

**WEST SHORE LAKE PONTCHARTRAIN  
HURRICANE AND STORM DAMAGE RISK REDUCTION STUDY  
FINAL INTEGRATED FEASIBILITY REPORT  
AND  
ENVIRONMENTAL IMPACT STATEMENT**

**Economic Appendix  
APPENDIX D**

**Annex A: Reach Map**

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**West Shore Lake Pontchartrain LA Hurricane and  
Storm Surge Risk Reduction Feasibility Study  
Economic Appendix**

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# PART 1: BACKGROUND INFORMATION

## INTRODUCTION

**General.** This appendix presents an economic evaluation of the Recommended Plan for the West Shore Lake Pontchartrain LA Hurricane and Surge Risk Reduction Feasibility Study. The evaluation area includes portions of three parishes in Southeast Louisiana. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, and ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies. The National Economic Development Procedures Manual for Flood Risk Management and Coastal Storm Risk Management, prepared by the Water Resources Support Center, Institute for Water Resources, was also used as a reference, along with the Users Manual for the Hydrologic Engineering Center Flood Damage Analysis Model (HEC-FDA).

The economic appendix consists of a description of the methodology used to determine National Economic Development (NED) damages under existing and future conditions and projects costs. The damages and costs were first calculated using October 2012 price levels but were later updated to October 2014 price levels using the Civil Works Construction Costs Index System (CWCCIS). Damages were converted to equivalent annual values using the FY 2014 Federal discount rate of 3.5 percent and a period of analysis of 50 years. The year 2020 was identified as the base year for each of the alternatives as the basis for plan comparison. Once the Recommended Plan was determined, the equivalent annual damage and benefit estimates, in addition to average annual construction and OMRR&R costs, were recalculated using the current FY 2015 Federal discount rate of 3.375 percent.

**NED Benefit Categories Considered.** The NED procedure manuals for coastal and urban areas recognize four primary categories of benefits for flood risk management measures: inundation reduction, intensification, location, and employment benefits. The majority of the benefits attributable to a project alternative generally result from the reduction of actual or potential damages caused by inundation. Inundation reduction, which is the only category of NED benefits addressed in this evaluation, includes the reduction of physical damages to structures, contents, and vehicles.

*Physical Flood Damage Reduction.* Physical flood damage reduction benefits include the decrease in potential damages to residential and commercial structures, their contents, and the privately owned vehicles associated with these structures. Damages included in the appendix considered both existing and future conditions. Projections of the future development expected to be in place in the study area during the period of analysis were included as part of the future condition analysis.

Office of Management and Budget survey forms were used to collect information on the value and placement of contents in the industrial facilities located in the study area. The information from these surveys was used to develop the physical flood damage and benefits for these industrial properties. This is applicable to the Zapps Potato Chip facility.

*Emergency Cost Reduction Benefits.* Emergency costs are those costs incurred by the community during and immediately following a major storm. They include the costs of emergency measures, such as evacuation and reoccupation activities conducted by local governments and homeowners, repair of streets, highways, and railroad tracks, and the subsequent cleanup and restoration of private, commercial, and public properties. Due to time and budget constraints, emergency costs were not quantified in this evaluation.

**Regional Economic Development.** When the economic activity lost in the flooded region can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts on the employment, income, and output of the regional economy are considered part of the RED account. The input-output macroeconomic model RECONS was used to address the impacts of the construction spending only associated with the Recommended Plan, since only this alternative provides detailed cost information necessary to prepare a complete and accurate analysis. The RED account is addressed at the conclusion of this appendix.

## **DESCRIPTION OF THE STUDY AREA**

**Geographic Location.** The study area includes the portions of St. James and St. John the Baptist Parishes located on the east bank of the Mississippi River and the portion of St. Charles Parish on the east bank of the Mississippi River west of the Bonnet Carre' Spillway. The West Shore Lake Pontchartrain evaluation area was divided into 81 unique hydrologic reaches to enable an economic analysis of the project alternatives through the use of the HEC-FDA certified model.

**Land Use.** The total number of acres of developed, agricultural, and undeveloped land in the study area is shown in Table 1. As shown in the table, approximately 5 percent of the total acres in the study area are currently developed. Since there are approximately 24,000 acres of agricultural land and 124,000 acres of undeveloped land there is sufficient land available to accommodate the projected residential and non-residential development through the year 2080 without impacting the wetlands in the area. This projected future development is expected to be located on parcels that tend to be relatively higher ground and are the least exposed to flood risk.

## SOCIOECONOMIC SETTING

**Population and Number of Households.** Table 2 displays the population in each of the parishes for the years 1980, 1990, 2000, and 2010 as well as projections for the year 2020 and the year 2080, the two years that engineering inputs were modeled and used to calculate damages. Population projections are based on the Moody's County Forecast Database, which has population projections to the year 2038. Moody's projections were extended by New Orleans District from the year 2030 to the year 2080 based on the growth rate forecasted by Moody's for the years 2018 through 2038. As shown in Table 2, St. Charles, St. James and St. John Parishes experienced a steady increase in population between 1980 and 2010.

Table 3 displays the estimated population of the three parishes located within the inventoried portion of the study area for the year 2012 and the projected population for the years 2020 and 2070. The 2012 estimates are based on an inventory of residential and non-residential properties assembled in 2012 by field survey teams. The number of inventoried residential structures was then multiplied by 2.9, the average number of persons per household in the study area in 2012. The annual compounded growth rate in population between 2012 and 2020 is expected to be 0.32 percent and 0.77 percent between 2020 and 2070.

Table 4 shows the total number of households in each parish for the years 1980, 1990, 2000, and 2010 and projections for the years 2020 and 2080. The projected number of households was based on the Moody's County Forecast Database and extended from the year 2038 to the year 2080 based on the growth rate forecasted by Moody's for the years 2018 through 2038.

The three parishes experienced a steady increase in the total number of households between 1980 and 2010, which paralleled the growth in population. This increase is commensurate with the population growth experienced by the entire Gulf Coast region during the same period. Similar to the projected population growth in the three-parish area, the number of households is expected to continue increasing through the year 2080.

**Income.** Table 5 shows the per capita personal income levels for each parish for the years 1990, 2000, 2005, 2010 and 2012, the year with the latest available data. As shown in the table, both parishes experienced a steady increase in per capita income between 1990 and 2012.

**Employment.** Table 6 shows the total nonfarm employment by parish for the years 1970, 1980, 1990, 2000, 2010, and projections for the years 2020 and 2080. The employment projections were based on the Moody's County Forecast Database and extended from the year 2038 to the year 2080 based on the growth rate forecasted by Moody's for the years 2018 through 2038.

In all portions of the study area, growth is highly dependent upon the major employment sectors. The increase in employment in the three parishes is likely the result of the influx of population and businesses that occurred to the area after Hurricane Katrina after 2005. The leading employment sectors include educational services, health care and social assistance, manufacturing, and retail trade. Approximately 1,900 non-residential structures are located in the study area including petroleum service companies, river services companies, Zapp's Potato Chips Factory in Gramercy, and the Marathon refinery in Garyville. Slightly over 10 percent of the total acres in the study area, or 23,800 acres, is devoted to agriculture, and about half of these acres is used for growing sugar cane.

**Compliance with Policy Guidance Letter (PGL) 25 and Executive Order 11988.**

Given continued growth in employment, it is expected that development will continue to occur in the study area with or without the storm surge risk reduction system, and will not conflict with PGL 25 and EO 11988, which state that the primary objective of a flood risk reduction project is to protect existing development, rather than to make undeveloped land available for more valuable uses. However, the overall growth rate is anticipated to be the same with or without the project in place. Thus, the project will not induce development, but would rather reduce the risk of the population being displaced after a major storm event.

## **RECENT FLOOD HISTORY**

**Tropical Flood Events.** While the three parishes have periodically experienced localized flooding from excessive rainfall events, the primary cause of the flood events that have taken place in the three-parish study area has been the tidal surges from hurricanes and tropical storms. During the past 25 years, coastal Louisiana was impacted by eight major tropical events: Hurricane Juan (1985), Hurricane Andrew (1992), Tropical Storm Isidore and Hurricane Lili (2002), Hurricanes Katrina and Rita (2005), and Hurricanes Gustav and Ike (2008). While none of these storms tracked directly through the study area, the tidal surges associated with these storm events inundated structures and resulted in billions of dollars in damages throughout coastal Louisiana.

Table 7 provides a summary of the total Federal Emergency Management Agency (FEMA) flood claims paid to all Louisiana policyholders as a result of these tropical events. The table includes the number of paid losses, the total amount paid, and the



average amount paid on each loss. The total and average paid losses have been converted to reflect 2011 price levels. The table excludes losses that were not covered by flood insurance.

The following is a summary of each of the eight major tropical events and their effects on the two-parish area and coastal Louisiana.

*Hurricane Juan.* Hurricane Juan caused extensive flooding throughout southern Louisiana due to its prolonged 5-day movement back and forth along the Louisiana coast. Rainfall totals in the area ranged from 5 inches to almost 17 inches. The storm was responsible for storm surges of 5 to 8 feet and tides of 3 to 6 feet above normal. According to FEMA officials, the estimated value of the residential and commercial damage and public assistance throughout coastal Louisiana totaled \$112.5 million.

*Hurricane Andrew.* On August 26, 1992, Hurricane Andrew made landfall in St. Mary Parish, 80 miles west of Morgan City. FEMA reported that over 2,000 flood claims were filed as a result of the storm in Louisiana. These claims had a total value of over \$25 million.

*Tropical Storm Isidore and Hurricane Lili.* On October 3, 2002, one week after Tropical Storm Isidore affected the southeastern and south central coastal areas of Louisiana, Hurricane Lili made landfall on the western edge of Vermilion Bay south of the cities of Abbeville and New Iberia as a weak Category 2 hurricane. The high winds caused tidal flooding in the communities east of the eye of the storm.

Insured flood losses from Tropical Storm Isidore and Hurricane Lili totaled nearly \$600 million. Approximately \$105 million of insured losses were related to Tropical Storm Isidore, while Hurricane Lili caused \$471 million of insured losses. According to windshield surveys conducted by the American Red Cross, approximately 10,000 residential structures were damaged by winds and storm surges of the two storms. These surveys included both insured and uninsured structures. Tropical Storm Isidore caused damage to 2,905 structures, while Hurricane Lili caused damage to 7,356 structures.

In a revised report released in mid-November by the Louisiana State University Agricultural Center (LSU AgCenter), the estimated agricultural damages caused by Tropical Storm Isidore and Hurricane Lili totaled \$454.3 million. This estimate also includes the agricultural damages caused by the continuation of rain during the month of October, which delayed the harvesting of crops. The excessive rains and storm surge flooded the agricultural fields and increased the harvest costs.

*Hurricane Katrina.* On August 29, 2005, Hurricane Katrina made landfall near the town of Buras in Plaquemines Parish about 50 miles east of coastal Lafourche and Terrebonne parishes. While the storm entered as a category 3 storm with winds in excess of 120 mile per hour, its storm surge of approximately 30 feet was more characteristic of a Category 5

hurricane. The majority of the damages from Hurricane Katrina occurred outside of the West Shore Lake Pontchartrain study area. However, if the hurricane had taken a more westerly track, the study area could have experienced the same magnitude of flooding as the city of New Orleans.

According to the Department of Health and Hospitals, approximately 1,400 deaths were reported following Hurricane Katrina. Approximately 1.3 million residents were displaced immediately following the storm, and 900,000 residents remained displaced as of October 5, 2005.

The storm caused more than \$40.6 billion of insured losses to the homes, businesses, and vehicles in six states. Approximately two thirds of these losses, or \$25.3 billion, occurred in Louisiana based on data obtained from the Insurance Information Institute. According to the Louisiana Recovery Authority, approximately 150,000 housing units were damaged, and according to the Department of Environmental Quality, 350,000 vehicles, and 60,000 fishing and recreational vessels were damaged.

According to the LSU AgCenter, agricultural losses totaled approximately \$825 million. The agricultural resources impacted by the storm include sugarcane, cotton, rice, soybeans, timber, pecans, citrus, and livestock. The losses to aquaculture (crawfish, alligators, and turtles), fisheries (shrimp, oysters, and menhaden), and wildlife and recreational resources totaled approximately \$175 million.

*Hurricane Rita.* The hurricane made landfall along the Texas-Louisiana border on September 24, 2005, as a Category 3 storm with winds in excess of 120 miles per hour. A storm surge of approximately 15 - 20 feet affected Coastal Louisiana from Terrebonne Parish to the Texas border. With estimated insured losses of approximately \$3 billion, Hurricane Rita became one of the most costly natural disasters in U.S. history.

Approximately 2,000 square miles of farmland and marshes throughout the coastal area were inundated. According to the LSU AgCenter, agricultural losses totaled approximately \$490 million. The agricultural resources impacted by the storm include sugarcane, cotton, rice, soybeans, timber, pecans, citrus, and livestock. The losses to aquaculture (crawfish, alligators, and turtles), fisheries (shrimp, oysters, and menhaden), and wildlife and recreational resources totaled approximately \$100 million.

*Hurricanes Gustav and Ike.* On September 1, 2008, almost exactly three years after Hurricane Katrina, Hurricane Gustav made landfall near Cocodrie in Terrebonne Parish as a strong Category 2 hurricane. It followed a northwest path into central Louisiana, and most of the damages caused by the storm resulted from its high winds and heavy rain. Coastal flooding occurred in the low lying areas of Jefferson and Lafourche Parishes and the coastal areas of Terrebonne Parish south of the City of Houma.

Nearly 2 million residents of South Louisiana evacuated in the days before Gustav made landfall. Louisiana officials reported that emergency spending totaled approximately \$500 million, which included \$210 million for state agencies, \$48 million for deploying the National Guard, \$13.5 million for general evacuation shelters, \$3 million for special-needs medical shelters, \$6.1 million for transporting the medical needy, \$21 million for costs of contraflow and evacuation from coastal communities and other areas, \$20 million in special generators to open ice plants, pharmacies and service stations throughout the impacted areas, \$5 million for state-purchased fuel, \$19.7 million for ready-to-eat meals, \$5.3 million for ice, and \$2.5 million for water supplies. The State Department of Transportation estimated that it cost approximately \$50 million to remove 1.5 million cubic yards of debris, and approximately \$20 million to repair draw bridges.

