new pump station. The existing Upper and Lower Ponds located on the Slidell Development Company, LLC property would provide partial retention for overflow from the W-14 Canal. The ponds would also be utilized as partial retention for the private development. All suitable excavated material from the W-14 Canal project would be used beneficially as substrate, at a height conducive to marsh establishment in the Big Branch Marsh NWR. The unavoidable loss of 61.4 acres of mixed pine/bottomland hardwood habitat would be compensated through the acquisition, management, maintenance, and monitoring of a mitigation site, which has been coordinated with the interagency team and the non-Federal sponsor.

This office has assessed the environmental impacts of the proposed action and has determined that the proposed action would have no significant impacts on air quality; water quality; aquatic resources; wetlands; wildlife; essential fish habitat; threatened and endangered species or their critical habitats; human urban environment; transportation; noise; cultural resources recreational resources; aesthetic (visual) resources; and the risk of encountering hazardous, toxic, and radioactive waste is low.

PREPARERS

EA # 409 was prepared by Ms. Bonnie S. Obiol – Environmental Manager and Biologist, with relevant sections prepared by: Ms. Elizabeth McCasland, Biologist – Mitigation; Mr. Paul Hughbanks – Cultural Resources; Mr. Kelly McCaffrey – Recreation Resources; Mr. Richard Radford – Aesthetic (Visual) Resources, Dr. J. Christopher Brown – HTRW, Ms. Toni Baldini – Socioeconomic Resources, and Ms. Donna Urban – Project Manager. The address of the preparers is: U.S. Army Corps of Engineers, New Orleans District; Planning, Programs, and Project Management Division, CEMVN-PM-R; P.O. Box 60267; New Orleans, Louisiana 70160-0267.

LITERATURE CITED

Average Weather for Slidell, LA – Temperature and Precipitation 2008. On-line resource at: http//www.weather.com/outlook/health/airquality/wxclimatology/monthly/graph/70458

Final Environmental Assessment Report: Limited Phase II Environmental Site Assessment. SELA Flood Control Stormwater Drainage Canal & Retention Ponds, Slidell, Louisiana. 6 November 2008. Contract Number: W912P8-08-D-0029. SPA-MMG, Inc., New Orleans.

Louisiana Natural Heritage Program, Department of Wildlife and Fisheries. 1990 The Longleaf Pine Flatwood Savannahs of Southeastern Louisiana. 1 May 1990.

McKee DC. 2006. Pile Driving and Bioacoustic Impacts on Fish. IN: Proceedings of the 2005 International Conference on Ecology and Transportation, Eds. Irwin CL, Garrett P, McDermott KP. Center for Transportation and the Environment, North Carolina State University, Raleigh, NC: pp. 24-25.

Moreno, Meredith, Emily Crow, Nathanael Heller, and William P. Athens. 2008 "Phase I Cultural Resources Survey and Archeological Inventory of the Proposed W-14 Drainage Canal Detention Ponds, St. Tammany Parish, Louisiana." R. Christopher Goodwin and Associates, Inc. New Orleans, Louisiana. Draft Report, #22-3151.

Phase I Environmental Site Assessment: SELA W-14 Canal, Slidell, Louisiana. 1 October 2008. Contract Number W912P8-07-D-0008. Gulf Engineers and Consultants, Inc., Baton Rouge.

Slidell Weather 2008. On-line resource at: http://www/idcide.com/weather/la/slidell.htm

Slidell: Weather from Answers.com 2008. On-line resource at: http://www.answers.com/topic/slidell-louisiana

U.S. Federal Transit Administration (USFTA). 1995. Transit Noise and Vibration Impact Assessment. FTA Report DOT-T-95-16, April 1995.

U.S. Department of Agriculture, Soil Conservation Service. 1990. Soil Survey of St. Tammany Parish, Louisiana; in cooperation with Louisiana Agriculture Experiment Station and Louisiana State Soil and Water Conservation Committee.

U.S. Department of Highway (USDOH). 1998. Draft Environmental Impact Statement, San Francisco-Oakland Bay Bridge East Spans Seismic Safety Project On Line at: http://www.dot.ca.gov/dist4/sfobbdeis/deis4b.htm

APPENDIX

Detail maps of the W-14 Canal
Economic Appendix
Mitigation Plan for Pine Savannah Restoration
Mitigation Credits Worksheet- Modified Charleston Method Variable Justification

EA #409 APPENDIX

This Page
Intentionally Left
Blank

SELA ST. TAMMANY PARISH, SLIDELL FLOOD CONTROL PROJECT DETENTION POND ALTERNATIVE

SHEET IDENTIFICATION NUMBER DWG 2 OF 6

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION

DESIGNED BY: Anthony Peguero — DATE: 10/29/2008
DRAWN BY: Mark Shields — CKD BY: XXX — SOLICITATION NO.: W912P8-00-B-XXXX
SUBMITTED BY: XXXXXXXXXXXXXX — CONTRACT NO.: W912P8-00-C-XXXX
FILE NAME: M:\N-SELA_Detention_Ponds2.mxd — FILE NO.: HHH-HHHH
SIZE: ANSI X — PLOT SCALE: 1=NN.1 — PLOT DATE: 10/29/2008

MARK | DESCRIPTION | DATE | APPR | MARK | DESCRIPTION | DATE | APPR

U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Job No. EGIS-08-123

SELA ST. TAMMANY PARISH, SLIDELL FLOOD CONTROL PROJECT DETENTION POND ALTERNATIVE

U.S. ARMY ENGINEER DISTRICT, CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION

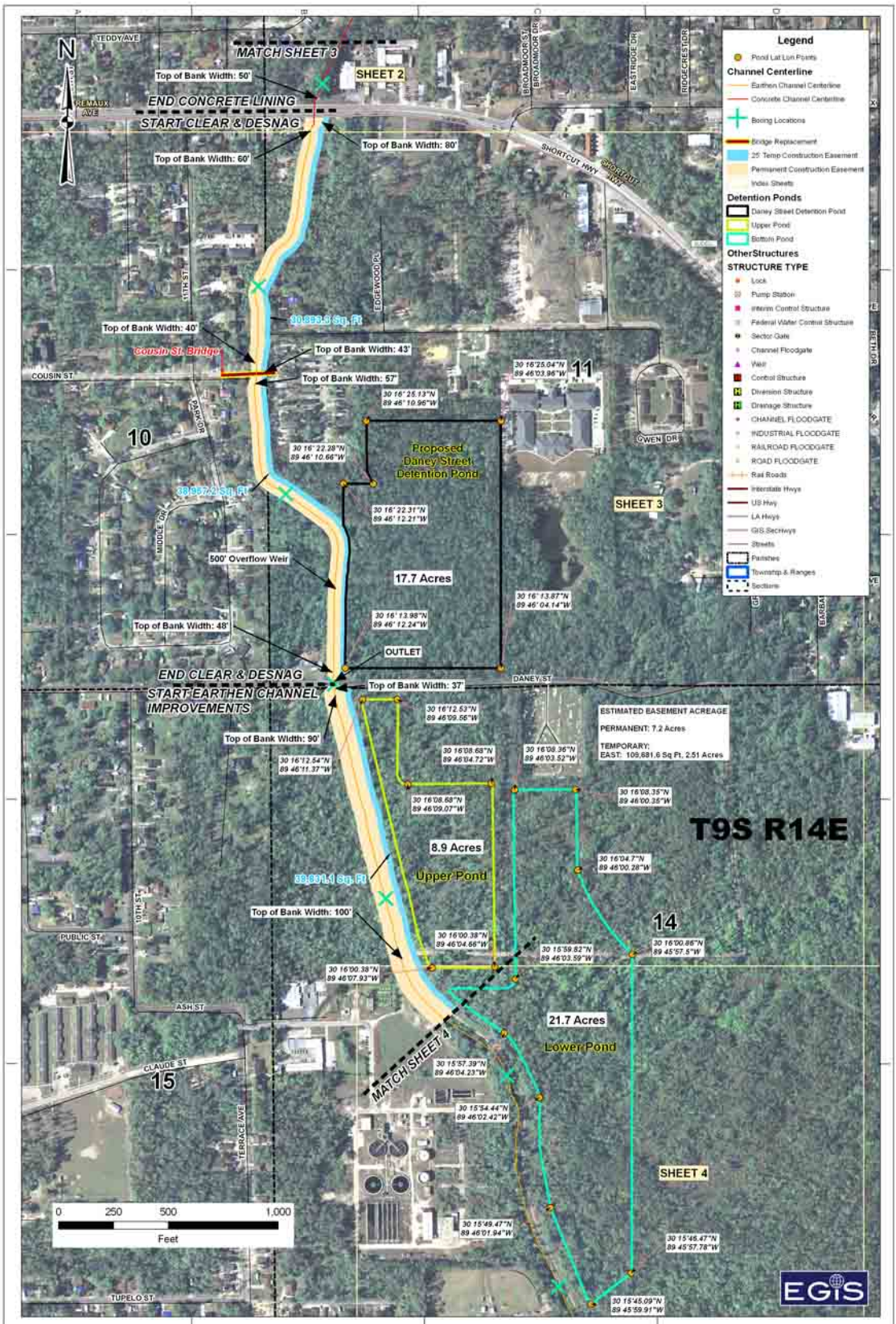
DESIGNED BY: Anthony Peguero | DATE: 10/29/2008
DRAWN BY: Mark Shields | CKD BY: XXX | SOLICITATION NO.: W912P8-90-B-XXXX
SUBMITTED BY: XXXXXXXXXXXXXXX | CONTRACT NO.: W912P8-90-C-XXXX
FILE NAME: M:\N-SELA_Detention_Ponds2.mxd | FILE NO.: HHN-HHHHH
SIZE: ANSI X | PLOT SCALE: 1=NN.1 | PLOT DATE: 10/29/2008