Almost two weeks later, on September 12 and 13, the Louisiana coastal region incurred additional flood damages as Hurricane Ike moved along the Louisiana coast. According to estimates from the state officials, approximately 12,000 homes and businesses were flooded by the two storms. Approximately 2,500 buildings in Terrebonne Parish south of the City of Houma incurred flood damages from Hurricane Ike.

The LSU AgCenter estimated that potential lost revenues and damages to the infrastructure of the agriculture, forestry, and fisheries industries in Louisiana resulting from the two hurricanes totaled approximately \$959 million. The storm surge primarily affected the cattle, rice, soybeans, and sugarcane.

*Hurricane Isaac.* On 29 August 2012, exactly seven years to the day after Hurricane Katrina, Southeast Louisiana was impacted by Hurricane Isaac. The storm made landfall near the mouth of the Mississippi River as a minimal Category 1 hurricane. It then reentered the Gulf of Mexico and made a second landfall near Port Fourchon, Louisiana. Hurricane Isaac produced 45 hours of tropical force winds from the south and southeast as it slowly tracked west of the city of New Orleans. The wind speed and track, combined with slow forward motion, large maximum wind radius, and intense rainfall, produced high storm surges and water elevations throughout coastal Louisiana. Substantial flooding occurred in areas outside federal levee systems, including, but not limited to Slidell, Mandeville, Madisonville, LaPlace, Braithwaite, and Lafitte. In the study area, the hurricane flooded approximately 7,000 structures in the area of LaPlace. The flood claims attributed to Hurricane Isaac in St. John Parish were approximately \$226,810,360. This figure is based on 3,332 flood claims reported by FEMA which does not include households without flood insurance policies.

**FEMA Flood Claims.** The study area has been impacted by numerous tropical events during the past several decades. According to FEMA data, flood claims for the three parishes in the West Shore-Lake Pontchartrain evaluation area that were paid between 1978 and December 2012 totaled \$338 million: \$100 million in St. Charles Parish, \$236 million in St. John the Baptist Parish, and \$1.74 million in St. James Parish. Table 8 shows the insurance payments between 1978 and December 2012 for each of the parishes in the study area.

## SCOPE OF THE STUDY

**Problem Description.** The exposure of the study area to coastal storm surge was made apparent by Hurricane Isaac (August 2012). Approximately 7,000 structures in the study area were damaged and the I-10 and I-55 transportation routes were impassable for 6 days after the storm had passed, necessitating the use of alternative transportation routes. The damages and response times during Hurricane Isaac were exacerbated due to standing water for days after the event.

**Project Alternatives.** Four alternatives were considered as part of the evaluation. Alternative A consists of 20.41 miles of earthen levee, which begins at the West Guide levee of the Bonne Carre' Spillway. It extends west around the interstate interchange and along the wet/dry interface. The Recommended Plan follows the same alignment as Alternative A between the West Guide levee of the Bonnet Carre' Spillway to the US-51 Interchange where it tracks north across US-51. It consists of 18.27 miles of earthen levees and a T-wall. Both Alternatives A and C will implement voluntary localized storm surge risk reduction measures which include elevation of structures and acquisition by government in the western portion of the study area. Alternative D is a westward continuation of The Recommended Plan along the I-10 corridor into Ascension Parish. At the St. James Parish line, Alternative D continues west just slightly north of I-10 until it reaches Old New River where it will proceed north to a non-federal levee in Ascension Parish (Laurel Ridge Levee). There are no localized storm surge risk reduction measures involved in this alternative.

Alternative C was determined to be the Recommended Plan for the 0.01 annual exceedance probability (AEP) level of risk reduction. The alternative includes the construction of levee alignment C in St. John the Baptist and St. Charles parishes, along with localized storm surge risk reduction measures in St. James Parish. These measures in St. James Parish include the construction of three berms built to the elevation 6.5 feet NGVD and the installation of flap gates for the culverts along Highway 3125. For areas located outside of the influence of berms and flap gates that contain structures with first floor elevations below the stages associated with the 2020 1% (100-year) ACE event, 14 residential structures will be raised to the stage associated with the 2070 1% (100-year) ACE event; 4 non-residential structures will be flood proofed to 3 feet above the ground elevation; and smaller berms will be constructed for 5 light industrial/warehouse facilities.

## **PART 2: ECONOMIC AND ENGINEERING INPUTS TO THE HEC-FDA MODEL**

### **HEC-FDA MODEL**

**Model Overview.** The Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) Version 1.2.5a Corps-certified model was used to calculate the damages and benefits for the West Shore Lake Pontchartrain evaluation. The economic and engineering inputs necessary for the model to calculate damages for existing conditions (2012), the project base year (2020), and the final year in the period of analysis (2070) include structure inventory, future development, contents-to-structure value ratios, vehicles, first floor elevations, and depth-damage relationships, ground elevations, and without-project stage probability relationships.

The uncertainty surrounding each of the economic and engineering variables was also entered into the model. Either a normal probability distribution, with a mean value and a standard deviation, or a triangular probability distribution, with a most likely, a maximum and a minimum value, was entered into the model to quantify the uncertainty associated with the key economic variables. A normal probability distribution was entered into the model to quantify the uncertainty surrounding the ground elevations. The number of years that stages were recorded at a given gage was entered for each study area reach to quantify the hydrologic uncertainty or error surrounding the stage-probability relationships.

### **ECONOMIC INPUTS TO THE HEC-FDA MODEL**

**Structure Inventory.** Field surveys were completed in 2012 (prior to Hurricane Isaac) to develop a residential and non-residential structure inventory for the economic analysis. Based on the structural information collected during the field surveys, the Marshall and Swift Valuation Service was used to calculate a depreciated replacement cost for all residential and non-residential structures in the study area reaches. The inventoried structures were classified as one of 14 structure types: residential one-story with slab or pier foundation, residential two-story with slab or pier foundation, mobile home, eating and recreation, grocery and gas station, multi-family residence, professional building, public and semi-public building, repairs and home use establishment, retail and personal services building, and warehouse, and contractor services building. Table 9 shows the number of structures by structure category and the total number of vehicles associated with the residential structures for existing conditions (2012) for each study area reach or HEC-FDA model station number. The value of the land was not included in the analysis.

**Future Development Inventory.** Projections were made of the future residential and non-residential development to take place in the West Shore Lake Pontchartrain study area under without-project conditions. Based on a pattern of historical development, a total of 565 residential and 149 non-residential structures were placed on the undeveloped land within the study area reaches as part of the structure inventory for the year 2020. An additional 10,428 residential and 679 non-residential structures were added to the inventory for the year 2070 to obtain the structure inventory for the year 2070.

The development projected to occur in each study area reach between the year 2012 and the year 2020 was placed at an elevation equal to the stage associated with the 2020 without-project one percent annual chance exceedance (1% ACE) 100-year event, unless the ground elevation was higher. The projected development occurring after the year 2020 was placed at an elevation equal to the stage associated with the without-project 1% ACE (100-year) event for the year 2070, unless the ground elevation was higher. The values for the projected residential and non-residential structures were assigned using the average value calculated for each structure category based on the 2012 existing development.

Table 10 shows the number of structures in each structure category and the average depreciated replacement values for (2012 price level) existing conditions. Table 11 shows the projected number of structures in each structure category for the future years 2020 and 2070, respectively. The value of the land was not included in the analysis.

**Residential and Non-Residential Content-to-Structure Value Ratios.** Content-to-structure value ratios (CSVs) were developed based on the on-site interviews conducted as part of the Jefferson-Orleans, Donaldsonville to the Gulf, and Morganza to the Gulf evaluations. These interviews were conducted with the owners of a sample of structures from each of the three residential content categories and each of the eight non-residential content categories from each of the three evaluation areas. Thus, a total of 96 residential structures and 210 non-residential structures were used to determine the CSVs for each of the residential and non-residential categories.

Since only a limited number of property owners participated in the field surveys and the participants were not randomly selected, statistical bootstrapping was performed to address the potential sampling error in estimating the mean and standard deviation of the CSV values. Statistical bootstrapping is a method that uses re-sampling with replacement to improve the estimate of a population statistic when the sample size is insufficient for straightforward statistical inference. The bootstrapping method has the effect of increasing the sample size. Thus, bootstrapping provides a way to account for the distortions caused by the specific sample that may not be fully representative of the population.

As shown in Table 12, a CSVr was computed for each residential and non-residential structure in the sample based on the total depreciated content value developed from the surveys. An average CSVr and standard deviation for each of the five residential structure categories and nine commercial structure classifications was calculated as the average of the individual structure CSVrs.

**Vehicle Inventory.** Based on 2000 Census block group data for the evaluation area, it was determined that there are an average of 1.74 vehicles associated with each household (owner occupied housing or rental unit). According to the Southeast Louisiana Evacuation Behavioral Report published in 2006 following Hurricanes Katrina and Rita, approximately 70 percent of privately owned vehicles are used for evacuation during storm events. The remaining 30 percent of the privately owned vehicles remain parked at the residences and are subject to flood damages. Using the Manheim Used Vehicle Value Index, which is based on over 4 million annual automobile transactions adjusted to reflect retail replacement value, each vehicle was assigned an average value of \$12,879 at the 2012 price level. Since only those vehicles not used for evacuation can be included in the damage calculations, an adjusted average vehicle value of \$6,723 ( $\$12,879 \times 1.74 \times 0.30$ ) was assigned to each individual residential structure record in the HEC-FDA model. This figure was rounded to \$7,000 per vehicle for the calculation of damages. If an individual structure had more than one housing unit, then the adjusted vehicle value was assigned to each housing unit in a residential or multi-family structure category.

**First Floor Elevations and Elevation of Vehicles.** Topographical data obtained from the Light Detection and Ranging (LIDAR) digital elevation model (DEM) using the NAVD88 (2004.65 epoch) were used to determine ground elevations. Field survey teams estimated the height of each residential and non-residential structure above the ground using hand levels. The ground elevation was added to the height of the foundation of the structure above the ground in order to determine the first floor elevation of the structure. Vehicles were assigned to the ground elevation of the adjacent residential structures.

**Depth-Damage Relationships.** Site-specific saltwater, long duration (approximately one week) depth-damage relationships, developed by a panel of building and construction experts for a separate study in Jefferson and Orleans Parishes, were used in the economic analysis. The Jefferson Orleans study area is adjacent to West Shore Lake Pontchartrain study area, approximately 25 miles to the east. These curves indicate the percentage of the total structure value that would be damaged at various depths of flooding. Damage percentages were determined for each one-half foot increment from one-half foot below first floor elevation to two feet above first floor, and for each one-foot increment from 2 feet to 15 feet above first floor elevation. The panel of experts developed depth-damage relationships for five residential structure categories and for three commercial structure categories. Depth-damage relationships were also developed for three residential content categories and eight commercial content categories.

Based on observations after Hurricane Katrina, mold and mildew only affects the contents located on the second floor of residential structures if the depth of flooding reaches the second floor. Thus, an adjustment was made to only include damages to second floor contents in cases where the depth of flooding extended above the first floor. This more adequately represents damages to the contents of two story residential structures.

The depth-damage relationships for vehicles were developed based on interviews with the owners of automobile dealerships that had experienced flood damages and were used to calculate flood damages to vehicles at the various levels of flooding.

Table 13 shows the residential and non-residential depth-damage relationships developed for structures, contents, and vehicles. More specific data regarding the depth-damage relationships can be found in the final report in support of Jefferson and Orleans Flood Control Feasibility Study (June 1996).

A post-flood survey was conducted to obtain damage information from residents in the study area whose properties had incurred flood damage from Hurricane Isaac. The owners of five one-story residential structures participated in the survey. The residents were asked to provide structural information that could be used to determine the depreciated replacement cost of their homes and the depth of flooding above first floor elevation, the dollar value of the damage to their structure, and the percentage of the contents damaged as a result of Hurricane Isaac. The residents were also asked to provide the dollar value of the damage to their vehicles. The information obtained from the surveys was then compared to the depth-damage relationships used in the evaluation. An evaluation of these data showed that residential one story structures receiving an average of 1.4 feet of flooding had an average of 61 percent of the structure damaged and 80 percent of the contents damaged. In addition, the vehicles were shown to be 100 percent damaged at an average of 1.4 feet of flooding. This empirical evidence closely correlates with the information received from the expert elicitation used in the salt-water, long-duration depth damage functions.

**Uncertainty Surrounding the Economic Inputs.** The uncertainty surrounding the four key economic variables was quantified and entered into the HEC-FDA model. These economic variables included structure values, contents-to-structure value ratios, first floor elevations, and depth-damage relationships. The HEC-FDA model used the uncertainty surrounding these variables to estimate the uncertainty surrounding the stage-damage relationships developed for each study area reach.

*Structure and Vehicle Values.* In order to quantify the uncertainty surrounding the values calculated for the residential and non-residential structure inventory, several survey teams valued an identical set of structures from various evaluation areas in the Gulf Coast region. The structure values calculated by each of the teams during windshield surveys were used to



develop a mean value and a standard deviation for each structure in the sample. The standard deviation was then expressed as a percentage of the mean value for that structure. The average standard deviation as a percentage of the mean for the sampled structures was then used to represent the uncertainty surrounding the structure value for all the inventoried residential and non-residential structures. The average standard deviation, which was expressed as a percentage of the mean structure value, totaled 11.4 percent for residential structures and 11.6 percent for non-residential structures.

The uncertainty surrounding the values assigned to the vehicles in the inventory was determined using a triangular probability distribution function. The Manheim vehicle value, adjusted for number of vehicles per household and for the evacuation of vehicles prior to a storm event, was used as the most likely value. The average value of a new vehicle before taxes, license, and shipping charges was used as the maximum value, while the average 10-year depreciation value of a vehicle was used as the minimum value.