SHEET DESIGNATION NUMBER: DWG 3 OF 6

MARK | DESCRIPTION | DATE | APPR | MARK | DESCRIPTION | DATE | APPR

U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT

Job No. EGIS-08-123



SHEET IDENTIFICATION NUMBER DWG 4 OF 6

SELA ST. TAMMANY PARISH, SLIDELL
FLOOD CONTROL PROJECT
DETENTION POND ALTERNATIVE

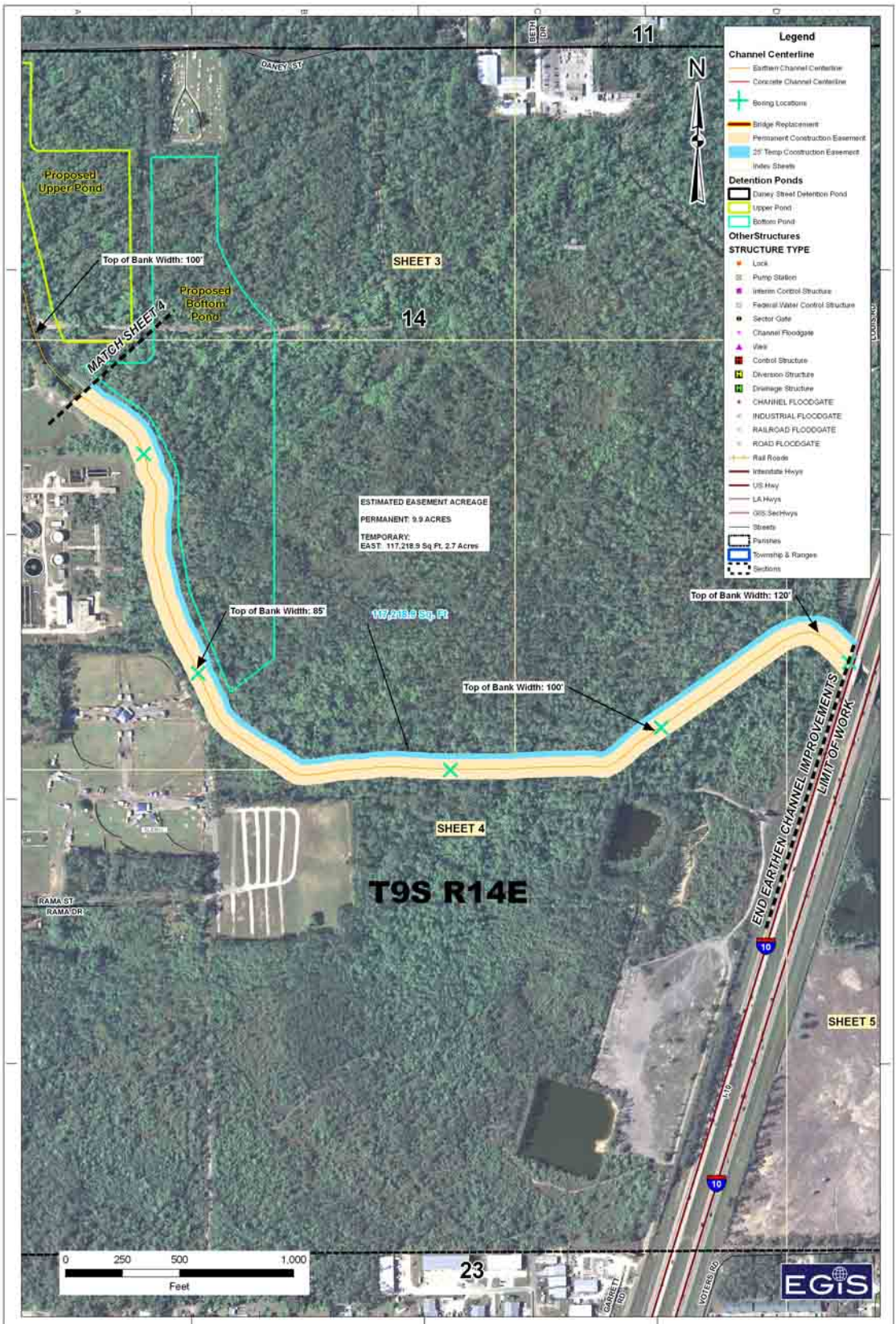
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
MISSISSIPPI VALLEY DIVISION

DESIGNED BY: Anthony Peguero
DRAWN BY: Mark Shields
CKD BY: XXX
SUBMITTED BY: XXXXXXXXXXXXXXX
DATE: 10/29/2008
SOLICITATION NO.: W912P8-00-B-XXXX
CONTRACT NO.: W912P8-00-C-XXXX
FILE NAME: M:\N-SELA_Detention_Ponds2.mxd
FILE NO.: HHH-HHHHH
SIZE: ANSI X
PLOT SCALE: 1=NN.1
PLOT DATE: 10/29/2008

MARK | DESCRIPTION | DATE | APPR

U.S. ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

Job No. EGIS-08-123



Job No. EGIS-08-123

SHEET DESIGNATION NUMBER DWG 6 OF 6

SELA ST. TAMMANY PARISH, SLIDELL FLOOD CONTROL PROJECT DETENTION POND ALTERNATIVE

U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS MISSISSIPPI VALLEY DIVISION

DESIGNED BY: Anthony Peguero	DATE: 10/30/2008		
DRAWN BY: Mark Shields	CKD BY: XXX	SOLICITATION NO.: W912P8-90-B-XXXX	
SUBMITTED BY: XXXXXXXXXXXXXXX		CONTRACT NO.: W912P8-90-C-XXXX	
FILE NAME: M:\N-GEL\...\Detention_Ponds2.mxd		FILE NO.: HHH-HHHHH	
SIZE: ANSI X	PLOT SCALE: 1=NN.1	PLOT DATE: 10/30/2008	

MARK	DESCRIPTION	DATE	APPR	MARK	DESCRIPTION	DATE	APPR

U.S. ARMY CORPS OF ENGINEERS NEW ORLEANS DISTRICT

Job No. EGIS-08-123

This Page
Intentionally Left
Blank

ECONOMIC APPENDIX
TABLE OF CONTENTS

SECTION 1 - INTRODUCTION

General. The City of Slidell, Louisiana, Southeast Louisiana Urban Flood Control Project (Slidell-SELA) is located in southeast Louisiana and is encompassed by the W-14 Main Diversion Canal Basin within the City of Slidell. This drainage basin experiences significant rainfall flooding. Extensive damage to homes and businesses in the affected area has resulted from past flooding events. The SELA Project authorized improvements to the W-14 Drainage Canal within the City Limits of Slidell. The project includes improving approximately four miles of the existing W-14 Canal by widening the existing canal and lowering its existing invert elevation to improve flood flow capacity, excavating four new detention ponds with overflow weirs, expanding an existing pond, installing culverts, replacing three existing bridges, and constructing a new pump station.

This appendix presents an economic evaluation of the improvements being considered for Slidell-SELA, Louisiana, which is located in St. Tammany Parish, Louisiana. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance. The National Economic Development Procedures Manual for Urban Flood Damage, prepared by the Water Resources Support Center, Institute for Water Resources, was used as a reference.

The evaluation consists of a description of the methodology used to determine economic damages and benefits under existing conditions, project costs, and benefit-to-cost analysis. The evaluation uses October 2008 price levels. The proposed improvements were evaluated by comparing estimated average annual benefits that would accrue to the study area with estimated average annual project costs. Benefits were converted to average annual values by using the FY 2009 Federal discount rate of 4-5/8 percent and a project life of 50 years. The estimated project base year (the year in which significant benefits will accrue as a result of project construction) is the year 2010.

National Economic Development Benefits Considered. The National Economic Development Procedures Manual for Urban Flood Damage recognizes four primary categories of benefits for urban flood control plans: inundation reduction, intensification, location and employment benefits. Inundation reduction is the only category of benefits for urban areas considered in this analysis. This category includes damages to residential and non-residential structures, losses to the contents in these structures, and damages to privately owned vehicles. It also includes the reduction of emergency costs, evacuation and subsistence costs, and reoccupation costs. The evaluation process involved the formulation and assessment of the flood control improvements, the identification of categories of possible flood control benefits, the determination of without- and with-project damages and costs incurred, and standard benefit-cost comparisons. The basic economic evaluation included the comparison of the urban flood damage setting for the without-project and with-project conditions. Without-project conditions, or existing conditions, including any SELA authorized project improvements reflect conditions expected to prevail in the absence of any alternative plan of improvement. With-project

conditions reflect conditions in the project area with the proposed additional flood improvements in place.

Inundation Reduction Benefits. Based on EC 1105-2-100, inundation reduction benefits are associated with physical damages or losses, income losses, and emergency costs. Most activities affected by a flood incur losses in one or more of these categories, but usually the majority of the benefits from a project result from the reduction of actual or potential physical damages due to inundation.

SECTION II – INUNDATION REDUCTION BENEFITS FOR STRUCTURES AND AUTOMOBILES

Flood Damage Reduction. Most of the benefits that accrue from a project are usually the result of reducing physical flood damages. Physical inundation damages include structural damages to buildings and losses to contents; damages to roads, bridges, and other public utilities; and losses to personal property such as automobiles. In determining potential flood damages for this area, flood damages were evaluated for urban structures and automobiles.