*Content-to-Structure Value Ratios.* A CSVR was computed for each residential and non-residential structure in the sample based on the total depreciated content value developed from these interviews. The mean and standard deviation values for each residential and non-residential category were entered into the HEC-FDA model after applying statistical bootstrapping. The model used a normal probability density function to describe the uncertainty surrounding the CSVR 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 are shown in Table 12.

*First Floor Elevations.* The topographical data used to estimate the first floor elevations assigned to the structure inventory contain two sources of uncertainty. The first source of uncertainty arises from the use of the 2009 LIDAR data, and the second source of uncertainty arises from the use of hand levels to determine the structure foundation heights above ground elevation. The error implicit in using LIDAR data to estimate the ground elevation of each of the inventoried structures is normally distributed with a mean of zero and a standard deviation of 0.6 feet. According to the Hydrologic Engineering Center training manual, and the uncertainty implicit in estimating foundation heights using hand levels from within 50 feet of the structure is normally distributed with a mean of zero and a standard deviation of 0.3 feet at the 95 percent level of confidence.

*Depth-Damage Relationships.* A triangular probability density function was used to determine the uncertainty surrounding the damage percentage associated with each depth of flooding. A minimum, maximum and most likely damage estimate was provided by a panel of experts for each depth of flooding. The specific range of values regarding probability distributions for the depth-damage curves can be found in the final 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.*

## **ENGINEERING INPUTS TO THE HEC-FDA MODEL**

**Ground Elevations.** Geospatial Engineering acquired elevation data for the West Shore Lake Pontchartrain study area. The LIDAR data were processed and used to create a digital elevation model (DEM) with a five-foot by five-foot horizontal grid resolution. The DEM used NAVD88 2004.65 vertical datum to determine the ground elevations for each of the residential and non-residential structures in the evaluation area.

**Stage-Probability Relationships.** Stage-probability relationships were provided for the existing (2012) without-project condition, future without-project conditions (2020 and 2070) and for future with-project conditions 0.01 AEP level of risk reduction (2020 and 2070). Water surface profiles were provided for eight annual chance exceedance (ACE) events: 99% (1-year), 20% (5-year), 10% (10-year), 4% (25-year), 2% (50-year), 1% (100-year), 0.5% (200-year), and 0.2% (500-year). The without-project water surface profiles were based on storm surge and incorporated heavy rainfall events. The with-project water surface profiles were based only on rainfall.

The 99% ACE (1-year) event, 20% ACE (5-year) event, and 10% ACE (10-year) event water surface profiles for the year 2012 were based on gage data for the without-project condition. For each of these ACE events, the water surface profiles for the years 2020 and 2070 were determined by adding relative sea level rise to the gage data. The water surface profiles for the 2% ACE (50-year) event through the 0.2% ACE (500-year) event were based on results from the ADCIRC model. The 4% ACE (25-year) event stages were determined by interpolation between the 10% ACE (10-year) event stages and the 2% ACE (50-year) event stages.

**Uncertainty Surrounding the Engineering Inputs.** The uncertainty surrounding two key engineering parameters was quantified and entered into the HEC-FDA model. These engineering variables included ground elevations and the stage-probability curves. The HEC-FDA model used the uncertainty surrounding these variables to estimate the uncertainty surrounding the elevation of the storm surges for each study area reach.

*Ground Elevations.* An engineering survey was conducted to estimate the uncertainty surrounding the use of the 2009 LIDAR data to estimate ground elevations in urbanized areas. A combination of the uncertainty surrounding the ground elevations and the foundation height (0.6 feet) of a residential and non-residential structure was discussed in the first floor elevation uncertainty section of this report.

*Stage-Probability Relationships.* A 50-year equivalent record length was used to quantify the uncertainty surrounding the stage-probability relationships for each study area reach. Based on this equivalent record length, the HEC-FDA model calculated the confidence limits surrounding the stage-probability functions.

## **PART 3: NATIONAL ECONOMIC DEVELOPMENT (NED) FLOOD DAMAGE AND BENEFIT CALCULATIONS**

**HEC-FDA Model Calculations.** The HEC-FDA model was utilized to evaluate flood damages using risk-based analysis. Damages were reported at the index location for each of the 83 study area reaches for which a structure inventory had been conducted. A range of possible values, with a maximum and a minimum value for each economic variable (first floor elevation, structure and content values, and depth-damage relationships), was entered into the HEC-FDA model to calculate the uncertainty or error surrounding the elevation-damage, or stage-damage, relationships. The model also used the number of years that stages were recorded at a given gage to determine the hydrologic uncertainty surrounding the stage-probability relationships.

The possible occurrences of each variable were derived through the use of Monte Carlo simulation, which used randomly selected numbers to simulate the values of the selected variables from within the established ranges and distributions. For each variable, a sampling technique was used to select from within the range of possible values. With each sample, or iteration, a different value was selected. The number of iterations performed affects the simulation execution time and the quality and accuracy of the results. This process was conducted simultaneously for each economic and hydrologic variable. The resulting mean value and probability distributions formed a comprehensive picture of all possible outcomes.

**Stage-Damage Relationships with Uncertainty.** The HEC-FDA model used the economic and engineering inputs to generate a stage-damage relationship for each structure category in each study area reach under existing (2012) and future (2020 and 2070) conditions. The possible occurrences of each economic variable were derived through the use of Monte Carlo simulation. A total of 1,000 iterations were executed by the model for the West Shore Lake Pontchartrain evaluation. The sum of all sampled values was divided by the number of samples to yield the expected value for a specific simulation. A mean and standard deviation was automatically calculated for the damages at each stage.

**Stage-Probability Relationships with Uncertainty.** The HEC-FDA model used an equivalent record length (50 years) for each study area reach to generate a stage-probability relationship with uncertainty for the without-project condition under existing (2012) and future (2020 and 2070) conditions through the use of graphical analysis. The model used the eight stage-probability events together with the equivalent record length to define the full range of the stage-probability or stage-probability functions by interpolating between the data points. Confidence bands surrounding the stages for each of the probability events were also provided.

**Without-Project Expected Annual Damages.** The model used Monte Carlo simulation to sample from the stage-probability curve with uncertainty. For each of the iterations within the simulation, stages were simultaneously selected for the entire range of probability events. The sum of all damage values divided by the number of iterations run by the model yielded the expected value, or mean damage value, with confidence bands for each probability event. The probability-damage relationships are integrated by weighting the damages corresponding to each magnitude of flooding (stage) by the percentage chance of exceedance (probability). From these weighted damages, the model determined the expected annual damages (EAD) with confidence bands (uncertainty). For the without-project alternative, the expected annual damages (EAD) were totaled for each study area reach to obtain the total without-project EAD under existing (2012) and future (2020 and 2070) conditions. Table 14 shows the number and type of structures that are damaged by each of annual chance exceedance events for the years 2020 and 2070 under without-project conditions using the intermediate sea level rise scenario. Table 15 shows the without-project damages by probability event for the years 2020 and 2070 using the intermediate sea level rise scenario.

*Structure Inventory Adjustments for Repetitive Flooding.* Adjustments were made to the structure inventory before executing the HEC-FDA model to more accurately reflect the most likely future without-project and with-project conditions. Under without-project and with-project conditions, owners of those structures that were identified as repetitively flooded structures are expected to take remedial measures to reduce flood risk rather than incur repair costs a highly frequent basis. To account for this effect, for the 2020 residential and non-residential structure inventory, all structures with a first floor elevation less than or equal to the 2012 10% ACE (10-year) water surface elevation within each study area reach were elevated to the stage associated with the 2070 1% ACE (100-year) event using the historic rate of sea-level rise scenario projected to occur during the period of analysis. This would also ensure that the structures would not be located within the 100-year floodplain during the period of analysis. The first floor elevations of 241 residential and 81 non-residential structures were adjusted for repetitive flooding. All but 10 structures would be behind the levee system. The remaining 10 structures are south of hwy 3125 and only decreases the available benefits associated with the flap gates.

**Equivalent Annual Damages.** Damages for each of the years during the period of analysis were computed by linear interpolation between 2020 and 2070. The FY 2014 Federal discount rate of 3.5 percent was used to compound the stream of expected annual damages and benefits before the project base year and to discount the stream of expected annual damages and benefits occurring after the base year to calculate the total present value of the damages over the period of analysis. The present value of the expected annual damages was then amortized over the period of analysis using the Federal discount rate to calculate the equivalent annual damages. Table 16 shows the equivalent annual without-project damages, with-project damages, equivalent annual benefits in both 2012 and inflated 2014 prices for each flood risk management component using projected intermediate sea level rise. It should be noted that future development was not included in the damage and benefit estimates for the proposed localized storm surge risk

reduction measures in St. James Parish. Since future development was not included in the damage and benefit calculations for the localized flood risk reduction components in St. James Parish, then the future development in St. James Parish was also excluded in the damage and benefit calculations for the Recommended Plan. This was done in order to have consistent damage results for all the individual components totaled and the results for the components combined into one model. Table 17 shows the equivalent annual without-project damages, with-project damages, equivalent annual benefits in both 2012 and inflated 2014 prices for the Recommended Plan by study area reaches using projected intermediate sea level rise.

## **PART 4: PROJECT COSTS OF THE RECOMMENDED PLAN**

**Construction Schedule.** Construction of the Recommended Plan is expected to begin in the year 2015 and will continue through the year 2020, which is established as the base year for analysis. For the 0.01 ACE level of risk reduction structural system component of this plan, four levee lifts are scheduled after the year 2020 to maintain the design elevation. The first levee lift will be overbuilt and allowed to settle for several years before the later levee lifts are added. The later lifts will account for the relative sea-level rise and subsidence that is projected to occur throughout the period of analysis. Construction of the berms and the installation of the flap gates on culverts are expected to begin in the year 2018 and be completed in the year 2019. Other localized storm surge risk reduction measures are implemented in the year 2019.

**Average Annual Costs.** Life cycle cost estimates were provided for the Alternative C levee alignment system in October 2014 price levels. The localized flood risk reduction components for the Recommend Plan, which included the costs associated with structure elevation, flood proofing and smaller berms for selected light industry/warehouse facilities, were initially estimated at 2012 price levels and inflated to 2014 price levels using the CWCCIS. The initial construction cost (first costs), along with the schedule of expenditures, were used to determine the interest during construction and gross investment cost at the end of the installation period (2020). The FY 2014 Federal discount rate of 3.5 percent was used to discount the costs to the base year and then amortize the costs over the 50-year period of analysis. The costs for the recommend plan are also shown using the current FY 2015 Federal discount rate of 3.375 percent.

The operations, maintenance, relocations, rehabilitation, and repair (OMRR&R) costs for each component of the Recommended Plan during the period of analysis was discounted to present value and annualized using the Federal discount rate of 3.5 percent for 50 years. The OMRR&R costs for the recommend plan were also annualized using the current FY 2015 discount rate of 3.375 percent.

Tables 18 through 24 C provide the life cycle costs for each of the project components, the average annual construction costs, the annual operation and maintenance costs, and the total average annual costs. The interest during construction costs is also included in the calculation of total average annual costs. Tables 25 through 31 C displays the annualization of OMRR&R costs over the period of analysis.

## **PART 5: RESULTS OF THE ECONOMIC ANALYSIS**

### **NET BENEFIT ANALYSIS**

**Calculation of Net Benefits.** The expected annual benefits attributable to the project alternative were converted to an equivalent time frame by using the FY14 Federal discount rate of 3.5 percent, and also at the current FY 2015 Federal discount rate of 3.375 percent for the Recommended Plan. The base year for this conversion is the year 2020 for the Recommended Plan. The equivalent annual benefits were then compared to the average annual costs to develop a benefit-to-cost ratio for the alternative. The net benefits for the alternative were calculated by subtracting the average annual costs from the equivalent annual benefits. The net benefits were used to determine the economic justification of the project alternative.

**Net Benefits for the Flood Risk Management Project Components including Levee Alignment Alternative C and all Localized Storm Surge Risk Reduction Measures.** Tables 32 through 37 summarize the equivalent annual damages and benefits, total annual costs, benefit-to-cost ratio, and equivalent annual net benefits for each component of the system analyzed. The benefits and costs are displayed in both 2012 and 2014 price levels. The benefits were originally calculated in 2012 price levels and the costs were calculated in 2014 price levels. The Civil Works Construction Cost Index System (CWCCIS) was used to price level the benefits and costs. Table 38 A contains the information mentioned above for the localized storm surge risk reduction measures outside of the structural levee system and Table 38 B shows the same results excluding Berm 2, given that this increment was not economically justified. Table 39 A summarizes the equivalent annual damages and benefits, total annual costs, benefit-to-cost ratio, and equivalent annual net benefits for the all components analyzed in the West Shore Lake Pontchartrain study area. This includes both the structural levee alignment and all localized storm surge risk reduction measures.

**Net Benefits for the Recommended Plan.** The equivalent annual damages and benefits, total annual costs, benefit-to-cost ratio, and equivalent annual net benefits for the Recommended Plan are displayed in Table 39 B. This includes Alternative C levee alignment and all of the localized storm surge risk reduction measures excluding Berm 2. The Recommended Plan has higher equivalent annual net benefits than the plan including Berm 2, and thus constitutes the National Economic Development (NED) Plan. Table 39 C shows the results from a single execution of the HEC-FDA model combining all flood

risk management components as a system (structural and localized storm surge risk reduction measures excluding Berm 2). Table 39 D shows the net benefits for the recommend plan using the current FY 2015 Federal discount rate of 3.375 percent. Estimates of EAD and benefits displayed as the summation of model executions for each individual FRM component varies from the estimates displayed for a model execution combining all flood risk management components is attributable to the manner in which the aforementioned Monte Carlo simulations are performed when system components are permitted to interact with each other.

**Results at the OMB 7% Discount Rate.** Project costs, OMRR&R, equivalent annual project damages, benefits, and net benefits are similarly displayed in Tables 40 through 61 C using the Office of Management and Budget (OMB) discount rate of 7 percent.