Analysis of Flood Damages to Structures. In the initiation of urban flood damage analyses, field investigations were conducted and data were collected to identify the extent and character of flooding in the project area. The determination of existing urban flood damages was based on the integration of depth-damage relationships and flood frequency distributions to structures located in the area. Development of the existing structure data was based upon a comprehensive field survey of all non-residential and residential structures located within the alignment of the project area. Site-specific flood damage curves were used to depict the relationships between the stage and area inundated, stage and frequency of occurrence, stage and damage, and damage and frequency of occurrence. These curves are the basis for the damage/benefit analysis in evaluating project alternatives.

Structure Inventory and Valuation. The study area surveyed is located in St. Tammany Parish. A comprehensive field survey was conducted to identify every structure at risk in the study area. The purpose of the inventory was to collect pertinent information on all residential and non-residential structures within the project area. Within the project area there were 650 non-residential structures, 105 mobile homes, and 5,000 residential structures that were surveyed. The survey estimated the number, value, and elevation of all structures. Ground elevations were determined using Light Detection and Ranging (LIDAR) information provided by St. Tammany Parish. First floor elevations were estimated using a hand level to insure accuracy.

Both non-residential and residential structures were surveyed for pertinent characteristics. These included the type of structure, number of stories, type of foundation and construction, structure dimensions, physical condition of the structure, and the location. Structures were differentiated by 11 basic types -- residential one-story,

residential two-story, mobile home, apartment or duplex, professional, retail and personal services, warehouses and contractor services, public and semi-public, eating and recreation, groceries and gas stations, and repairs and home use.

Residential and non-residential structure values were calculated using the Marshall and Swift (M&S) Residential Estimator Program. This continuously price-adjusted computer program uses cost per square foot, geographically localized by zip code, to calculate a depreciated replacement value for each structure. Mobile homes within the area were assessed using an average value per structure based on size.

Automobile Valuation. Information obtained from the US Census Bureau, General Housing Characteristics: 2000, for St. Tammany Parish, Louisiana, and automobile registration obtained from the State of Louisiana, Department of Public Safety, indicates there are slightly over 2 vehicles on average per household in St. Tammany Parish. For automobile flood damage calculations, it was assumed that each residence had one automobile, which was susceptible to damage. For slab homes, automobiles were placed at 0.5 foot below the first floor level, assuming garages and carports are lower than first-floor elevations of homes. For pier homes, automobiles were placed at ground elevation. The average value per automobile expressed in 2008 price levels is $12,200 based on the Manheim Used Vehicle Index. This index is based on all completed sales transactions at Manheim's US auctions. This is a sample size of over four million transactions annually. This index uses the twenty J.D. Power and Associates market classes and makes adjustments for differences in mileage alone, an unchanging mix of units sold, and seasonality. Manheim Auctions is a wholly owned subsidiary of Cox Enterprises, Inc. and conducts over 80 used vehicle auctions throughout the United States and has been in operation for over 50 years.

Depth-Damage Relationships and Content-to-Structure Value Ratio (CSVR). Depth-damage relationships define the relationship between the depth of flooding and the percent of damage at varying depths that occurs to structures and contents. These mathematical functions are used to quantify the flood damages to a given structure. The content-to-structure value ratio (CSVR) is expressed as a ratio of two values: the depreciated replacement cost of contents and the depreciated replacement cost of the structure. One method to derive these relationships is the "Expert Opinion" method described in the Handbook of Forecasting Techniques, IWR Contract Report 75-7, December 1975 and Handbook of Forecasting Techniques, Part II, Description of 31 Techniques, Supplement to IWR Contract Report 75-7, August 1977. A panel of experts was convened to develop site-specific depth-damage relationships and CSVRS for feasibility studies associated with Jefferson and Orleans Parishes. Professionals in the fields of residential and non-residential construction, general contractors, insurance claims adjusters with experience in flood damage, and a certified restoration expert were selected to sit on the panel. The panel was tasked with developing an array of residential and non-residential structure and content types. Residential structure types were divided into one-story on pier, one-story on slab, two-story on pier, two-story on slab and mobile homes. Non-residential structure types were categorized as metal-frame walls, masonry bearing walls, and wood or steel frame walls. Residential contents were evaluated as

one-story, two-story, or mobile home. Non-residential content categories included the following types: eating and recreation, groceries and gas stations, multi-family residences, repair and home use, retail and personal services, professional businesses, public and semi-public, and warehouse and contractor services. The results of this panel were published in the report Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-To-Structure Value Ratios (CSVRS) In Support Of the Jefferson and Orleans Flood Control Feasibility Studies, June 1996 Final Report.

Automobile Depth-Damage. Vehicle depth-damage was based on interviews with car dealerships and insurance adjustors who had recent experience with flood damages and claims for automobiles. Based on these interviews with professionals relationships were developed between depth of flooding and percent damage. Automobile damages are then calculated by correlating depth of flooding, depth-damage per automobile, and damage per automobile. The elevation of each automobile is determined by its corresponding structure elevation.

SECTION III – RISK-BASED ANALYSIS

Overview of Risk-Based Analysis. The use of risk-based analysis procedures for formulating and evaluating flood damage reduction measures (ER 1105-2-101) is required by the Army Corps of Engineers in conducting studies. Uncertainty is implicit in many areas of planning for water resource projects. The uncertainty arises due to error in the data being measured or errors inherent in the methods used to estimate the values of certain critical variables. The potential for error exists throughout the traditional analysis because each of the variables has been assigned a single point value rather than a range of values. In order to compensate for possible error, risk-based analysis can be applied to the planning and design of water resource projects. This approach, which quantifies the extent of systematic risk, provides the decision-maker with a broader range of information. Thus, a decision can be made that reflects the explicit tradeoff between risks and costs.

The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) computer program was utilized to evaluate flood damages using risk-based methods. This program is used to quantify the uncertainty in discharge-exceedance probability, stage-discharge, and stage-damage functions and assimilates it into the economic and engineering performance analyses of alternatives. Monte Carlo simulation is used to compute the expected value of damage while explicitly accounting for the uncertainty in economic and hydraulic parameters used to determine flood inundation damages. The analysis considered a range of possible values, with a maximum and a minimum value, for each economic variable used to calculate the elevation- or stage-damage curves, and for each hydrologic/hydraulic variable used to calculate the stage-frequency curves. It also considered a probability distribution for the likely occurrence of any given outcome within the specified range. The HEC-FDA program used Monte Carlo simulation to derive the possible occurrences of each variable. Randomly generated numbers were used to simulate the occurrences of selected variables from within the established ranges and distributions. In order to use this program the inherent uncertainty associated with each of the key hydrologic/hydraulic and economic variables in the analysis was quantified.

Economic Uncertainty. Risk-based analysis was performed on four key economic variables: structure values, contents-to-structure value ratios, first floor elevations, and depth-damage relationships. Each of these variables was analyzed for its impact on the elevation-damage curve.

Uncertainty in Structure & Automobile Values. Uncertainty in structure values can result from errors in estimating the square footage of the structure, and/or inaccurate judgments regarding the age and condition of the structure. In order to determine the error associated with structure values, a comparison was made between the traditional windshield survey and a more precise method. Homeowners in Orleans and Jefferson Parishes were interviewed to collect more accurate information regarding square footage and other relevant information that affects structure value. Windshield surveys were used to determine the M&S values for a sample of 18 residential properties. These values were then compared to the M&S values compiled using data on the square footage and age of the structure provided by the homeowners. A similar procedure was used to compare the M&S values of 28 non-residential structures compiled during field surveys with data obtained from the owners of these businesses. These comparisons were made in order to estimate the uncertainty inherent in data compiled during drive-by surveys. The uncertainty is represented by a normal probability density function with a standard deviation of 11.4% for residential structures and 11.6% for non-residential structures. A triangular probability distribution function was used to determine the uncertainty surrounding the values assigned to the automobiles in the inventory. The most likely value was assumed to be the average value of a used car ($10,750). The maximum value was assumed to be the average value of a new car before taxes, license, and shipping charges ($16,800). The average 10-year depreciation value of an automobile ($2,000) was used as the minimum value.

Uncertainty in Contents-to-Structure Value Ratios. On-site interviews were conducted for a sample of 10 structures from each of the three residential content categories (30 residential structures) and from each of the eight non-residential content categories (80 non-residential structures). A CSVR was computed for each structure in the sample based on the total depreciated content value developed from these interviews. A probability density function was then used to describe the distribution of these observations around the expected mean. A normal probability density function was used for each content category. The expected values and standard deviations are shown for each of the three residential categories and the eight non-residential categories on page 81 in the report dated June 1996 entitled Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRS) In Support of the Jefferson and Orleans Flood Control Feasibility Studies.

Uncertainty in First Floor Elevations. First floor elevations were determined using aerial photographs with 1-foot contours and hand-levels to determine the height above ground level. These first floor elevations were then compared to the first floor elevations of 89 randomly selected structures throughout the study area using engineering surveys. Based on this comparison, a truncated normal probability density function was used to

describe the uncertainty associated with this variable. A standard deviation of 0.6 feet was calculated with a truncated range of 1.2 feet.

Uncertainty in Depth-Damage Relationships. A panel of experts developed depth-damage relationships for 5 residential structure categories and 3 non-residential structure categories. Depth-damage relationships were also developed for 3 residential content categories and 8 non-residential categories. The panel determined the expected damage that would occur at each increment of flooding. A triangular probability density function was used to determine the uncertainty associated with each increment of flooding. A minimum, maximum and most likely damage estimate was provided for each increment of flooding.

Economic Uncertainty Results. As discussed above, risk-based analysis was performed on 4 key economic variables: structure values, CSVRs, first floor elevations, and depth-damage relationships. Each of these variables was analyzed for its impact on the elevation-damage relationships. In order to develop a frequency-damage relationship, a damage with error relationship was developed for each stage associated with the frequency events for the without- and with-project conditions. An elevation-damage with error curve was developed for the stages associated with the frequency events.

SECTION IV – NET BENEFIT ANALYSIS

Average Annual Benefits and Costs. The economic justification of the plan given detailed consideration was determined by comparing estimates of the average annual costs and average annual benefits which are expected to accrue over the life of the project (50 years). Recommendation of any construction plan by the Corps of Engineers requires that average annual benefits equal or exceed average annual costs.

The values estimated for benefits and costs at the time of accrual were made comparable by conversion to an equivalent time basis using the FY 2009 Federal discount rate of 4-5/8 percent. The period of analysis, or project life, utilized in the analysis is 50 years. The benefits and costs are expressed as the average annual value of the present worth of all expenditures and all plan outputs. These expenditures and outputs are measured at a specific point in time (base year). The base year (2010), is the year in which the project becomes operational or when significant benefits start to accrue.

Estimated with-project damages would be limited to the effects of rainfall or events exceeding the level of protection. The total benefits of the project include the benefits anticipated over the 50-year project. The equivalent annual damage reduced (benefits) for inundation reduction for structures and automobiles were based on the results from the HEC-FDA program. The benefit of the alternative was compared with the costs to determine the economic justification of the proposed flood control alternative, benefit-to-cost ratio, and net benefits.

Total project first costs include costs for mitigation, real estate, and relocations. The schedule of yearly expenditures is annualized based on a base year of 2010. Costs were

converted to average annual values using the FY 2009 Federal discount rate of 4-5/8 percent, a project life of 50 years, and a 2008 price level. Table 1 displays first costs, average annual costs, average annual benefits, net benefits and the benefit-cost ratio. The recommended plan has net benefits of $16,886,600 with a benefit-cost ratio of 2.46.

Table 1
SELA Slidell, LA
Average Annual Benefits, Average Annual Costs, and Benefit-Cost Ratio

Total First Costs	249,856,000
Average Annual Costs	11,368,300
Operation and Maintenance	200,000
Total Average Annual Costs	11,568,300
Average Annual Benefits	28,454,900
Benefit-Cost Ratio	2.46
Net Benefits	16,886,600

NONSTRUCTURAL ALTERNATIVES

Methodology. The Economics Branch of the New Orleans District developed a Microsoft Excel workbook within an @Risk framework that can be used to quantify the uncertainty implicit in the analysis of two non-structural flood damage reduction options: structure raising and buyouts. Inputs for the model include depth-damage relationships, stage-frequency relationships, structure valuations, contents-to-structure value ratios, and first floor elevations. The workbook was then used to quantify the uncertainty surrounding the without-project damages, the benefits attributable to the nonstructural options, and the costs of these measures. Finally, the workbook was used to compare the benefits and costs and to determine the economic feasibility of the nonstructural options within a risk-based framework.

For this analysis, uncertainty was quantified for certain critical variables (stage-frequency data, depth-damage relationships, structure and content values, and first floor elevations of those structures) through the development of corresponding probability distributions.

Structure-Raising Option. A structure-raising option was considered for all residential structures within the 100-year floodplain for the study area. This option involved raising residential structures to the elevation of the stages associated with the existing condition 100-year storm event. Thus, the benefits associated with this option were defined as the reduction in damages that would occur from the rainfall associated with various storm events. The benefits and costs associated with this option are discussed below. The result of this analysis assumes 100% participation of all property owners.

The cost per square foot for raising a structure is based on data obtained during interviews conducted by USACE personnel in March 2008 with representatives of three major metropolitan New Orleans area contracting firms that specialize in the raising of structures. Costs were derived for slab and pier foundation residential structures with both one and two stories, and also for mobile homes. A triangular probability distribution is used to define the uncertainty associated with the structure raising costs. Minimum, most likely and maximum values are the three parameters required to define the triangular distribution. Figure 1 displays the most likely costs for each of the five residential categories analyzed.

The cost per square foot to raise an individual structure to the required height was multiplied by square footage of each residential structure in the planning area. This total was combined with the one-month temporary relocation cost of $14,100 per structure (includes packing/moving, labor, storage, hotel costs, per diem costs, kennel costs for pets, and contingencies) in order to determine the total cost of raising each structure. The costs per structure were then totaled and amortized over the 50-year life of the project using the FY 2009 Federal discount rate of 4-5/8 percent and the 2008 price level. These costs were then compared to benefits.

The @Risk spreadsheet model was used to calculate the benefits associated with the structure-raising option. The benefits were defined as the reduction in the without-project

damages that would result from structures being raised above the 100-year stage. The benefits for the structure-raising option only consider the reduction in damages to residential structures and their contents, not nonresidential structures or automobiles. These benefits were then totaled by reach and compared to the costs of the structure raising option. The economic justification was determined by comparing the expected annual benefits to the expected annual costs. Net benefits were calculated by subtracting the expected annual costs from the expected annual benefits. Figure 2 shows the expected annual damages for the with and without-project conditions, structures raised, total first costs, total annual costs, the expected annual damages reduced for all structures in a reach and for only those whose benefit/cost ratios were greater than 1. It also shows net benefits for all structures in a reach and for only those whose benefit/cost ratios were greater than 1. Finally, it shows benefit/cost ratio for all structures in a reach and for only those whose benefit/cost ratios were greater than 1.

Figure 1
Cost per Square Foot for Structure Raising ($)
(Most Likely Costs)

Ft. of Raising	1-Story Slab	2-Story Slab	1-Story Pier	2-Story Pier	Mobile Home
1	63.00	63.00	48.00	48.00	18.00
2	63.00	63.00	48.00	48.00	18.00
3	63.00	63.00	48.00	48.00	18.00
4	64.13	64.13	49.13	49.13	18.00
5	65.25	65.25	50.25	50.25	20.00
6	66.38	66.38	51.38	51.38	21.00
7	66.38	66.38	51.38	51.38	21.00
8	66.38	66.38	51.38	51.38	21.00
9	66.38	66.38	51.38	51.38	21.00
10	66.38	66.38	51.38	51.38	21.00
11	66.38	66.38	51.38	51.38	21.00
12	66.38	66.38	51.38	51.38	21.00
13	66.38	66.38	51.38	51.38	21.00

Figure 2
SELA Slidell W-14 Non-Structural Measures
FY 2009 Price Level, 4-5/8% Interest Rate

Reach	Expected Annual Damage Without Project ($1,000)	Expected Annual Damage With Non-Structural Actions ($1,000)	Number of Raisings	Total First Cost ($1,000)	Total Annual Cost ($1,000)	Expected Annual Damage Reduced-all BCR ($1,000)	Expected Annual Damage Reduced - BCR>1 ($1,000)	Net Benefits - all BCR ($1,000)	Net Benefits - BCR>1 ($1,000)	BCR - all	BCR - BCR>1
1	319.3	91.3	88.7	9749.0	503.4	228.0	115.4	-275.3	59.0	0.5	2.0
2	400.2	63.5	128.4	14532.9	750.4	336.6	196.4	-413.8	106.5	0.4	2.2
3	86.8	22.7	26.7	3798.1	196.1	64.1	31.5	-132.0	17.0	0.3	2.2
4	752.0	45.9	74.6	8730.2	450.8	706.1	628.5	255.3	499.2	1.6	5.0
5	8963.9	229.3	237.4	33296.2	1719.2	8734.6	8568.1	7015.3	7356.4	5.1	7.1
6	11623.7	307.5	335.3	36961.5	1908.5	11316.2	11132.7	9407.7	9639.8	5.9	7.5
7	107.9	13.6	15.5	1663.1	85.9	94.2	78.8	8.4	58.5	1.1	4.0
8	0.1	0.1	0.1	7.5	0.4	0.1	0.0	-0.3	0.0	0.1	1.7
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.2	0.1	0.0	2.1	0.1	0.0	0.0	-0.1	0.0	0.1	0.0
All Reaches	**22254.1**	**774.1**	**906.7**	**108740.4**	**5614.8**	**21479.9**	**20751.3**	**15865.1**	**17736.3**	**3.8**	**6.9**

PINE-SAVANNAH RESTORATION PLAN
For the SLIDELL W-14 CANAL PROJECT
EA #409

1. Mitigation Goals and Objectives

The goal is to restore, maintain, and preserve the increasingly rare and ecologically significant longleaf pine savannah habitat on 146 acres adjacent to Big Branch Marsh National Wildlife Refuge (NWR) in St. Tammany Parish, Louisiana. Southern pine savannahs and open woodlands once dominated the southeastern United States, and may have totaled over 200 million acres at the time of European colonization (Conner *et al*. 2001). Longleaf pine communities characterized the Atlantic and Gulf coastal regions, and covered an estimated 60 to 92 million acres (Wahlenburg 1946, Frost 1993, Ware *et al*. 1993, Landers *et al*. 1995). Today, longleaf forests have declined to less than 3 million acres (Landers *et al*. 1995), of which approximately 3 percent remains in relatively natural condition (Frost 1993).

Southern pine forests today are very different from precolonial communities in extent, species composition, age, and structure (Ware *et al*. 1993, Noel *et al*. 1998). Original pine forests were old, open, and contained a structure of two layers (canopy and diverse herbaceous groundcover); these forests were dominated by longleaf pine in the coastal plain. In contrast, much of today's forest is young, dense, and dominated by loblolly pine, with a substantial hardwood component and little or no herbaceous groundcover (Ware *et al*. 1993, Noel *et al*. 1998). Drainages, however, with associated shrub and midstory layers and hardwoods, are integral components of the southern pine ecosystem and thus, should be managed throughout the landscape, as appropriate.