## **REGIONAL ECONOMIC DEVELOPMENT IMPACTS OF RECOMMENDED PLAN**

**Background.** The Westshore Lake Pontchartrain hurricane risk reduction system consists of a levee alignment in St. Charles and St. John the Baptist Parishes and a series of localized storm surge risk reduction measures including the construction of berms, the installation of flap gates, the raising residential structures, and the floodproofing nonresidential structures in St. James Parish. This system is being implemented in response to reoccurring hurricane storm damage and is designed to prevent loss of life and to reduce flood damages. For this analysis, the regional economic development (RED) effects of implementing the components of the Westshore Lake Pontchartrain hurricane risk reduction system will be estimated. The RECONS impact area the Gulf of Louisiana consisting of the New Orleans and Baton Rouge Metropolitan Statistical Areas was selected based on the labor market, commuter-shed, and population centers serving the project area. According to RECONS' 2009 data, the population of the study area is 2,199,734. The number of households is 816,005. Total personal income is \$90,517 million (Table 62).

**Methodology.** This Regional Economic Development (RED) analysis employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a region's economy to predict the effect of changes in one industry on others. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending drive the input-output model to project new levels of sales (output), value added (GRP), employment, and income for each industry.

The specific input-output model used in this analysis is RECONS (Regional Economic System). This model was developed by the Institute for Water Resources (IWR), Michigan State University, and the Louis Berger Group. RECONS uses industry multipliers derived from the commercial input-output model IMPLAN to estimate the effects that spending on USACE projects has on a regional economy. The model is linear and static, showing relationships and impacts at a certain fixed point in time. Spending impacts are composed of three different effects: direct, indirect, and induced.

Direct effects represent the impacts the new federal expenditures have on industries which directly support the new project. Labor and construction materials can be considered direct components to the project. Indirect effects represent changes to secondary industries that support the direct industries. Induced effects are changes in consumer spending patterns caused by the change in employment and income within the industries affected by the direct and induced effects. The additional income workers receive via a project may be spent on clothing, groceries, dining out, and other items in the regional area.

The inputs for the RECONS model are expenditures that are entered by work activity or industry sector, each with its own unique production function. The production function “FRM Construction” was selected to gauge the impacts of the construction of the levee, the berms, the installation of the flap gates, the structure raising, and the floodproofing of structures. The production function “FRM Operations and Maintenance” was selected to gauge the impacts of the operations and maintenance costs associated with the features of the system. The baseline data used by RECONS to represent the regional economy of Louisiana are annual averages from the Bureau of the Census, the Bureau of Labor Statistics, and the Bureau of Economic Analysis for the year 2009. The model results are expressed in 2014 dollars.

**Assumptions.** Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if output is to increase, inputs will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all of its commodities. Finally, since the model is static, it is assumed that the economic conditions of 2009, the year of the socio-economic data in the RECONS model database, will prevail during the years of the construction process.

**Description of Metrics.** “Output” is the sum total of transactions that take place as a result of the construction project, including both value added and intermediate goods purchased in the economy. “Labor Income” includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. “Gross Regional Product (GRP)” is the value-added output of the study regions. This metric



captures all final goods and services produced in the study areas because of the project's existence. It is different from output in the sense that one dollar of a final good or service may have multiple transactions associated with it. "Jobs" is the estimated worker-years of labor required to build the project.

**Results.** For the region including the study area, the construction stimulus of \$1.066 billion would generate 15,773 worker-years of labor, \$853,482,895 in labor income, \$1,743,979,232 in output, and \$1,130,044,210 in Gross Regional Product (see Table 62). For the state of Louisiana as a whole, the construction stimulus would generate 16,623 worker-years of labor, \$907,236,790 in labor income, \$1,837,864,861 in output, and \$1,198,467,210 in Gross Regional Product (see Table 62).

The impact area captures about 90% of the direct spending on the project. About 4% of the spending leaks out into other parts of the state of Louisiana. The rest of the nation captures about 6%. The secondary impacts, the combined indirect and induced multiplier effects, account for nearly 44% of the total output, about 38% of employment, 33% of labor income, and almost 42% of gross regional product in the impact area.

## **OPTIMIZATION OF LEVEL OF RISK REDUCTION**

**Optimization of Alternative C Levee Alignment System.** The 0.02 (50-year) AEP, 0.01 (100-year) AEP, and 0.005 (200-year) AEP levels of risk reduction (LORR) were estimated using the stage-probability relationships for the without-project conditions. A top of levee elevation was also entered into the HEC-FDA model for each of the three LORRs equal to the 0.02 (50-year) ACE stage, the 0.01 (100-year) ACE stage, and the 0.005 (200-year) ACE stage, respectively. While detailed engineering inputs were available for the 0.01 (100-year) AEP, only the without-project stage-probability relationships with a top of levee elevation was used to analyze the 0.01 (100-year) AEP in order to maintain consistency in results for optimization purposes. It should be noted that the results for the 0.01 (100-year) AEP using only the without-project conditions with a top of levee elevation will not be equivalent to the results based on the detailed engineering inputs. However, this approach can be used to show the level of risk reduction that generates the highest level of net benefits.

The HEC-FDA model was used to calculate the expected annual without and with-project damages for each of the three levels of risk reduction for 2020 and 2070. The expected annual damage values were then converted to equivalent annual damages using the FY 2014 Federal discount rate and a 50-year period of analysis. The equivalent annual without project damages minus the equivalent annual damages for each of the three LORRs were used to calculate the equivalent annual benefits.

Preliminary project costs which were later revised for final draft report were only available for the 0.01 (100-year) AEP level of risk reduction for the Alternative C

alignment levee system. The costs for the 0.01 (100-year) AEP level of risk reduction were adjusted to reflect costs for the 0.02 (50-year) AEP and the 0.005 (200-year) AEP levels of risk reduction based on adjustments to reflect additional levee height, quantity of fill, relocations, railroad gates, mitigations and administrative costs. The costs were annualized using the FY 2014 Federal discount rate, a 50-year period of analysis, and 2014 price levels. The level of risk reduction with the highest net benefits was determined to be the 100-year level of risk reduction for Alternative C levee alignment system in St. Charles and St. John parishes. The results of the optimization for the 0.02 (50-year) AEP, 0.01 (100-year) AEP and the 0.005 (200-year) AEP are shown in Tables 63, 64, and 65.

## **SENSITIVITY ANALYSIS**

**Alternative C Levee Alignment – Without Future Development.** The projected development was removed from the structure inventory for the study area reaches receiving risk reduction from the Alternative C Levee Alignment System. Table 66 shows the benefits, benefit-to-cost ratio and net benefits for the levee alignment without future development.

**Alternative C Levee Alignment Without and With Localized Storm Surge Risk Reduction Measures - Without Future Development.** Table 67 shows the benefits, benefit-to-cost ratio and net benefits for Levee alignment C including all of the localized storm surge risk reduction measures when removing the future development from the structure inventory. Tables 68 and 69 show the net benefits for the Alternative C Levee Alignment and Alternative C Levee alignment including the localized storm surge risk reduction measures at the 7 percent OMB interest rate.

**Recommended Plan - Without Future Development.** Tables 69 B and 69 C displays the benefits, benefit-to-cost ratio and net benefits for the Recommended Plan which includes the Alternative C Levee Alignment and localized storm surge risk reduction measures excluding Berm 2 with future development removed from the structure inventory. Table 69 D and E show the results from a single execution of the HEC-FDA model at both the 3.5 percent and 7 percent discount rates combining all flood risk management components as a system (structural and localized storm surge risk reduction measures excluding Berm 2). Estimates of EAD and benefits displayed as the summation of model executions for each individual FRM component varies from the estimates displayed for a model execution combining all flood risk management components is attributable to the manner in which the aforementioned Monte Carlo simulations are performed when system components are permitted to interact with each other.

**Sea Level Rise Scenarios.** The without-project conditions for Alternative C Levee Alignment for the three sea level rise scenarios, low/ historic, intermediate, and high were estimated using the HEC-FDA model results from the draft report and the intermediate sea level rise model results from the current analysis. The difference in without-project damages between the intermediate and low sea level rise and the difference in damages between the intermediate and high sea level rise was applied to the intermediate without-project damages using updated engineering inputs. The percent reduction in the without-project damages for the intermediate sea-level rise in the current phase of the analysis was applied to the without-project damages for the two other sea level rise scenarios previously calculated. The benefits were then calculated for low and high sea level rise applying the percent reduction in damages that was calculated with the Alternative C levee alignment in place. The benefits were then compared to the project costs for the three sea level rise scenarios. Estimates of without-project damages were revised based in the current phase due to refinement of engineering inputs. The results of the sea level rise scenarios are shown in Table 70. The sea-level rise scenarios without future development are shown in Table 71. The analysis shows that the Recommended Plan is economically justified for all sea level rise scenarios with or without future development.

## **RISK ANALYSIS**

**Benefit Exceedance Probability Relationship.** The HEC-FDA model used the uncertainty surrounding the economic and engineering inputs to generate results that can be used to assess the performance of the Recommended Plan. A spreadsheet was developed using the expected annual damage and benefit results from the HEC-FDA model to calculate the equivalent annual without-project and with-project damages and the damages reduced for each of the project alternatives. Table 72 shows the equivalent annual benefits at the 75, 50, and 25 percentiles. These percentiles reflect the percentage chance that the benefits will be greater than or equal to the indicated values. The benefit exceedance probability relationship for each of the project alternatives can be compared to the point estimate of the average annual costs for each of the project alternatives. The table indicates the percent chance that the equivalent annual benefits will exceed the equivalent annual costs therefore the benefit cost ratio is greater than one and the net benefits are positive.

**Project Performance by Reach for the Years of Analysis.** The results from the HEC-FDA model were also used to calculate the long-term annual exceedance probability (AEP) and the conditional non-exceedance probability, or assurance, for various probability storm events. The model provided a target stage to assess project performance for each study area reach for the base year, 2020, and the last year in the 50-year period of analysis under both without-project and with-project conditions. For study area reaches without proposed levees or berms, the target stage was set by default at the elevation where the model calculated five percent residual damages for the 1% ACE (100-year) event.

The HEC-FDA model calculated a target stage AEP with a median and expected value that reflected the likelihood that the target stages will be exceeded in a given year. The median value was calculated using point estimates, while the expected value was calculated using Monte Carlo simulation. The results also show the long-term risk or the probability of a target stage being exceeded over 10-year, 30-year, and 50-year periods. Finally, the model results show the conditional non-exceedance probability or the likelihood that a target stage will not be exceeded by the 10% ACE (10 year), the 4% ACE (25-year), the 2% ACE (50-year), the 1% ACE (100-year), the 0.4% ACE (250-year), and the 0.2% ACE (500-year). Tables 73 and 74 display the project performance results for each study area reach for the base year, 2020, and the last year in the 50-year period of analysis, 2070, under without-project and with-project conditions.

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Table 1  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 Land Use in the Study Area  
 (2009)

Land Class Name	Acres	Percentage of Total
<b>Developed land</b>	10,947	4.7
<b>Agricultural Land</b>	23,779	10.3
<b>Undeveloped Land</b>	124,181	53.9
<b>Open Water</b>	71,576	31.1
<b>Total</b>	230,483	100.0

Source: National Agricultural Statistical Service

Note: Sugarcane accounts for approximately half of the agricultural land and pasture/hay the remainder.

Table 2  
 Historical and Projected Parish Population  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 (1,000s)

Parish	1980	1990	2000	2010	2020	2080
St. Charles	37.5	42.5	48.2	52.8	56.2	65.5
St. James	21.6	20.8	21.4	22.1	22.3	26.5
St. John the Baptist	32.3	40.1	43.1	45.9	51.7	60.2
Total	91.4	103.4	112.7	120.8	130.2	152.1

Source: U.S. Census data, and Moody's County Forecast Database

Table 3

Existing Condition and Projected Population within  
 Inventoried Study Area

West Shore Lake Pontchartrain, LA Feasibility Study  
 (1,000s)

Parish	2012	2020	2070
Total in Study Area	62.90	64.7	95.9

Source: U.S. Census data, and Moody's County Forecast Database

Note: Population estimates in 2012 assumes 2.9 residents per housing unit and 20 housing units within a multi family structure.

Table 4  
 Number of Households by Parish  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 (1,000s)

Parish	1980	1990	2000	2010	2020	2080
St. Charles	11.6	14.4	16.5	17.2	18.3	22.0
St. James	6.1	6.4	7.0	6.9	7.2	8.7
St. John the Baptist	9.4	12.7	14.3	15.1	16.3	19.6
Total	27.1	33.5	37.8	39.2	41.8	50.2

Source: U.S. Census data, and Moody's County Forecast Database

Table 5  
Per Capita Income (\$s)  
West Shore Lake Pontchartrain, LA Feasibility Study

Parish	1990	2000	2005	2010	2012
St. Charles	17,297	24,228	26,826	32,599	34,992
St. John the Baptist	14,231	18,327	22,951	29,663	31,492
St. James	14,440	19,720	24,715	29,351	31,349

Source: U.S. Census data, and Moody's County Forecast Database

Table 6  
Total Non-Farm Employment  
West Shore Lake Pontchartrain, LA Feasibility Study  
(1,000s)

Parish	1970	1980	1990	2000	2010	2020	2080
St. Charles	9.0	18.1	18.5	20.1	24.3	26.3	36.2
St. John the Baptist	5.4	9.8	9.4	7.6	8.1	8.9	11.5
St. James	4.2	9.4	11.0	13.4	15.0	16.3	22.4
Total	18.5	37.2	39.0	41.1	47.4	51.5	70.1

Source: U.S. Census data, and Moody's County Forecast Database



Table 7  
 FEMA Flood Claims in Louisiana  
 West Shore Lake Pontchartrain, LA Feasibility Study

Event	Year	Number of Paid Claims	Total Amount Paid (1,000s)	Average Amount Paid (1,000s)
Tropical Storm Juan	Oct-85	6,187	\$ 189,842	\$ 30.7
Hurricane Andrew	Aug-92	5,589	\$ 270,791	\$ 48.5
Tropical Storm Isadore	Sep-02	8,441	\$ 141,869	\$ 16.8
Hurricane Lili	Oct-02	2,563	\$ 46,049	\$ 18.0
Hurricane Katrina	Aug-05	167,099	\$ 18,556,254	\$ 111.0
Hurricane Rita	Sep-05	9,507	\$ 539,086	\$ 56.7
Hurricane Gustav	Sep-08	4,524	\$ 115,250	\$ 25.5
Hurricane Ike	Sep-08	46,137	\$ 2,712,969	\$ 58.8

Source: Federal Emergency Management Agency (FEMA)  
 Note: Total amount paid and average amount paid have been updated to the Oct 2011 price level using the CPI for all urban consumers.