Little old growth remains, and virtually no longleaf forest has escaped changes in the natural fire regime (Simberloff 1993, Walker 1999). Precolonial fire frequencies in the southeast have been estimated at 1 to 3 years for the lower Gulf coastal plains (Stout and Marion 1993, Ware *et al*. 1993, Frost 1998). Active fire suppression began to be institutionalized in the southeastern United States between 1910 and 1930 (Frost 1993, Ware *et al*. 1993). Such fire suppression has severe and numerous impacts on southern pine ecosystems, including changes in tree species composition and forest structure. Longleaf pine cannot reproduce without access to the mineral soil, and will be replaced under fire suppression by other species of pines and hardwoods. The structure of the forest changes from two layers (a canopy and a diverse groundcover) to a multi-layered midstory and canopy with little or no groundcover.

2. Location

As there were insufficient pine-savannah mitigation bank credits available, a mitigation plan centered on land acquisition and rehabilitation of that property was required to meet project mitigation requirements. The proposed 146-acre mitigation area occurs on four tracts (i.e., the Blossman #1, Blossman #2, Elmwood, and a portion of the Mentab tract) which are adjacent to or inholdings within Big Branch Marsh NWR, St. Tammany Parish, Louisiana (Township 8

South, Range 12 East, Sections 35 and 48; Township 9 South, Range 12 East, Section 2; and Township 9 South, Range 13 East, Section 10, 40, and 41). All of the proposed sites are within the acquisition boundary of the Big Branch NWR, who would accept and manage the properties with conservation easements in place.

3. Existing Conditions

The Modified Charleston Method was used to evaluate the forest composition and condition of the sites under consideration for mitigation. The 52-acre Blossman #1 tract is currently comprised of a slash/loblolly pine stand with a herbaceous understory and sparse midstory due to frequent fire. It is estimated it would take no more than 5 years to return to pine savannah function because large pine trees currently exist on site. A hardwood drain is present and Chinese tallow trees are found intermittently throughout the site. The 41.6-acre Blossman #2 tract is currently comprised of an immature stand of slash/loblolly pine after having been logged approximately 15 years ago. It would take 10-20 years to replace pine/savannah functions on this tract than other tracts. This site is also bisected by a slough which would have more bottomland hardwood species in the immediate vicinity. The 36-acre Elmwood tract is comprised of longleaf, loblolly, and slash pine stand, and would take 0-5 years to return to pine savannah function because large pine trees currently exist on site. A portion of the tract contains a herbaceous understory with sparse midstory while other areas contain a moderate hardwood midstory approximately 5-10 feet in height. Chinese tallow trees are found intermittently throughout the site. The 322-acre Mentab tract (of which 33.5 acres is included in the subject mitigation proposal) was clearcut approximately 12 years ago and subsequently bedded and replanted with loblolly pine. Because large pine trees currently exist on the tract, it is estimated that it would take a reduced time (0-5 years) for this tract to replace pine/savannah function.

Existing drains, dams, plowed fire lanes and other surface feature alterations (i.e., bedding, disking, logging ruts or placement of fill) on tracts to be planted would be degraded prior to planting so as to restore natural surface contours to the maximum extent practicable. Resultant ground surface elevations would be made conducive to the establishment and support of wetland vegetation.

Drainage and roadside ditches which enhance the removal of water from planted tracts would be plugged, backfilled, or otherwise made ineffective. Roadways that are to be maintained for access would be culverted as needed to insure that surface flow is not impeded and minimizing dam reservoirs and/or reservoir shadows. Structures installed for the purposes of restoring natural hydrology would be maintained in good repair and would be functional at all times.

Monitoring the response of pine flatwood/savannah to restoration and management actions (including appropriate fire management), would be necessary to ensure the success of the mitigation project. The United States Fish and Wildlife Service (USFW) would acquire data in years 3 and 5 following implementation of initial restorative actions and submit collected data to the CEMVN Environmental Branch (Chief CWMVN-PM-R). Following collection of suitable baseline data, elements to be reviewed during the 5 year period are basic hydrologic information, longleaf pine seedling survival data, and vegetation composition and structure (including overstory species per percent cover, midstory woody composition per percent cover, and

groundcover composition per percent cover). Progress will be measured by the restoration criteria as listed below:

1. Survival of planted bare root longleaf pine seedlings shall not be less than 30 percent of the initial number of seedlings planted at year 3.
2. In the first three years of establishing the mitigation project, site hydrology shall be restored if needed as follows:
    a) Percent of area affected by artificial drainage <10%
    b) Percent of area affected by incoming surface flow <20%
    c) Percent of area affected by unnatural surface alterations 25%

4. Habitat to be Rehabilitated: Pine Savannah Long-Term Criteria

Vegetative cover for high quality restored pine flatwood /wetland savannah will fall within the following ranges:

Vegetation Strata	**Estimated Total Percent Cover**
Longleaf/Slash pine* overstory	10 – 50 %
Total overstory (pine plus various hardwoods)	15 – 55 %
Woody understory (shrub/small trees)	5 – 15 %
Herbaceous ground cover**	90 – 100 %
(* longleaf pine indicated by soil type and topography)	
(** sampled at least 12 months following a burn)	

Vegetation composition should consist of a variety of indigenous species, with a predominance of longleaf or Slash pine in the overstory, and additional age classes of longleaf/Slash pine in the understory. Negative indicator species (NIS) will be maintained at a minimum level. A small number of indigenous hardwood shrub and tree species is desirable for wildlife diversity, and undoubtedly occurred on the pre-settlement landscape. General goals are as follows:

Vegetation Composition	**Species/type Composition**
Overstory (> 15 ft ht)	70– 90%* longleaf/slash pine
Understory (2 – 15 ft ht)	>50%* longleaf/slash pine; 4 species of indigenous shrubs/hardwood trees in pine flatwood wetlands
Herbaceous groundcover (< 2 ft)	50 – 90%* grasses/sedges; 10 – 50%* forbs; > 10 Native species/sq meter, > 50 herbaceous species per mitigation site; NIS species < 1% of total cover

The objective of the site restoration is to have 10-50 percent overstory of preferably longleaf pine trees, from 5-15 percent woody understory, and 90-100 percent herbaceous groundcover to include grasses, sedges, and forbs. Present habitat on the site consists of scattered overstory slash and loblolly pines, midstory hardwoods, and midstory loblolly and slash pine throughout the tract. Some areas contain midstory hardwoods, others contain midstory pines, and others have minimal midstory and no overstory.

The strategy to accomplish the above objective is to remove Chinese tallow trees through the use of chemicals; remove midstory hardwoods and midstory loblolly pine in areas where they occur in abundance on the tracts through shearing, drum chopping, or alternate means without moving the soil. No wind rowing would take place. Vegetation would be lopped in place with the drum chopper. Sheared vegetation would be allowed to fall to either side of the bulldozer, allowing for tree planting access. As waters of the United States, wetlands within the mitigation site would be subject to all applicable requirements established under the Clean Water Act.

Prescribed burn to prepare the site for longleaf planting.
A prescribed burn may be utilized prior to planting of longleaf pines. The prescribed burn would facilitate planting of the longleaf by removing slash from the shearing or drum chopping. A fireline no more than 10 feet wide along the perimeter of the tract acres would be applied. The fireline would be applied with the use of the blade of a bulldozer, drum chopper, or other means to minimize soil disturbance. The operator would attempt to remove the vegetation above ground by scraping brush, grasses, and fine fuels from the surface. If roots of larger plants become uprooted while pushing the fireline, the operator would attempt to replace the uprooted soil in its original location to the degree possible with the equipment on site.

Containerized longleaf seedlings would be planted during the dormant season (December 15 to March 15), at a density of 302 trees per acre. The objective of the planting is to have survival of at least 30 percent of the seedlings after three years of planting

5. Rehabilitation Work Plan

1. Fire Management Regime.

Restoration of the site to pine flatwoods, savannahs and associated habitats depends upon the reestablishment of the natural frequency and seasonality of fire. Historically, most wildfires occurred during the growing season, which in Louisiana is generally considered to be late March to late October, with the majority of fires concentrated between 15 April and 15 June. Growing season burns will be favored over dormant season burns, however initial burning may be necessary during the dormant season to establish control of the shrub and woody layers. Burn frequency will be approximately every 2 - 3 years, commencing in the spring after mitigation site acquisition. Heavily fire suppressed sites may require burns on a more frequent basis to reduce the midstory/understory hardwood and shrub component. In the pine flatwood/savannah sections, burns will be conducted at a frequency to ensure that there will be no more than 40% woody vegetation cover in the shrub stratum at year 3 and no more than 30% woody vegetation cover in the shrub stratum at year 5. Natural or existing firebreaks will be utilized whenever possible to reduce unnatural disturbances to the site and allow burning in large blocks which mimics natural fire behavior. No ditching, bedding, plowed fire lines or other soil disturbance

within seeps, wetlands/uplands interface or adjacent areas will be constructed so natural water flow patterns remain unaltered. A state certified burn manager will conduct all prescribed burns and everyone on the fire crew should have a Red Card.

2. Supplemental Vegetative Plantings.

Longleaf pine seedlings, preferably obtained from local seed sources, will be planted in native savannah areas determined to be deficient of natural longleaf pine regeneration following the initial prescribed burn of the site. Seedlings will be planted in variable sized and shaped patches and/or cohorts with seedlings spaced approximately 5 feet apart within patches/cohorts that are spaced at least 50 feet apart. Intensity of plantings will be determined by optimal longleaf overstory coverage of 10 to 50 percent. During the grass-stage the growing tip (bud) of the tree is protected under a thick arrangement of needles at ground level. When fires sweep through, the needles may burn but the tip of the bud remains protected. New needles quickly replace those that were burned off. During the grass-stage, longleaf pine seedlings are virtually immune to fire. At this stage, although the tree will not be growing upwards, the seedling will be putting down an impressive root system underground. As planted longleaf seedlings begin to enter the bottlebrush stage, fire regime will be altered, especially in those planted cohort areas, to avoid loss due to fire. At this stage of growth, longleaf pine trees are slightly more vulnerable to fire. It may take a year or so before the bark thickens enough to withstand most fires. The longleaf may remain in this stage for a couple of years.

3. Restoring Site Hydrology.

Prior to the first burn and planting of the site, existing plowed fire breaks will be graded and filled to natural elevations prior to planting. Additionally, all roadside berms that are aligned perpendicular to natural sheet flow will be returned to natural grade to restore hydrology.

4. Control of Undesirable/Exotic Species.

Undesirable tree species that are not common to longleaf pine flatwood/savannah forests and are not removed through the burning process will be manually removed, felled and left on site or killed via select use of stem-applied herbicides. Should the non-Federal sponsor decide to remove undesirable tree species by logging, they must make a written request to CEMVN providing documentation as to the effects the timbering activity would have on community structure, ecosystem health, wildlife, aesthetics and fire fuel availability. In no case will timber from the savannah areas be removed without prior review and approval by CEMVN. Appropriate actions as necessary to remove exotic animals, such as feral hogs, will be taken when their numbers cause serious damage. Also, cattle grazing will be prohibited at all times. The mitigation sites will be monitored, managed and protected as described elsewhere in this agreement.

6. Performance Standards

To be used to compensate for unavoidable impacts to pine flatwoods/savannah and related habitats, the sites must be shown to progress from their current state (as described in the baseline conditions) towards an open, highly species diverse pine flatwood/savannah ecosystem with isolated insolated pockets of wetlands. Elements that can be measured to show this progression include basic hydrologic information, longleaf pine seedling survival and growth data, vegetation

composition and structure (including overstory species per percent cover, midstory woody composition per percent cover, and groundcover composition per percent cover). The positive and negative herbaceous indicator species identified in the Ecological Value Assessment for longleaf pine savannahs can also be used to measure successful management; reflected by an increase in the diversity of positive species versus the reduction in the number of negative species. The control of woody shrubs and hardwood encroachment or lack of encroachment into savannah areas can be used to measure the success of management in moving the site to a high quality ecosystem. The following criteria use these elements to measure success:

a) Initial Success Criteria (Year 1)
    1. Floristic survey of current site conditions completed.
    2. During the dry season, non-indigenous hardwood overstory species within the savannah areas will be removed to a level below 10% canopy coverage and non-indigenous pine species will be thinned to below 40% canopy coverage.
    3. Controlled burns must have occurred throughout the site including along the margins any wetlands.
    4. All work necessary to restore hydrology to the site must be complete prior to vegetative plantings. At a minimum, prior to planting, all earthen work must be completed.
    5. Long leaf pine plantings have occurred at an initial density of 300 trees per acre using cohorts of 25 trees per cohort and follows the planting regime described in the site restoration plan.
    6. Long-leaf seedlings will have a survival rate of at least 30% (100 trees per acre)

b) Interim Success Criteria (Year 3)
    1. Plant survivorship must be 60 stems per acre or greater in the bottle brush and/or more progressed stage. Most planted seedlings should be progressing from the grass stage to bottlebrush stage.
    2. Plant composition of pine flatwoods/savannah and related habitats. Vegetative monitoring data should indicate that: (1) the diversity of positive indicator species has been increased (on the average, more than 14 positive species present), (2) negative indicator species have become less prominent (on the average, less than 1 negative species present) and (3) woody shrub height and density are managed appropriately by habitat type.
    3. Prescribed burns have occurred at least twice throughout the pine flatwood/savannah habitat and at least once along the margins of the wetlands.

c) Long-term Success Criteria (Year 5 and beyond)
    1. Vegetative cover for high quality rehabilitated longleaf pine flatwood wetland savannah will fall within the following ranges:

Vegetation Strata	Estimated Total Percent Cover
Longleaf pine overstory	10 – 50 %
Total overstory (longleaf pine plus various hardwoods)	15 – 55 %

Vegetation Strata	Estimated Total Percent Cover
Woody understory (shrubs/small trees)	5 – 15 %
Herbaceous groundcover sampled at least 12 months following a burn	90 – 100 %

2. Pine flatwoods/savanna vegetation composition should consist of a variety of indigenous species, with a predominance of longleaf pine in the overstory, and additional age classes of longleaf pine in the understory. Negative indicator species (NIS) will be maintained at a minimum level. A small number of indigenous hardwood shrub and tree species is desirable for wildlife diversity, and undoubtedly occurred on the pre-settlement landscape. General goals are as follows:

Vegetation Composition	Species / type Composition
Overstory (> 15 ft. ht.)	70 – 90 % * longleaf pine
Understory (2 – 15 ft. ht.)	> 50 % * longleaf pine; 4 species of indigenous shrubs/hardwood trees in pine flatwood wetlands
Herbaceous groundcover (< 2 ft.)	50 – 90 % * grasses / sedges 10 – 50 % * forbs; > 10 native species / meter square; > 50 herbaceous species / site; NIS species < 1%*
* percent of total cover of designated strata	

3. Fire Management. Prescribed burns throughout the pine flatwood/savannah habitat as well as along the margins of any wetlands have occurred at a frequency of once every 2-3 years.

7. Monitoring Plan and Reporting

Monitoring will be performed during the spring. The sponsor will provide to the CEMVN Chief of Environmental Planning and Restoration Branch (Chief CEMVN PM-R) reports for all monitoring events by June 1 of each monitoring year. Reports will be submitted as follows: baseline data (prior to beginning site restoration and prior to or within one year of authorizing credit sales), a planting and hydrologic restoration report (upon completion of the work; may be included with the baseline if occurring in the same year), an initial success criteria report (three years after planting), an interim success criteria report (two years after successfully meeting the initial success criteria). Long-term success criteria reports (five years after successfully meeting the interim success criteria and every fifth year thereafter). The report will include a summary of where, when and percent coverage of burns that have occurred since the previous monitoring report. Data collected for initial, interim and long-term monitoring will be the same as for baseline conditions using the same sample plots.

a) Establishment of permanent monitoring plots and Vegetation Monitoring Data reporting

1. The mitigation site would be divided into relatively homogenous habitat or management units to account for habitat types present and areas with management histories that are significantly different from each other. Such units would be considered unique if they are greater than 50 acres in size. Each management unit would be sampled to determine current baseline levels for restoration criteria.

2. 3-5 line intercept transects would be systematically distributed within each management unit. Transects would be a minimum of 500 meters in length and 1-meter square intercepts would be established at 20 meter intervals along the transects and sampled for data collection as described below under "1 meter square plot size". At three equal distant intervals 100 meter square intercepts would be established and sampled for data collection as described below under "100 meter square plot size". Plot size and data to be collected from plots are listed below. Additional plant species noted outside sample plots would be recorded to obtain a total species list for the site. Cover will be determined from sample plots as follows:

Plot Size	**Strata**	**Data Collected**
1 meter square	Groundcover (all herbs; woody plants <2 ft.)	a) Species present b) Cover by species c) Total cover all species d) Total cover NIS* e) Total number all species (excluding NIS) f) Percent cover grasses/sedges (excluding NIS) g) Percent cover forbs (excluding NIS)
100 meter square	Understory (woody plants 2-15 ft tall)	a) Species present b) Cover by species c) Total cover all species d) Total cover NIS
	Overstory (>15 ft.)	a) Species present b) Cover by species c) Total cover all species d) Total cover NIS
	Groundcover (<2 ft.)	Additional species not found in meter square plot
*Negative Indicator Species		
Cover Classes: <1%; 1-5%; 5-10%; 10-25%; 25-50%; 50-75%; 75-95%; >95%		

3. At least four permanent photo points would be established and photos taken in years 1, 3 and 5.

4. Longleaf pine seedlings would be planted in variable sized and shaped patches/cohorts with seedlings spaced approximately 5 feet apart within the

patches/cohorts which should be spaced at least 50 feet apart. Intensity of plantings would be determined by optimal longleaf overstory coverge of 10 to 50 percent. Average survival rates would be determined for planted longleaf pine seedlings by surveying a representative sample of patches/cohorts at 3 years following initial planting. The approximate center-point of each patch/cohort would be marked in the field to facilitate relocation and subsequent survey.

5. No timbering of longleaf pine is allowed unless monitoring demonstrates that stand density has unacceptably reduced ground cover of the savannah area.

6. The NFS, or their assigns, would utilize available data and exercise best professional judgment in estimating the percent area negatively effected by artificial drainage (*e.g.*, canals and ditches) as well as the percent area impacted by surface feature alterations (e.g., bedding, chopping, plowed rows and/or fire breaks, rutting, dozing, road embankments, disking and other sources of fill placement) following remedial measures to correct these alterations.

b) Baseline Data Report In order to demonstrate site rehabilitation through management, the sponsor will perform a Floristic Survey using an acknowledged scientific methodology and collect Vegetative Monitoring data (Section 7.a) from the permanent plots prior to performing any site management. This baseline data will be collected at each sample plot. In addition, the sponsor will provide a report detailing the hydrologic disturbances that need attention and provide a work plan identifying work necessary to accomplish hydrologic restoration.

c) Fire Management Reporting For each burn event, the following information will be reported: date of burn, percent coverage of the site burned, percent coverage by species for various vegetative strata, species composition, and a map showing the location of the area burned (if the percentage of the site burned is less than 100%).

d) Initial Success Criteria Report To be submitted following the end of the first year after planting seedlings.