Table 8  
 FEMA Flood Claims by Parish  
 1978-2011  
 West Shore Lake Pontchartrain, LA Feasibility Study

Parish	Number of Claims December 2012	Total Nominal Dollar Amount (in millions)	Average Dollar Amount per Claim (in thousands)
St. Charles	5907	\$ 100.13	\$ 16.95
St. James	135	\$ 1.74	\$ 12.87
St. John the Baptist	3840	\$ 236.18	\$ 61.51
Total	9882	\$ 338.05	\$ 34.21

Source: FEMA  
 Note: Average dollar amount for total claims due to Hurricane Isaac is approximately \$125,000.

Table 9  
 Number of Structures in the Existing Condition  
 (2012)  
 West Shore Lake Pontchartrain, LA Feasibility Study

Reach Name	Residential	Mobile Home	Non-Residential	Vehicle	Total
Total	18,470	1,488	1,882	33,564	55,404

Table 10  
 Residential and Non-Residential Structure Inventory  
 Existing Conditions (2012)  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 (2012 price levels in \$1,000s)

Structure Category	Number	Average Depreciated Replacement Value
<i>Residential</i>		
One-Story Slab	11,532	\$ 156
One-Story Pier	4,551	\$ 88
Two-Story Slab	2,236	\$ 186
Two-Story Pier	151	\$ 171
Mobile Home	1,488	\$ 14
<b>Total Residential</b>	<b>19,958</b>	
<i>Non-Residential</i>		
Eating and Recreation	128	\$ 223
Professional	310	\$ 646
Public and Semi-Public	402	\$ 967
Repair and Home Use	74	\$ 158
Retail and Personal Services	258	\$ 368
Warehouse	543	\$ 249
Grocery and Gas Station	78	\$ 286
Multi-Family Occupancy	86	\$ 307
Industrial	3	\$ 2,568
<b>Total Non-Residential</b>	<b>1,882</b>	

Table 11  
Number of Projected Residential and Non-Residential Structures  
West Shore Lake Pontchartrain, LA Feasibility Study

Future Conditions (2020)	
Structure Category	Number
<i>Residential</i>	
One-Story Slab	312
One-Story Pier	63
Two-Story Slab	23
Two-Story Pier	5
Mobile Home	162
<b>Total Residential</b>	<b>565</b>
<i>Non-Residential</i>	
Eating and Recreation	11
Professional	27
Public and Semi-Public	32
Repair and Home Use	5
Retail and Personal Services	18
Warehouse	48
Grocery and Gas Station	5
Multi-Family Occupancy	3
Industrial	0
<b>Total Non-Residential</b>	<b>149</b>
Future Conditions (2070)	
Structure Category	Number
<i>Residential</i>	
One-Story Slab	5,745
One-Story Pier	1,206
Two-Story Slab	394
Two-Story Pier	91
Mobile Home	2,992
<b>Total Residential</b>	<b>10,428</b>
<i>Non-Residential</i>	
Eating and Recreation	54
Professional	120
Public and Semi-Public	133
Repair and Home Use	30
Retail and Personal Services	85
Warehouse	217
Grocery and Gas Station	23
Multi-Family Occupancy	17
Industrial	0
<b>Total Non-Residential</b>	<b>679</b>

Table 12  
 Content-to-Structure Value Ratios (CSVs) and Standard Deviations (SDs)  
 by Structure Category  
 West Shore Lake Pontchartrain, LA Feasibility Study

Structure Category		(CSV, SD)	Bootstrapped (CSV,SD)
Residential	One-story	(0.69, 0.37)	(0.69, 0.37)
	Two-story	(0.67, 0.35)	(0.67, 0.35)
	Mobile home	(01.14, 0.79)	(1.14, 0.79)
Non-Residential	Eating and Recreation	(1.70, 3.27)	(1.70, 2.93)
	Groceries and Gas Stations	(1.34, 0.80)	(1.34, 0.78)
	Professional Buildings	(0.54, 0.59)	(0.54, 0.54)
	Public and Semi-Public Buildings	(0.55, 0.90)	(0.55, 0.80)
	Multi-Family Buildings	(0.28, 0.17)	(0.28, 0.17)
	Repair and Home Use	(2.36, 3.20)	(2.36, 2.95)
	Retail and Personal Services	(1.19, 1.11)	(1.19, 1.05)
	Warehouses and Contractor Services	(2.07, 3.66)	(2.07, 3.25)





Table 13 (Cont)  
 Depth-Damage Relationships for Structures, Contents and Vehicles  
 Morganza to the Gulf of Mexico, LA  
 Post-Authorization Change Report

PUBL	COM		Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Structure	Mean %	0.0	0.0	3.5	36.5	36.8	36.8	41.1	41.1	48.5	48.5	48.5	49.5	49.5	65.0	65.0	72.5	75.0	77.8	77.8	77.8	
			Lower %	0.0	0.0	0.0	24.3	28.6	29.4	32.0	33.6	41.5	42.0	42.0	42.9	44.3	59.3	59.7	66.5	68.8	74.7	75.7	75.7	
			Upper %	0.0	0.0	7.0	41.0	41.3	41.3	46.1	46.1	54.5	58.2	58.2	58.2	58.2	79.2	79.2	88.3	91.4	94.8	94.8	94.8	
		Contents	Mean %	0.0	0.0	0.0	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	60.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
			Lower %	0.0	0.0	0.0	45.2	45.2	45.2	45.2	45.2	45.2	45.2	45.2	45.2	45.2	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0
			Upper %	0.0	0.0	0.0	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2	75.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
REPA	COM		Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Structure	Mean %	0.0	0.0	3.5	36.5	36.8	36.8	41.1	41.1	48.5	48.5	48.5	49.5	49.5	65.0	65.0	72.5	75.0	77.8	77.8	77.8	
			Lower %	0.0	0.0	0.0	24.3	28.6	29.4	32.0	33.6	41.5	42.0	42.0	42.9	44.3	59.3	59.7	66.5	68.8	74.7	75.7	75.7	
			Upper %	0.0	0.0	7.0	41.0	41.3	41.3	46.1	46.1	54.5	58.2	58.2	58.2	58.2	79.2	79.2	88.3	91.4	94.8	94.8	94.8	
		Contents	Mean %	0.0	0.0	0.0	87.5	87.5	87.5	87.5	98.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
			Lower %	0.0	0.0	0.0	67.5	67.5	67.5	67.5	78.9	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
			Upper %	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
RETA	COM		Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Structure	Mean %	0.0	0.0	3.5	36.5	36.8	36.8	41.1	41.1	48.5	48.5	48.5	49.5	49.5	65.0	65.0	72.5	75.0	77.8	77.8	77.8	
			Lower %	0.0	0.0	0.0	24.3	28.6	29.4	32.0	33.6	41.5	42.0	42.0	42.9	44.3	59.3	59.7	66.5	68.8	74.7	75.7	75.7	
			Upper %	0.0	0.0	7.0	41.0	41.3	41.3	46.1	46.1	54.5	58.2	58.2	58.2	58.2	79.2	79.2	88.3	91.4	94.8	94.8	94.8	
			Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Contents	Mean %	0.0	0.0	0.0	99.4	99.5	99.7	99.8	99.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
			Lower %	0.0	0.0	0.0	79.4	79.5	79.7	79.8	79.9	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
			Upper %	0.0	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
WARE	COM		Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Structure	Mean %	0.0	0.0	3.5	36.5	36.8	36.8	41.1	41.1	48.5	48.5	48.5	49.5	49.5	65.0	65.0	72.5	75.0	77.8	77.8	77.8	
			Lower %	0.0	0.0	0.0	24.3	28.6	29.4	32.0	33.6	41.5	42.0	42.0	42.9	44.3	59.3	59.7	66.5	68.8	74.7	75.7	75.7	
			Upper %	0.0	0.0	7.0	41.0	41.3	41.3	46.1	46.1	54.5	58.2	58.2	58.2	58.2	79.2	79.2	88.3	91.4	94.8	94.8	94.8	
			Stage	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	
		Contents	Mean %	0.0	0.0	0.0	36.1	53.0	61.5	69.9	79.5	96.3	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	97.0	
			Lower %	0.0	0.0	0.0	1.1	18.0	26.5	34.9	44.5	61.3	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	62.0	
			Upper %	0.0	0.0	0.0	71.1	88.0	96.5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Source: Based on Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRs) in Support of the Lower Atchafalaya and Morganza to the Gulf, Louisiana, Feasibility Study Final Report dated May 1997



Table 14

Structures Damaged by Probability Event in 2020 and 2070 Intermediate Sea Level Rise  
Residential, Non-Residential, Mobile Homes and Industrial  
Existing and Future Without-Project Conditions  
West Shore Lake Pontchartrain, LA Feasibility Study

Annual Chance Exceedance Event (ACE)	Residential	Non-Residential	Mobile Home	IND	Total
Base year 2020					
0.99 (1 yr)	-	-	-	-	-
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	89	30	26	-	145
0.04 (25 yr)	558	117	98	-	773
0.02 (50 yr)	4,313	323	271	1	4,908
0.01 (100 yr)	6,942	647	523	2	8,114
0.005 (200 yr)	8,440	822	595	2	9,859
0.002 (500 yr)	9,170	1,014	672	2	10,858
Future year 2070 Intermediate Sea Level Rise					
0.99 (1 yr)	19	21	-	-	40
0.20 (5 yr)	258	48	56	-	362
0.10 (10 yr)	1,705	234	231	2	2,172
0.04 (25 yr)	4,486	400	420	2	5,308
0.02 (50 yr)	12,316	1,128	826	2	14,272
0.01 (100 yr)	19,381	2,032	1,037	2	22,452
0.005 (200 yr)	21,273	2,212	1,173	2	24,660
0.002 (500 yr)	23,037	2,446	1,241	2	26,726

Table 15

Damages By Probability Event in 2020 and 2070 Intermediate Sea Level Rise  
 Residential, Non-Residential, Mobile Homes and Industrial  
 Existing and Future Without-Project Conditions  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 (Damages in \$1,000s using 2012 Price Levels)

Annual Chance Exceedance Event (ACE)	Residential	Non-Residential	Mobile Home	IND	Total
Base year 2020					
0.99 (1 yr)	\$ -	\$ -	\$ -	\$ -	\$ -
0.20 (5 yr)	-	-	-	-	-
0.10 (10 yr)	805	1,315	47	-	2,168
0.04 (25 yr)	45,685	17,621	452	-	63,758
0.02 (50 yr)	492,044	112,847	3,744	10	608,645
0.01 (100 yr)	1,060,300	177,277	6,767	344	1,244,688
0.005 (200 yr)	1,428,436	402,940	11,242	685	1,843,303
0.002 (500 yr)	1,634,417	526,761	13,299	885	2,175,362
Future year 2070 Intermediate Sea Level Rise					
0.99 (1 yr)	93	37	-	-	130
0.20 (5 yr)	9,025	1,030	149	-	10,204
0.10 (10 yr)	154,128	59,334	1,502	130	215,094
0.04 (25 yr)	472,488	117,001	3,748	587	593,825
0.02 (50 yr)	1,741,939	642,685	15,150	1,732	2,401,506
0.01 (100 yr)	2,966,925	1,492,510	21,187	1,829	4,482,451
0.005 (200 yr)	3,687,303	1,766,872	24,871	1,829	5,480,875
0.002 (500 yr)	4,059,892	2,067,546	28,044	1,829	6,157,311

Note: 2012 price levels were used for the damages.

Table 16  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 Flood Risk Management (FRM) System by Component  
 (Damages in \$1,000s in 2012 and 2014 Price Levels)

FRM Component	Equiv Annual Without Project Damages 2012 Prices (2020-2070)	Equiv Annual With-Project Damages 2012 Prices (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
0.01 AEP (100-year) Level of Risk Reduction Structural System	\$ 177,193	\$ 91,832	\$ 85,146	\$ 87,700
Berm 1	\$ 2,110	\$ 1,069	\$ 1,042	\$ 1,073
Berm 2	\$ 905	\$ 683	\$ 222	\$ 229
Berm 3	\$ 1,419	\$ 491	\$ 928	\$ 956
Installation of Flap Gates on Culverts	\$ 3,677	\$ 2,590	\$ 1,087	\$ 1,119
Structure Raising outside of Levee Alignment and Berms	\$ 2,411	\$ 187	\$ 2,223	\$ 2,290

Note: Separate HEC-FDA model runs are made for each Flood Risk Management component.  
 Inducements of \$215,110 attributed to the 0.01 AEP Level of Risk Reduction Structural System are included in the analysis.