1. Planting Restoration information will be reported and will include the following: source of the seedlings; areas planted; the number of seedlings planted; a map showing the location and identity of each cohort; and a table showing data on the size of each cohort and the number of seedlings planted by cohort. In addition, the center point of each cohort will be permanently marked and GPS coordinates will be provided in the table.
   Hydrologic Restoration information will be reported and will include the following: date(s) of activities documentation (fire break and road side berm restoration which will be returned to natural grade) demonstrating unimpeded sheet flow.
2. Vegetation Monitoring data (Section 7.a) will be provided. In addition, documentation will be provided on the success of the plantings and the percentage of seedling survival. This vegetative monitoring data will be compared to baseline data to demonstrate rehabilitation and/or maintenance of the pine flatwoods/savanna and

related habitats.

3. Should this report indicate that the initial success criteria were not attained; the report will include an Adaptive Management Plan (Section 9) and that indicates what is determined to be the problem(s) and a plan of action on solving the problems.

e) Interim Success Criteria Report: To be submitted following the end of the third year after the planting of seedlings.

1. Should the Initial Success Criteria Report indicate that management has been effective and initial success criteria are achieved, this report will document attainment of the interim success criteria as described in Section 6.b. Vegetation Monitoring data (Section 7.a) will be provided. In addition, documentation will be provided on the success of the plantings and the percentage of seedling survival. This vegetative monitoring data will be compared to baseline data to demonstrate rehabilitation and/or maintenance of the pine flatwoods/savannah and related habitats.
2. Fire Management Reports (see Section 8.c) will be provided for each burn event.
3. Hydrologic Restoration information will be reported and will include the following: photographic documentation (fire break and road side berm restoration) demonstrating unimpeded sheet flow and documentation that shows the bank site meets the wetland criterion for site vegetation, soils and hydrology as described in the 1987 Wetlands Manual.
4. Should information in this report indicate that the interim success criteria were not attained, report will include an Adaptive Management Plan (Section 9) should be submitted to CEMVN. This plan should identify and describe the problem(s) and provide a plan of action on solving these problems.

f) Long Term Monitoring Reports

1. Should the Interim Success Criteria report indicate that management has been effective and interim success criteria are achieved, a Long Term Success Criteria Report showing Vegetative Monitoring data (Section 7.a) will be submitted every five years thereafter documenting the results of the monitoring. This vegetative monitoring data will be compared to baseline data to demonstrate rehabilitation and/or maintenance of the pine flatwoods/savannah and related habitats.
2. Fire Management Reports (Section 7.c) will be provided to CEMVN for each burn event.
3. Should information in any of these reports indicate that the long-term success criteria are not attained, an Adaptive Management Plan (Section 9) should be submitted to CEMVN. This plan should identify and describe the problem(s) and provide a plan of action on solving these problems.

8. Long-Term Maintenance and Protection

The non-Federal sponsor will be responsible for maintaining and protecting lands contained within the mitigation site in perpetuity. The non-Federal sponsor will be required to place a conservation servitude over the property and that conservation servitude will incorporate this

Pine-Savannah Restoration Plan by reference. A copy of the conservation servitude to be filed in the Conveyance records of the parish in which the site is located will be provided to CEMVN for review and approval prior to filing. After filing, a copy of the recorded conservation servitude, clearly showing the book, page and date of filing, will be provided to CEMVN.

a) Uses Prohibited by the Conservation Servitude

1. Placing, filling, storing, or dumping of refuse, trash, vehicle bodies or parts, rubbish, debris, junk, waste, or other such items on the Property.
2. Mechanized land clearing or deposition of soil, shell, rock or other fill on the Property without written authorization from CEMVN.
3. Cutting, removal or destruction of vegetation on the property except in accordance with the non-Federal Sponsor's timber management plan and/or in accordance with any permits authorized by the Corps of Engineers at the time the cutting is proposed. Timber harvests/thinning will only be approved if the Corps determines that such activities are needed to maintain or enhance the ecological value of the site.
4. Grazing of cattle or other livestock on the property.
5. Commercial, industrial, agricultural, or residential uses of the Property without prior approval from the Corps.
6. Dredging, draining, ditching, damming or in any way altering the hydrology of the Property except as required or permitted by this Pine-Savannah Restoration Plan.
7. All other activities, which the Corps determines to be inconsistent with the establishment, maintenance and protection of wetlands within this Pine-Savannah Restoration Plan and that may or may not be subject to Corps of Engineers regulatory authority.

b) Uses Allowed By the Conservation Servitude. No other human activities that result in the material degradation of habitat within the lands covered by this Savannah-Pine Restoration Plan will occur. The conservation servitude will not prohibit, subject to appropriate regulatory authority, the following activities:

1. Monitoring of vegetation, soils and water;
2. Hunting and fishing, and non-consumptive recreational uses such as hiking and bird watching;
3. Ecological education;
4. Sub-surface exploration and production of minerals;
5. Provision of rights-of-way;
6. Compliance with Federal regulations or appropriate court orders.

9. Adaptive Management Plan

In the event reports in Section 7 submitted to CEMVN reveals that any success criteria have not been met, the non-Federal sponsor, or their assigns, will take all necessary measures to modify management practices in order to achieve these criteria in the future. If survival is less than 30 percent of the initial number of seedlings planted three years after planting or 25 percent of the initial number of seedlings planted between five and seven years reports after planting, as

determined by sampling or by observing high mortality at any location within the planted tract, the non-Federal sponsor, or their assigns, will take appropriate actions to address the causes of mortality and replace all dead seedlings with new seedlings during the following non-growing season.

In the event that the hydrology has not been restored to the site, an evaluation will be performed to determine the additional hydrological work needed to restore the hydrology. If success was not obtained due to loss of seedlings, the cause of the seedling loss will be documented; should the loss be due to too intense of a burning program, the report will document a potential plan for altering the prescribed fire regime to reduce future loss; if the loss is due to disease, the report will document that supplemental planting material will be obtained from a different source. Following the review of the report, the sponsor will perform the list of corrective actions approved by CEMVN. After managing the site for up to two years, the non-Federal sponsor, or their assigns, will provide a subsequent report documenting that success criteria have now been met.

10. Financial Assurances

The purposes of financial assurances are twofold: (1) to ensure that sufficient funds are available for performance of the ecologic restoration of the site or acquisition of similar or preferable ecological value in the case of site failure, and (2) to provide a source of funding for the perpetual maintenance of the site. To accomplish these goals, sufficient funds to perform the restoration work must be ensured and a Long-Term Management Fund established.

The costs for monitoring and for operation and maintenance of the mitigation project are estimated to be $117,337. The breakdown of costs are described below. This estimate includes management in perpetuity.

Hardwood mistory removal and periodic control of exotic species	$ 17,520
Maintenance of prescribed burning program	$ 45,625
Environmental monitoring (including hydrological maps, plot sampling and analysis)	$ 39,000
Salary expense (preparation of refuge management plans, fire management plans, compatibility determinations, and Section 7 Endangered Species Consultation)	$ 10,000
Post boundary signs protecting the area	$ 1,092
Provide law enforcement	$ 4,100

The Coastal Protection and Restoration Authority of Louisiana (CPRA) is expected to serve as the non-federal sponsor for the Slidell W-14 Drainage Canal Improvements project, including the required mitigation, as described in Environmental Assessment #409. At such time as a project partnership agreement is executed for construction of the project, the CPRA would self-certify its ability to provide the required funding.

In the event that the non-Federal sponsor is unable to meet its financial commitment to the mitigation project, the CEMVN would assume responsibility for monitoring, operation, and maintenance, subject to the availability of additional appropriations.

LITERATURE CITED

Conner, R. N., D. C. Rudolph, and J. R. Walters. 2001. The red-cockaded woodpecker: surviving in a fire-maintained ecosystem. University of Texas Press, Austin, TX.

Frost, C. C. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Pp. 17-44 *in* S. M. Hermann, ed. The longleaf ecosystem: ecology, restoration, and management. Tall Timbers Fire Ecology Conference Proceedings, No. 18. Tall Timbers Research Station, Tallahassee, FL.

Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: a first approximation. Pp. 70-81 *in* T. L. Pruden and L. A. Brennan, eds. Fire in ecosystem management: shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL.

Landers, J. L., D. H. Van Lear, and W. D. Boyer. 1995. The longleaf pine forests of the southeast: requiem or renaissance? Journal of Forestry 93(11):39-44.

Noel, J. M., W. J. Platt, and E. B. Moser. 1998. Structural characteristics of old- and second-growth stands of longleaf pine (*Pinus palustris*) in the Gulf coastal region of the U.S.A. Conservation Biology 12:533-548.

Simberloff, D. 1993. Species-area and fragmentation effects on old growth forests: prospects for longleaf pine communities. Pp. 1-14 *in* S. M. Hermann, ed. The longleaf pine ecosystem: ecology, restoration, and management. Tall Timbers Fire Ecology Conference Proceedings, No. 18. Tall Timbers Research Station, Tallahassee, FL.

Stout, I. J., and W. R. Marion. 1993. Pine flatwoods and xeric pine forests of the southern (lower) coastal plain. Pp. 373-446 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley and Sons, Inc., New York, NY.

Wahlenburg, W. G. 1946. Longleaf pine: its use, ecology, regeneration, protection, growth, and management. Charles Lothrop Pack Forestry Foundation and USDA Forest Service, Washington, D.C.

Walker, J. L. 1999. Longleaf pine forests and woodlands: old growth under fire! Pp. 33-40 *in* G. L. Miller, ed. The value of old growth forest ecosystems of the Eastern United States: conference proceedings. University of North Carolina, Ashville, NC.

Ware, S., C. Frost, and P. D. Doerr. 1993. Southern mixed hardwood forest: the former longleaf pine forest. Pp. 447-493 *in* W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. Biodiversity of the southeastern United States: lowland terrestrial communities. John Wiley and Sons, Inc., New York, NY.