Table 17  
West Shore Lake Pontchartrain, LA Feasibility Study  
Recommended Plan  
(Damages in \$1,000s)

Reach	Equiv Annual W/O Project Damages 2012 Prices (2020-2070)	Equiv Annual With-Project Damages 2012 Prices (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020- 2070)
1	\$ 1,300.8	\$ 368.3	\$ 932.5	\$ 960.5
10	\$ 33.1	\$ 35.6	\$ (2.5)	\$ (2.5)
11	\$ 2,858.3	\$ 424.9	\$ 2,433.3	\$ 2,506.3
12	\$ 15.0	\$ 16.5	\$ (1.5)	\$ (1.6)
13	\$ -	\$ -	\$ -	\$ -
14	\$ -	\$ -	\$ -	\$ -
15	\$ 1.2	\$ 1.3	\$ (0.1)	\$ (0.1)
16	\$ 2.9	\$ 2.8	\$ 0.1	\$ 0.1
17	\$ -	\$ -	\$ -	\$ -
18	\$ -	\$ -	\$ -	\$ -
19	\$ -	\$ -	\$ -	\$ -
2	\$ 72.6	\$ 8.3	\$ 64.3	\$ 66.2
20	\$ -	\$ -	\$ -	\$ -
21	\$ 801.5	\$ 111.5	\$ 690.0	\$ 710.7
22	\$ -	\$ -	\$ -	\$ -
23	\$ -	\$ -	\$ -	\$ -
24	\$ 231.4	\$ 4.3	\$ 227.1	\$ 233.9
25	\$ 1.2	\$ 1.3	\$ (0.1)	\$ (0.1)
26	\$ 0.1	\$ 0.1	\$ -	\$ -
27	\$ -	\$ -	\$ -	\$ -
28	\$ -	\$ -	\$ -	\$ -
29	\$ -	\$ -	\$ -	\$ -
3	\$ 33.5	\$ 36.2	\$ (2.7)	\$ (2.8)
30	\$ 11.1	\$ 12.1	\$ (1.0)	\$ (1.1)
31	\$ -	\$ -	\$ -	\$ -
32	\$ -	\$ -	\$ -	\$ -
33	\$ 50.0	\$ 3.8	\$ 46.2	\$ 47.6
34	\$ -	\$ -	\$ -	\$ -
35	\$ -	\$ -	\$ -	\$ -
36	\$ 4.2	\$ 3.1	\$ 1.1	\$ 1.1
37	\$ 1.5	\$ 1.6	\$ (0.1)	\$ (0.1)
38	\$ -	\$ -	\$ -	\$ -
39	\$ 3.6	\$ 3.8	\$ (0.2)	\$ (0.2)
4	\$ -	\$ -	\$ -	\$ -
40	\$ 0.2	\$ 0.2	\$ (0.0)	\$ (0.0)
41	\$ -	\$ -	\$ -	\$ -
42	\$ 4.6	\$ 5.0	\$ (0.4)	\$ (0.4)
43	\$ 7.6	\$ 8.0	\$ (0.4)	\$ (0.4)
44	\$ 0.3	\$ 0.3	\$ (0.0)	\$ (0.0)
45	\$ -	\$ -	\$ -	\$ -
46	\$ 1,824.4	\$ 898.3	\$ 926.1	\$ 953.9

Table 17 cont.  
West Shore Lake Pontchartrain, LA Feasibility Study  
Recommended Plan  
(Damages in \$1,000s)

Reach	Equiv Annual W/O Project Damages 2012 Prices (2020-2070)	Equiv Annual With-Project Damages 2012 Prices (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020- 2070)
47	\$ -	\$ -	\$ -	\$ -
48	\$ -	\$ -	\$ -	\$ -
49	\$ -	\$ -	\$ -	\$ -
5	\$ 0.1	\$ 0.1	\$ -	\$ -
50	\$ -	\$ -	\$ -	\$ -
51	\$ -	\$ -	\$ -	\$ -
52	\$ 8.4	\$ 8.9	\$ (0.6)	\$ (0.6)
53	\$ 430.9	\$ 452.2	\$ (21.2)	\$ (21.9)
54	\$ 765.9	\$ 67.3	\$ 698.6	\$ 719.5
55	\$ 1,109.3	\$ 204.6	\$ 904.7	\$ 931.8
56	\$ 641.7	\$ 252.2	\$ 389.5	\$ 401.2
57	\$ 28.9	\$ 6.9	\$ 21.9	\$ 22.6
58	\$ 216.1	\$ 8.4	\$ 207.7	\$ 213.9
59	\$ 50.3	\$ 51.9	\$ (1.6)	\$ (1.6)
6	\$ 83.1	\$ 83.2	\$ (0.2)	\$ (0.2)
60	\$ 854.4	\$ 860.1	\$ (5.6)	\$ (5.8)
7	\$ 4,537.5	\$ 409.4	\$ 4,128.1	\$ 4,251.9
8	\$ 1,909.3	\$ 1,158.1	\$ 751.2	\$ 773.8
9	\$ 49.7	\$ 53.7	\$ (4.0)	\$ (4.1)
SA 1	\$ 2,954.4	\$ 2,151.4	\$ 803.0	\$ 827.1
SA 10	\$ 3,551.6	\$ 217.3	\$ 3,334.3	\$ 3,434.3
SA 11	\$ 11.9	\$ 0.2	\$ 11.8	\$ 12.1
SA 12	\$ 1,303.1	\$ 644.0	\$ 659.1	\$ 678.9
SA 13	\$ 1,229.4	\$ 156.6	\$ 1,072.8	\$ 1,105.0
SA 14	\$ 53,512.0	\$ 52,327.8	\$ 1,184.1	\$ 1,219.7
SA 15	\$ 522.0	\$ 279.5	\$ 242.5	\$ 249.8
SA 16	\$ 2,223.8	\$ 1,258.1	\$ 965.6	\$ 994.6
SA 17	\$ -	\$ -	\$ -	\$ -
SA 18	\$ 84.2	\$ 2.4	\$ 81.8	\$ 84.2
SA 19	\$ 1.7	\$ -	\$ 1.7	\$ 1.7
SA 2	\$ 2,694.9	\$ 2,154.8	\$ 540.1	\$ 556.3
SA 20	\$ -	\$ -	\$ -	\$ -
SA 21	\$ 11,183.1	\$ 4,279.4	\$ 6,903.7	\$ 7,110.8
SA 22	\$ 1,176.0	\$ 847.4	\$ 328.6	\$ 338.5
SA 23	\$ 560.2	\$ 118.4	\$ 441.8	\$ 455.1
SA 24	\$ 1,107.4	\$ 348.5	\$ 759.0	\$ 781.7
SA 25	\$ 258.9	\$ 139.4	\$ 119.6	\$ 123.1
SA 26	\$ 13.7	\$ 0.1	\$ 13.6	\$ 14.0
SA 27	\$ 2,093.1	\$ 61.4	\$ 2,031.6	\$ 2,092.6
SA 28X	\$ 1,154.5	\$ 6.4	\$ 1,148.1	\$ 1,182.5
SA 28Y	\$ 609.2	\$ 6.9	\$ 602.3	\$ 620.4
SA 29	\$ 4,646.7	\$ 14.9	\$ 4,631.8	\$ 4,770.7
SA 29C	\$ 632.6	\$ 434.0	\$ 198.6	\$ 204.5
SA 3	\$ 2,834.5	\$ 2,814.9	\$ 19.6	\$ 20.2
SA 30	\$ 6,269.7	\$ 190.5	\$ 6,079.2	\$ 6,261.6
SA 30C	\$ 971.5	\$ 3.0	\$ 968.5	\$ 997.5
SA 31	\$ 7,408.5	\$ 17.7	\$ 7,390.8	\$ 7,612.5
SA 31C	\$ -	\$ -	\$ -	\$ -
SA 32	\$ 10,827.0	\$ 119.8	\$ 10,707.3	\$ 11,028.5

Table 17 cont.  
West Shore Lake Pontchartrain, LA Feasibility Study  
Recommended Plan  
(Damages in \$1,000s)

Reach	Equiv Annual W/O Project Damages 2012 Prices (2020-2070)	Equiv Annual With-Project Damages 2012 Prices (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020 2070)
SA 33	\$ 8,869.9	\$ 312.6	\$ 8,557.3	\$ 8,814.0
SA 34	\$ 9,979.4	\$ 819.2	\$ 9,160.2	\$ 9,435.0
SA 35	\$ 2,673.2	\$ 40.6	\$ 2,632.5	\$ 2,711.5
SA 36	\$ 1,448.9	\$ 0.6	\$ 1,448.4	\$ 1,491.8
SA 37	\$ 0.7	\$ -	\$ 0.7	\$ 0.7
SA 38	\$ 4,194.3	\$ 26.9	\$ 4,167.4	\$ 4,292.4
SA 39	\$ 136.8	\$ 0.1	\$ 136.7	\$ 140.8
SA 39C	\$ 146.4	\$ -	\$ 146.4	\$ 150.8
SA 4	\$ 15,585.9	\$ 15,142.9	\$ 443.0	\$ 456.3
SA 40P	\$ 46.7	\$ 0.7	\$ 46.0	\$ 47.4
SA 41	\$ 890.5	\$ 2.2	\$ 888.3	\$ 915.0
SA 41P	\$ 6.6	\$ 0.0	\$ 6.6	\$ 6.8
SA 42P	\$ 3.7	\$ -	\$ 3.7	\$ 3.8
SA 43P	\$ -	\$ -	\$ -	\$ -
SA 44C	\$ -	\$ -	\$ -	\$ -
SA 5	\$ 345.0	\$ 260.3	\$ 84.6	\$ 87.2
SA 6	\$ 2,915.6	\$ 2,863.8	\$ 51.8	\$ 53.4
SA 7	\$ 807.7	\$ 393.2	\$ 414.6	\$ 427.0
SA 8	\$ 792.2	\$ 66.2	\$ 726.0	\$ 747.8
SA 9	\$ 2,489.0	\$ 650.4	\$ 1,838.7	\$ 1,893.9
Total	\$ 189,112.1	\$ 94,738.1	\$ 94,373.9	\$ 97,205.2

Note: Future development is included in St. John Parish but not in St. James Parish.  
Recommended Plan excludes Berm 2.

Table 18  
Average Annual Costs

Hurricane Protection Levee  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.1475	67,324
2016	-3	124,713	1.1087	138,271
2017	-2	124,713	1.0712	133,595
2018	-1	124,713	1.0350	129,078
2019	0	124,713	1.0000	124,713
2020	1	-	0.9662	-
2021	2	-	0.9335	-
2022	3	-	0.9019	-
2023	4	-	0.8714	-
2024	5	-	0.8420	-
2025	6	-	0.8135	-
2026	7	7,441	0.7860	5,849
2027	8	7,441	0.7594	5,651
2028	9	-	0.7337	-
2029	10	17,008	0.7089	12,057
2030	11	8,504	0.6849	5,825
2031	12	8,504	0.6618	5,628
2032	13	-	0.6394	-
2033	14	-	0.6178	-
2034	15	-	0.5969	-
2035	16	-	0.5767	-
2036	17	-	0.5572	-
2037	18	-	0.5384	-
2038	19	-	0.5202	-
2039	20	-	0.5026	-
2040	21	-	0.4856	-
2041	22	-	0.4692	-
2042	23	-	0.4533	-
2043	24	-	0.4380	-
2044	25	-	0.4231	-
2045	26	19,284	0.4088	7,884
2046	27	9,642	0.3950	3,809
2047	28	9,642	0.3817	3,680
2048	29	-	0.3687	-
2049	30	-	0.3563	-
2050	31	-	0.3442	-
2051	32	-	0.3326	-
2052	33	-	0.3213	-
2053	34	-	0.3105	-
2054	35	-	0.3000	-
2055	36	-	0.2898	-
2056	37	-	0.2800	-
2057	38	-	0.2706	-
2058	39	-	0.2614	-
2059	40	-	0.2526	-
2060	41	15,807	0.2440	3,857
2061	42	7,904	0.2358	1,863
2062	43	7,904	0.2278	1,800
2063	44	-	0.2201	-
2064	45	-	0.2127	-
2065	46	-	0.2055	-
2066	47	-	0.1985	-
2067	48	-	0.1918	-
2068	49	-	0.1853	-
2069	50	-	0.1791	-
<b>Total:</b>		<b>676,598</b>		<b>650,883</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:				\$ 27,750
Annual OMRR&R Costs:				4,374
Total Average Annual Costs:				\$ 32,124

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 19  
Average Annual Costs

Berm 1  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1	7140	1.0350	7,390
2019	0	7140	1.0000	7,140
2020	1	-	0.9662	-
2021	2	-	0.9335	-
2022	3	-	0.9019	-
2023	4	-	0.8714	-
2024	5	-	0.8420	-
2025	6	-	0.8135	-
2026	7	-	0.7860	-
2027	8	-	0.7594	-
2028	9	-	0.7337	-
2029	10	-	0.7089	-
2030	11	-	0.6849	-
2031	12	-	0.6618	-
2032	13	-	0.6394	-
2033	14	-	0.6178	-
2034	15	-	0.5969	-
2035	16	-	0.5767	-
2036	17	-	0.5572	-
2037	18	-	0.5384	-
2038	19	-	0.5202	-
2039	20	-	0.5026	-
2040	21	-	0.4856	-
2041	22	-	0.4692	-
2042	23	-	0.4533	-
2043	24	-	0.4380	-
2044	25	-	0.4231	-
2045	26	-	0.4088	-
2046	27	-	0.3950	-
2047	28	-	0.3817	-
2048	29	-	0.3687	-
2049	30	-	0.3563	-
2050	31	-	0.3442	-
2051	32	-	0.3326	-
2052	33	-	0.3213	-
2053	34	-	0.3105	-
2054	35	-	0.3000	-
2055	36	-	0.2898	-
2056	37	-	0.2800	-
2057	38	-	0.2706	-
2058	39	-	0.2614	-
2059	40	-	0.2526	-
2060	41	-	0.2440	-
2061	42	-	0.2358	-
2062	43	-	0.2278	-
2063	44	-	0.2201	-
2064	45	-	0.2127	-
2065	46	-	0.2055	-
2066	47	-	0.1985	-
2067	48	-	0.1918	-
2068	49	-	0.1853	-
2069	50	-	0.1791	-
<b>Total:</b>		<b>14,280</b>		<b>14,530</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:				\$ 619
Annual OMRR&R Costs:				223
Total Average Annual Costs:				\$ 842

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 20  
Average Annual Costs

Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1	8972	1.0350	9,286
2019	0	8972	1.0000	8,972
2020	1		0.9662	-
2021	2		0.9335	-
2022	3		0.9019	-
2023	4		0.8714	-
2024	5		0.8420	-
2025	6		0.8135	-
2026	7		0.7860	-
2027	8		0.7594	-
2028	9		0.7337	-
2029	10		0.7089	-
2030	11		0.6849	-
2031	12		0.6618	-
2032	13		0.6394	-
2033	14		0.6178	-
2034	15		0.5969	-
2035	16		0.5767	-
2036	17		0.5572	-
2037	18		0.5384	-
2038	19		0.5202	-
2039	20		0.5026	-
2040	21		0.4856	-
2041	22		0.4692	-
2042	23		0.4533	-
2043	24		0.4380	-
2044	25		0.4231	-
2045	26		0.4088	-
2046	27		0.3950	-
2047	28		0.3817	-
2048	29		0.3687	-
2049	30		0.3563	-
2050	31		0.3442	-
2051	32		0.3326	-
2052	33		0.3213	-
2053	34		0.3105	-
2054	35		0.3000	-
2055	36		0.2898	-
2056	37		0.2800	-
2057	38		0.2706	-
2058	39		0.2614	-
2059	40		0.2526	-
2060	41		0.2440	-
2061	42		0.2358	-
2062	43		0.2278	-
2063	44		0.2201	-
2064	45		0.2127	-
2065	46		0.2055	-
2066	47		0.1985	-
2067	48		0.1918	-
2068	49		0.1853	-
2069	50		0.1791	-
<b>Total:</b>		<b>17,943</b>		<b>18,257</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:				\$ 778
Annual OMRR&R Costs:				278
Total Average Annual Costs:				\$ 1,057

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 21  
Average Annual Costs

Berm 3  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1	7109	1.0350	7,358
2019	0	7109	1.0000	7,109
2020	1		0.9662	-
2021	2		0.9335	-
2022	3		0.9019	-
2023	4		0.8714	-
2024	5		0.8420	-
2025	6		0.8135	-
2026	7		0.7860	-
2027	8		0.7594	-
2028	9		0.7337	-
2029	10		0.7089	-
2030	11		0.6849	-
2031	12		0.6618	-
2032	13		0.6394	-
2033	14		0.6178	-
2034	15		0.5969	-
2035	16		0.5767	-
2036	17		0.5572	-
2037	18		0.5384	-
2038	19		0.5202	-
2039	20		0.5026	-
2040	21		0.4856	-
2041	22		0.4692	-
2042	23		0.4533	-
2043	24		0.4380	-
2044	25		0.4231	-
2045	26		0.4088	-
2046	27		0.3950	-
2047	28		0.3817	-
2048	29		0.3687	-
2049	30		0.3563	-
2050	31		0.3442	-
2051	32		0.3326	-
2052	33		0.3213	-
2053	34		0.3105	-
2054	35		0.3000	-
2055	36		0.2898	-
2056	37		0.2800	-
2057	38		0.2706	-
2058	39		0.2614	-
2059	40		0.2526	-
2060	41		0.2440	-
2061	42		0.2358	-
2062	43		0.2278	-
2063	44		0.2201	-
2064	45		0.2127	-
2065	46		0.2055	-
2066	47		0.1985	-
2067	48		0.1918	-
2068	49		0.1853	-
2069	50		0.1791	-
<b>Total:</b>		<b>14,218</b>		<b>14,467</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:				\$ 617
Annual OMRR&R Costs:				223
Total Average Annual Costs:				\$ 839

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)



Table 22  
Average Annual Costs

Installation of Flap Gates on Culverts  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1	2995	1.0350	3,100
2019	0	2995	1.0000	2,995
2020	1		0.9662	-
2021	2		0.9335	-
2022	3		0.9019	-
2023	4		0.8714	-
2024	5		0.8420	-
2025	6		0.8135	-
2026	7		0.7860	-
2027	8		0.7594	-
2028	9		0.7337	-
2029	10		0.7089	-
2030	11		0.6849	-
2031	12		0.6618	-
2032	13		0.6394	-
2033	14		0.6178	-
2034	15		0.5969	-
2035	16		0.5767	-
2036	17		0.5572	-
2037	18		0.5384	-
2038	19		0.5202	-
2039	20		0.5026	-
2040	21		0.4856	-
2041	22		0.4692	-
2042	23		0.4533	-
2043	24		0.4380	-
2044	25		0.4231	-
2045	26		0.4088	-
2046	27		0.3950	-
2047	28		0.3817	-
2048	29		0.3687	-
2049	30		0.3563	-
2050	31		0.3442	-
2051	32		0.3326	-
2052	33		0.3213	-
2053	34		0.3105	-
2054	35		0.3000	-
2055	36		0.2898	-
2056	37		0.2800	-
2057	38		0.2706	-
2058	39		0.2614	-
2059	40		0.2526	-
2060	41		0.2440	-
2061	42		0.2358	-
2062	43		0.2278	-
2063	44		0.2201	-
2064	45		0.2127	-
2065	46		0.2055	-
2066	47		0.1985	-
2067	48		0.1918	-
2068	49		0.1853	-
2069	50		0.1791	-
<b>Total:</b>		<b>5,990</b>		<b>6,094</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:			\$	260
Annual OMRR&R Costs:				204
Total Average Annual Costs:			\$	464

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 23  
Average Annual Costs

Other Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0	7005	1.0000	7,005
2020	1		0.9662	-
2021	2		0.9335	-
2022	3		0.9019	-
2023	4		0.8714	-
2024	5		0.8420	-
2025	6		0.8135	-
2026	7		0.7860	-
2027	8		0.7594	-
2028	9		0.7337	-
2029	10		0.7089	-
2030	11		0.6849	-
2031	12		0.6618	-
2032	13		0.6394	-
2033	14		0.6178	-
2034	15		0.5969	-
2035	16		0.5767	-
2036	17		0.5572	-
2037	18		0.5384	-
2038	19		0.5202	-
2039	20		0.5026	-
2040	21		0.4856	-
2041	22		0.4692	-
2042	23		0.4533	-
2043	24		0.4380	-
2044	25		0.4231	-
2045	26		0.4088	-
2046	27		0.3950	-
2047	28		0.3817	-
2048	29		0.3687	-
2049	30		0.3563	-
2050	31		0.3442	-
2051	32		0.3326	-
2052	33		0.3213	-
2053	34		0.3105	-
2054	35		0.3000	-
2055	36		0.2898	-
2056	37		0.2800	-
2057	38		0.2706	-
2058	39		0.2614	-
2059	40		0.2526	-
2060	41		0.2440	-
2061	42		0.2358	-
2062	43		0.2278	-
2063	44		0.2201	-
2064	45		0.2127	-
2065	46		0.2055	-
2066	47		0.1985	-
2067	48		0.1918	-
2068	49		0.1853	-
2069	50		0.1791	-
<b>Total:</b>		<b>7,005</b>		<b>7,005</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:			\$	299
Annual OMRR&R Costs:				0
Total Average Annual Costs:			\$	299

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 24 A  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized  
Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.1475	67,324
2016	-3	124,713	1.1087	138,271
2017	-2	124,713	1.0712	133,595
2018	-1	150,928	1.0350	156,211
2019	0	157,933	1.0000	157,933
2020	1	-	0.9662	-
2021	2	-	0.9335	-
2022	3	-	0.9019	-
2023	4	-	0.8714	-
2024	5	-	0.8420	-
2025	6	-	0.8135	-
2026	7	7,441	0.7860	5,849
2027	8	7,441	0.7594	5,651
2028	9	-	0.7337	-
2029	10	17,008	0.7089	12,057
2030	11	8,504	0.6849	5,825
2031	12	8,504	0.6618	5,628
2032	13	-	0.6394	-
2033	14	-	0.6178	-
2034	15	-	0.5969	-
2035	16	-	0.5767	-
2036	17	-	0.5572	-
2037	18	-	0.5384	-
2038	19	-	0.5202	-
2039	20	-	0.5026	-
2040	21	-	0.4856	-
2041	22	-	0.4692	-
2042	23	-	0.4533	-
2043	24	-	0.4380	-
2044	25	-	0.4231	-
2045	26	19,284	0.4088	7,884
2046	27	9,642	0.3950	3,809
2047	28	9,642	0.3817	3,680
2048	29	-	0.3687	-
2049	30	-	0.3563	-
2050	31	-	0.3442	-
2051	32	-	0.3326	-
2052	33	-	0.3213	-
2053	34	-	0.3105	-
2054	35	-	0.3000	-
2055	36	-	0.2898	-
2056	37	-	0.2800	-
2057	38	-	0.2706	-
2058	39	-	0.2614	-
2059	40	-	0.2526	-
2060	41	15,807	0.2440	3,857
2061	42	7,904	0.2358	1,863
2062	43	7,904	0.2278	1,800
2063	44	-	0.2201	-
2064	45	-	0.2127	-
2065	46	-	0.2055	-
2066	47	-	0.1985	-
2067	48	-	0.1918	-
2068	49	-	0.1853	-
2069	50	-	0.1791	-
<b>Total:</b>		<b>736,034</b>		<b>711,237</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:			\$	30,323
Annual OMRR&R Costs:				5,302
Total Average Annual Costs:			\$	35,625

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 24 B  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized  
Storm Surge Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.1475	67,324
2016	-3	124,713	1.1087	138,271
2017	-2	124,713	1.0712	133,595
2018	-1	141,957	1.0350	146,925
2019	0	148,962	1.0000	148,962
2020	1	-	0.9662	-
2021	2	-	0.9335	-
2022	3	-	0.9019	-
2023	4	-	0.8714	-
2024	5	-	0.8420	-
2025	6	-	0.8135	-
2026	7	7,441	0.7860	5,849
2027	8	7,441	0.7594	5,651
2028	9	-	0.7337	-
2029	10	17,008	0.7089	12,057
2030	11	8,504	0.6849	5,825
2031	12	8,504	0.6618	5,628
2032	13	-	0.6394	-
2033	14	-	0.6178	-
2034	15	-	0.5969	-
2035	16	-	0.5767	-
2036	17	-	0.5572	-
2037	18	-	0.5384	-
2038	19	-	0.5202	-
2039	20	-	0.5026	-
2040	21	-	0.4856	-
2041	22	-	0.4692	-
2042	23	-	0.4533	-
2043	24	-	0.4380	-
2044	25	-	0.4231	-
2045	26	19,284	0.4088	7,884
2046	27	9,642	0.3950	3,809
2047	28	9,642	0.3817	3,680
2048	29	-	0.3687	-
2049	30	-	0.3563	-
2050	31	-	0.3442	-
2051	32	-	0.3326	-
2052	33	-	0.3213	-
2053	34	-	0.3105	-
2054	35	-	0.3000	-
2055	36	-	0.2898	-
2056	37	-	0.2800	-
2057	38	-	0.2706	-
2058	39	-	0.2614	-
2059	40	-	0.2526	-
2060	41	15,807	0.2440	3,857
2061	42	7,904	0.2358	1,863
2062	43	7,904	0.2278	1,800
2063	44	-	0.2201	-
2064	45	-	0.2127	-
2065	46	-	0.2055	-
2066	47	-	0.1985	-
2067	48	-	0.1918	-
2068	49	-	0.1853	-
2069	50	-	0.1791	-
<b>Total:</b>		<b>718,091</b>		<b>692,980</b>
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual Construction Costs:			\$	29,544
Annual OMRR&R Costs:				5,023
Total Average Annual Costs:			\$	34,568

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 24 C  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized Storm Surge  
Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.1420	66,999
2016	-3	124,713	1.1047	137,771
2017	-2	124,713	1.0686	133,273
2018	-1	141,957	1.0338	146,748
2019	0	148,962	1.0000	148,962
2020	1	-	0.9674	-
2021	2	-	0.9358	-
2022	3	-	0.9052	-
2023	4	-	0.8757	-
2024	5	-	0.8471	-
2025	6	-	0.8194	-
2026	7	7,441	0.7927	5,898
2027	8	7,441	0.7668	5,706
2028	9	-	0.7418	-
2029	10	17,008	0.7175	12,204
2030	11	8,504	0.6941	5,903
2031	12	8,504	0.6715	5,710
2032	13	-	0.6495	-
2033	14	-	0.6283	-
2034	15	-	0.6078	-
2035	16	-	0.5880	-
2036	17	-	0.5688	-
2037	18	-	0.5502	-
2038	19	-	0.5322	-
2039	20	-	0.5149	-
2040	21	-	0.4981	-
2041	22	-	0.4818	-
2042	23	-	0.4661	-
2043	24	-	0.4508	-
2044	25	-	0.4361	-
2045	26	19,284	0.4219	8,135
2046	27	9,642	0.4081	3,935
2047	28	9,642	0.3948	3,806
2048	29	-	0.3819	-
2049	30	-	0.3694	-
2050	31	-	0.3574	-
2051	32	-	0.3457	-
2052	33	-	0.3344	-
2053	34	-	0.3235	-
2054	35	-	0.3129	-
2055	36	-	0.3027	-
2056	37	-	0.2928	-
2057	38	-	0.2833	-
2058	39	-	0.2740	-
2059	40	-	0.2651	-
2060	41	15,807	0.2564	4,053
2061	42	7,904	0.2481	1,961
2062	43	7,904	0.2400	1,896
2063	44	-	0.2321	-
2064	45	-	0.2245	-
2065	46	-	0.2172	-
2066	47	-	0.2101	-
2067	48	-	0.2033	-
2068	49	-	0.1966	-
2069	50	-	0.1902	-
<b>Total:</b>		<b>718,091</b>		<b>692,960</b>
FY 2015 Federal Discount Rate:			3.375%	
Amortization Factor:			0.04168	
Average Annual Construction Costs:			\$	28,881
Annual OMR&R Costs:				5,070
Total Average Annual Costs:			\$	33,951