MEMORANDUM

DATE: Friday, April 17, 2009

TO: File

FROM: Karen Soileau

SUBJECT: W-14 Canal MCM Variable Justification

Required Mitigation Credits Worksheet:

Column 1: W-14 Canal Permanent Impacts

Priority Category:	Secondary – mixed pine/hardwood forest
Existing Vegetative Condition:	Class 3 – severely fragmented
Existing Hydrologic Condition:	Class 4 – major drainage canal that effectively removes water from distant areas and adjacent wetlands
Duration:	Over 10 – long-term impacts are proposed
Dominant Impact:	Dredge – excavating
Cumulative Impact:	Low – upgrade of existing canal to provide for increased flood protection
Size in Acres:	17.91 (see December 9 and 10, 2008 e-mails from the COE – sum of permanent construction acreage plus pump station acreage)

Column 2: W-14 Canal Temporary Impacts

Priority Category:	Secondary – mixed pine/hardwood forest
Existing Vegetative Condition:	Class 3 – severely fragmented
Existing Hydrologic Condition:	Class 4 – major drainage canal that effectively removes water from distant areas and adjacent wetlands
Duration:	1 to 3 – only temporary construction impacts are associated with this acreage
Dominant Impact:	Dredge – excavating
Cumulative Impact:	Low – upgrade of existing canal to provide for increased flood protection
Size in Acres:	10.7 (see December 9, 2008 e-mail from the COE – sum of temporary construction acreage)

Column 3: Detention Ponds

Priority Category:	Secondary – mixed pine/hardwood forest
Existing Vegetative Condition:	Class 2 – some level of disturbance (e.g. hurricane impacts) and lack of fire, however, ponds contiguous with larger forested tracts
Existing Hydrologic Condition:	Class 3 – minor restoration activities needed to restore hydrologic functions
Duration:	Over 10 – long-term impacts are proposed

Dominant Impact:	Dredge – excavating
Cumulative Impact:	Low – excavation of detention ponds, not expected to exacerbate development
Size in Acres:	32.8 – Sum of acreage from the Robert Road Detention Pond including the new 3.1 acre pond and the Daney Street Detention Pond. Upper and Lower Detention Pond acreage not included because mitigation for impacts to those areas provided by Slidell Development through the Section 404 permitting process.

Results: Impacts to be Mitigated = **486.1 credits**

Proposed Restoration/Enhancement Mitigation Worksheet:

Column 1: Blossman Tract

Mitigation Type:	Enhancement 1 – site would be managed as a pine savannah via hardwood midstory removal, prescribed fire, and planting of longleaf pine
Maintenance/Management:	Active Vegetative Manipulation – ongoing fire management necessary
Development:	No Impact – no development bordering site
Oil & Gas Activities:	No Impact – no prospects
Size:	Area $\geq$ 500 acres – site adjacent to Big Branch Marsh NWR
Utility Corridors:	No Impact – no maintained ROWs on the property
Transportation:	No Impact – site not bounded by road
Control:	Conservancy – transferring title to Big Branch Marsh NWR
Temporal Lag:	0 to 5 years – reduced time to replace pine savannah functions because large pine trees exist on-site. Hardwood midstory removal, tallow control, prescribed fire, and tree planting in some areas is necessary.
Credit Schedule:	Schedule 3 – appropriate for most Civil Works projects
Kind:	Category 1 – in-kind, site historically pine savannah
Location Relative to Impact:	Zone 2 – impact and mitigation occur within the same HUC
Size in Acres:	52.0 – size of tract

Column 2: Elmwood Tract

Mitigation Type:	Enhancement 1 – site would be managed as pine savannah via hardwood midstory removal, prescribed fire, and planting of longleaf pine
Maintenance/Management:	Active Vegetative Manipulation – ongoing fire management necessary

Development:	No Impact – no development bordering site
Oil & Gas Activities:	No Impact – no prospects
Size:	Area ≥ 500 acres – site adjacent to Big Branch Marsh NWR
Utility Corridors:	No Impact – no maintained ROWs on the property
Transportation:	No Impact – site not bounded by road
Control:	Conservancy – transferring title to Big Brnach Marsh NWR
Temporal Lag:	0 to 5 years – reduced time to replace pine savannah functions because large pine trees exist on-site. Hardwood midstory removal, tallow control, prescribed fire, and tree planting in some areas is necessary.
Credit Schedule:	Schedule 3 – appropriate for most Civil Works projects
Kind:	Category 1 – in-kind, site historically pine savannah
Location Relative to Impact:	Zone 2 – impact and mitigation occur within the same HUC
Size in Acres:	36.0 – size of tract

Column 3: Blossman #2

Mitigation Type:	Enhancement 1 - site would be managed as pine savannah via thinning, prescribed fire, and tallow control
Maintenance/Management:	Active Vegetative Manipulation – ongoing fire management necessary
Development:	No Impact – no development bordering site
Oil & Gas Activities:	No Impact – no prospects
Size:	Area ≥ 500 acres – site adjacent to Big Branch Marsh NWR
Utility Corridors:	No Impact – no maintained ROWs on the property
Transportation:	No Impact – site not bounded by road
Control:	Conservancy – transferring title to Big Branch Marsh NWR
Temporal Lag:	10 to 20 – immature pine on-site, therefore, would take longer to replace pine savannah functions than other tracts
Credit Schedule:	Schedule 3 – appropriate for most Civil Works projects
Kind:	Category 1 – in-kind, site historically pine savannah
Location Relative to Impact:	Zone 2 – impact and mitigation occur within the same HUC
Size in Acres:	41.6 – size of tract

Results: Mitigation Project = **434.9 credits** Thus, 51.2 credits still needed.

Therefore, I ran the MCM on the 322-acre Mentab tract to see how many additional acres would need to be purchased to meet mitigation requirements.

Column 4: Mentab

Mitigation Type:	Enhancement 1 – site would be managed as pine savannah via hardwood midstory removal, prescribed fire, and longleaf pine planting
Maintenance/Management:	Active Vegetative Manipulation – ongoing fire management necessary
Development:	No Impact - no development bordering site
Oil & Gas Activities:	No Impact – no prospects
Size:	Area ≥ 500 acres – site adjacent to Big Branch Marsh NWR
Utility Corridors:	No Impact – no maintained ROWs on the property
Transportation:	Slight – unimproved road borders site
Control:	Conservancy – transferring title to Big Branch Marsh NWR
Temporal Lag:	0 to 5 years – reduced time to replace pine savannah functions because large pine trees exist on-site. Hardwood midstory removal, prescribed fire, and tree planting in some areas is necessary.
Credit Schedule:	Schedule 3 – appropriate for most Civil Works projects
Kind:	Category 1 – in-kind, site historically pine savannah
Location Relative to Impact:	Zone 2 – impact and mitigation occur within the same HUC
Size in Acres:	15.5 – acreage needed from the 322-acre Mentab tract to meet mitigation requirements

Results: Mitigation Project = **486.4 credits**

Table 2B: Proposed Restoration/Enhancement Mitigation Worksheet

Site-Specific Mitigation Site Name:

Mitigation Project HUC: 08090201
Mitigation Project Basin: Lake Pontchartrain/Breton Sound/Chandeleur Sound
Impacted HUC: 08090201
Mitigation Project in the same basin as the impact: Yes
Proximity Factor: 1

	Factors	Blossman	Elmwood	Blossman #2	Mentab
Net Improvement	Mitigation Type	Enhancement I 2.4	Enhancement I 2.4	Enhancement I 2.4	Enhancement I 2.4
	Maintenance/ Management Requirement	Active Vegetative Manipulation 0.8	Active Vegetative Manipulation 0.8	Active Vegetative Manipulation 0.8	Active Vegetative Manipulation 0.8
Negative Influences on the mitigation site	Commercial/Residential Development	No Impact	No Impact	No Impact	No Impact
	Oil & gas activities	No Impact	No Impact	No Impact	No Impact
	Size	area >500 acres	area >500 acres	area >500 acres	area >500 acres
	Utility Corridors	No Impact	No Impact	No Impact	No Impact
	Transportation	No Impact 0	No Impact 0	No Impact 0	Slight -0.1
	Control	Transfer Fee Title Conservancy 0.6	Transfer Fee Title Conservancy 0.6	Transfer Fee Title Conservancy 0.6	Transfer Fee Title Conservancy 0.6
	Temporal Lag	0 to 5 0	0 to 5 0	10 to 20 -0.2	0 to 5 0
	Credit Schedule	Schedule 3 0.2	Schedule 3 0.2	Schedule 3 0.2	Schedule 3 0.2
	Kind	Category 1 0.4	Category 1 0.4	Category 1 0.4	Category 1 0.4
	Location Relative to Impact	Zone 2 0.3	Zone 2 0.3	Zone 2 0.3	Zone 2 0.3
	Sum of m Factors	3.42	3.42	3.22	3.32
	Size in Acres	52.0	36.0	41.6	15.5
	M × A=	177.8	123.12	133.952	51.46
Acreage required for Site-		142.1	0.0	0.0	0.0
	Total Restoration/Enhancement Credits = ∑ (M × A) =				486.4

SUMMARY WORKSHEET

Mitigation Summary Worksheet For Permit Application # 0
Mitigation will be performed at: (No Bank Selected)
AND/OR Mitigation will be site specific and performed at: 0

1. Impacts to be Mitigated

Credits	Acres
486.1	61.4

2. Out of Basin Factor

	Required	Value
Project-Specific Mitigation	No	1
Bank	Yes	#N/A

3. Project-specific Mitigation Project Credit Summary

Credits	Acres
486.4	52.0

4. Banking Mitigation Credit Summary

Credits	Acres
-0.3	#N/A

IV. Grand Totals

Credits	Acres
486.4	52.0