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 25  
Average Annual Costs

Hurricane Protection Levee  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3	0	1.1087	-
2017	-2	0	1.0712	-
2018	-1	0	1.0350	-
2019	0	0	1.0000	-
2020	1	50	0.9662	48
2021	2	1558	0.9335	1,454
2022	3	1558	0.9019	1,405
2023	4	3377	0.8714	2,943
2024	5	1558	0.8420	1,311
2025	6	2737	0.8135	2,226
2026	7	3567	0.7860	2,803
2027	8	1890	0.7594	1,436
2028	9	1558	0.7337	1,143
2029	10	4377	0.7089	3,103
2030	11	4723	0.6849	3,235
2031	12	1964	0.6618	1,300
2032	13	3409	0.6394	2,180
2033	14	2474	0.6178	1,528
2034	15	1558	0.5969	930
2035	16	4857	0.5767	2,801
2036	17	1737	0.5572	968
2037	18	2474	0.5384	1,332
2038	19	3377	0.5202	1,757
2039	20	2037	0.5026	1,024
2040	21	5146	0.4856	2,499
2041	22	4389	0.4692	2,059
2042	23	1599	0.4533	725
2043	24	1858	0.4380	814
2044	25	3377	0.4231	1,429
2045	26	33213	0.4088	13,579
2046	27	1653	0.3950	653
2047	28	3719	0.3817	1,420
2048	29	1558	0.3687	574
2049	30	2474	0.3563	881
2050	31	36781	0.3442	12,661
2051	32	1954	0.3326	650
2052	33	1599	0.3213	514
2053	34	4293	0.3105	1,333
2054	35	1558	0.3000	467
2055	36	10038	0.2898	2,909
2056	37	12833	0.2800	3,594
2057	38	2389	0.2706	646
2058	39	1685	0.2614	440
2059	40	3843	0.2526	971
2060	41	5146	0.2440	1,256
2061	42	2457	0.2358	579
2062	43	3532	0.2278	805
2063	44	1858	0.2201	409
2064	45	1558	0.2127	331
2065	46	5345	0.2055	1,098
2066	47	1667	0.1985	331
2067	48	2043	0.1918	392
2068	49	3377	0.1853	626
2069	50	72782	0.1791	13,032
Total:		286,561		102,603
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 4,374

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 26  
Average Annual Costs

Berm 1  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0		1.0000	-
2020	1	64	0.9662	62
2021	2	64	0.9335	60
2022	3	221	0.9019	199
2023	4	64	0.8714	56
2024	5	147	0.8420	124
2025	6	221	0.8135	180
2026	7	64	0.7860	50
2027	8	64	0.7594	49
2028	9	221	0.7337	162
2029	10	264	0.7089	187
2030	11	64	0.6849	44
2031	12	221	0.6618	146
2032	13	64	0.6394	41
2033	14	64	0.6178	40
2034	15	305	0.5969	182
2035	16	64	0.5767	37
2036	17	64	0.5572	36
2037	18	221	0.5384	119
2038	19	64	0.5202	33
2039	20	288	0.5026	145
2040	21	221	0.4856	107
2041	22	64	0.4692	30
2042	23	64	0.4533	29
2043	24	221	0.4380	97
2044	25	320	0.4231	135
2045	26	64	0.4088	26
2046	27	221	0.3950	87
2047	28	64	0.3817	24
2048	29	64	0.3687	24
2049	30	2579	0.3563	919
2050	31	64	0.3442	22
2051	32	64	0.3326	21
2052	33	221	0.3213	71
2053	34	64	0.3105	20
2054	35	1827	0.3000	548
2055	36	221	0.2898	64
2056	37	64	0.2800	18
2057	38	64	0.2706	17
2058	39	221	0.2614	58
2059	40	288	0.2526	73
2060	41	64	0.2440	16
2061	42	221	0.2358	52
2062	43	64	0.2278	15
2063	44	64	0.2201	14
2064	45	305	0.2127	65
2065	46	64	0.2055	13
2066	47	64	0.1985	13
2067	48	221	0.1918	42
2068	49	64	0.1853	12
2069	50	3567	0.1791	639
Total:		14,491		5,222
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 223

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 27  
Average Annual Costs

Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0		1.0000	-
2020	1	80	0.9662	77
2021	2	80	0.9335	75
2022	3	277	0.9019	250
2023	4	80	0.8714	70
2024	5	184	0.8420	155
2025	6	277	0.8135	225
2026	7	80	0.7860	63
2027	8	80	0.7594	61
2028	9	277	0.7337	203
2029	10	330	0.7089	234
2030	11	80	0.6849	55
2031	12	277	0.6618	183
2032	13	80	0.6394	51
2033	14	80	0.6178	49
2034	15	381	0.5969	227
2035	16	80	0.5767	46
2036	17	80	0.5572	45
2037	18	277	0.5384	149
2038	19	80	0.5202	42
2039	20	359	0.5026	180
2040	21	277	0.4856	135
2041	22	80	0.4692	38
2042	23	80	0.4533	36
2043	24	277	0.4380	121
2044	25	400	0.4231	169
2045	26	80	0.4088	33
2046	27	277	0.3950	109
2047	28	80	0.3817	31
2048	29	80	0.3687	29
2049	30	3224	0.3563	1,149
2050	31	80	0.3442	28
2051	32	80	0.3326	27
2052	33	277	0.3213	89
2053	34	80	0.3105	25
2054	35	2284	0.3000	685
2055	36	277	0.2898	80
2056	37	80	0.2800	22
2057	38	80	0.2706	22
2058	39	277	0.2614	72
2059	40	359	0.2526	91
2060	41	80	0.2440	20
2061	42	277	0.2358	65
2062	43	80	0.2278	18
2063	44	80	0.2201	18
2064	45	381	0.2127	81
2065	46	80	0.2055	16
2066	47	80	0.1985	16
2067	48	277	0.1918	53
2068	49	80	0.1853	15
2069	50	4459	0.1791	798
Total:		18,122		6,531
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 278

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Note: Berm 2 is an integral component of the recommended plan but is not a justified increment that comprises the NED Plan. Refer to the NED Plan section of the economic appendix.

Table 28  
Average Annual Costs

Berm 3  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0		1.0000	-
2020	1	64	0.9662	62
2021	2	64	0.9335	60
2022	3	221	0.9019	199
2023	4	64	0.8714	56
2024	5	147	0.8420	124
2025	6	221	0.8135	180
2026	7	64	0.7860	50
2027	8	64	0.7594	49
2028	9	221	0.7337	162
2029	10	264	0.7089	187
2030	11	64	0.6849	44
2031	12	221	0.6618	146
2032	13	64	0.6394	41
2033	14	64	0.6178	40
2034	15	305	0.5969	182
2035	16	64	0.5767	37
2036	17	64	0.5572	36
2037	18	221	0.5384	119
2038	19	64	0.5202	33
2039	20	288	0.5026	145
2040	21	221	0.4856	107
2041	22	64	0.4692	30
2042	23	64	0.4533	29
2043	24	221	0.4380	97
2044	25	320	0.4231	135
2045	26	64	0.4088	26
2046	27	221	0.3950	87
2047	28	64	0.3817	24
2048	29	64	0.3687	24
2049	30	2,579	0.3563	919
2050	31	64	0.3442	22
2051	32	64	0.3326	21
2052	33	221	0.3213	71
2053	34	64	0.3105	20
2054	35	1,827	0.3000	548
2055	36	221	0.2898	64
2056	37	64	0.2800	18
2057	38	64	0.2706	17
2058	39	221	0.2614	58
2059	40	288	0.2526	73
2060	41	64	0.2440	16
2061	42	221	0.2358	52
2062	43	64	0.2278	15
2063	44	64	0.2201	14
2064	45	305	0.2127	65
2065	46	64	0.2055	13
2066	47	64	0.1985	13
2067	48	221	0.1918	42
2068	49	64	0.1853	12
2069	50	3,567	0.1791	639
Total:		14,491		5,222
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 223

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 29  
Average Annual Costs

Installation of Flap Gates on Culverts  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0		1.0000	-
2020	1	58	0.9662	56
2021	2	58	0.9335	54
2022	3	203	0.9019	183
2023	4	58	0.8714	51
2024	5	135	0.8420	114
2025	6	203	0.8135	165
2026	7	58	0.7860	46
2027	8	58	0.7594	44
2028	9	203	0.7337	149
2029	10	242	0.7089	172
2030	11	58	0.6849	40
2031	12	203	0.6618	134
2032	13	58	0.6394	37
2033	14	58	0.6178	36
2034	15	280	0.5969	167
2035	16	58	0.5767	33
2036	17	58	0.5572	32
2037	18	203	0.5384	109
2038	19	58	0.5202	30
2039	20	264	0.5026	133
2040	21	203	0.4856	99
2041	22	58	0.4692	27
2042	23	58	0.4533	26
2043	24	203	0.4380	89
2044	25	293	0.4231	124
2045	26	58	0.4088	24
2046	27	203	0.3950	80
2047	28	58	0.3817	22
2048	29	58	0.3687	21
2049	30	2,364	0.3563	842
2050	31	58	0.3442	20
2051	32	58	0.3326	19
2052	33	203	0.3213	65
2053	34	58	0.3105	18
2054	35	1,675	0.3000	502
2055	36	203	0.2898	59
2056	37	58	0.2800	16
2057	38	58	0.2706	16
2058	39	203	0.2614	53
2059	40	264	0.2526	67
2060	41	58	0.2440	14
2061	42	203	0.2358	48
2062	43	58	0.2278	13
2063	44	58	0.2201	13
2064	45	280	0.2127	60
2065	46	58	0.2055	12
2066	47	58	0.1985	12
2067	48	203	0.1918	39
2068	49	58	0.1853	11
2069	50	3,270	0.1791	586
Total:		13,272		4,781
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 204

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 30  
Average Annual Costs

Other Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.1475	-
2016	-3		1.1087	-
2017	-2		1.0712	-
2018	-1		1.0350	-
2019	0		1.0000	-
2020	1	-	0.9662	-
2021	2	-	0.9335	-
2022	3	-	0.9019	-
2023	4	-	0.8714	-
2024	5	-	0.8420	-
2025	6	-	0.8135	-
2026	7	-	0.7860	-
2027	8	-	0.7594	-
2028	9	-	0.7337	-
2029	10	-	0.7089	-
2030	11	-	0.6849	-
2031	12	-	0.6618	-
2032	13	-	0.6394	-
2033	14	-	0.6178	-
2034	15	-	0.5969	-
2035	16	-	0.5767	-
2036	17	-	0.5572	-
2037	18	-	0.5384	-
2038	19	-	0.5202	-
2039	20	-	0.5026	-
2040	21	-	0.4856	-
2041	22	-	0.4692	-
2042	23	-	0.4533	-
2043	24	-	0.4380	-
2044	25	-	0.4231	-
2045	26	-	0.4088	-
2046	27	-	0.3950	-
2047	28	-	0.3817	-
2048	29	-	0.3687	-
2049	30	-	0.3563	-
2050	31	-	0.3442	-
2051	32	-	0.3326	-
2052	33	-	0.3213	-
2053	34	-	0.3105	-
2054	35	-	0.3000	-
2055	36	-	0.2898	-
2056	37	-	0.2800	-
2057	38	-	0.2706	-
2058	39	-	0.2614	-
2059	40	-	0.2526	-
2060	41	-	0.2440	-
2061	42	-	0.2358	-
2062	43	-	0.2278	-
2063	44	-	0.2201	-
2064	45	-	0.2127	-
2065	46	-	0.2055	-
2066	47	-	0.1985	-
2067	48	-	0.1918	-
2068	49	-	0.1853	-
2069	50	-	0.1791	-
Total:		-		-
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ -

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 31 A  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all  
Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	-	1.1475	-
2016	-3	-	1.1087	-
2017	-2	-	1.0712	-
2018	-1	-	1.0350	-
2019	0	-	1.0000	-
2020	1	316	0.9662	305
2021	2	1,824	0.9335	1,702
2022	3	2,480	0.9019	2,236
2023	4	3,643	0.8714	3,175
2024	5	2,171	0.8420	1,828
2025	6	3,659	0.8135	2,976
2026	7	3,833	0.7860	3,012
2027	8	2,156	0.7594	1,638
2028	9	2,480	0.7337	1,819
2029	10	5,477	0.7089	3,883
2030	11	4,989	0.6849	3,417
2031	12	2,886	0.6618	1,910
2032	13	3,675	0.6394	2,350
2033	14	2,740	0.6178	1,693
2034	15	2,829	0.5969	1,688
2035	16	5,123	0.5767	2,954
2036	17	2,003	0.5572	1,116
2037	18	3,396	0.5384	1,828
2038	19	3,643	0.5202	1,895
2039	20	3,236	0.5026	1,626
2040	21	6,068	0.4856	2,947
2041	22	4,655	0.4692	2,184
2042	23	1,865	0.4533	845
2043	24	2,780	0.4380	1,218
2044	25	4,710	0.4231	1,993
2045	26	33,479	0.4088	13,687
2046	27	2,575	0.3950	1,017
2047	28	3,985	0.3817	1,521
2048	29	1,824	0.3687	672
2049	30	13,220	0.3563	4,710
2050	31	37,047	0.3442	12,753
2051	32	2,220	0.3326	738
2052	33	2,521	0.3213	810
2053	34	4,559	0.3105	1,416
2054	35	9,171	0.3000	2,751
2055	36	10,960	0.2898	3,176
2056	37	13,099	0.2800	3,668
2057	38	2,655	0.2706	718
2058	39	2,607	0.2614	681
2059	40	5,042	0.2526	1,273
2060	41	5,412	0.2440	1,321
2061	42	3,379	0.2358	797
2062	43	3,798	0.2278	865
2063	44	2,124	0.2201	468
2064	45	2,829	0.2127	602
2065	46	5,611	0.2055	1,153
2066	47	1,933	0.1985	384
2067	48	2,965	0.1918	569
2068	49	3,643	0.1853	675
2069	50	87,645	0.1791	15,693
Total:		346,937		124,358
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 5,302

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 31 B  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all  
Localized Storm Surge Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	-	1.1475	-
2016	-3	-	1.1087	-
2017	-2	-	1.0712	-
2018	-1	-	1.0350	-
2019	0	-	1.0000	-
2020	1	236	0.9662	228
2021	2	1,744	0.9335	1,628
2022	3	2,203	0.9019	1,987
2023	4	3,563	0.8714	3,105
2024	5	1,987	0.8420	1,673
2025	6	3,382	0.8135	2,751
2026	7	3,753	0.7860	2,950
2027	8	2,076	0.7594	1,577
2028	9	2,203	0.7337	1,616
2029	10	5,147	0.7089	3,649
2030	11	4,909	0.6849	3,363
2031	12	2,609	0.6618	1,727
2032	13	3,595	0.6394	2,299
2033	14	2,660	0.6178	1,643
2034	15	2,448	0.5969	1,461
2035	16	5,043	0.5767	2,908
2036	17	1,923	0.5572	1,072
2037	18	3,119	0.5384	1,679
2038	19	3,563	0.5202	1,853
2039	20	2,877	0.5026	1,446
2040	21	5,791	0.4856	2,812
2041	22	4,575	0.4692	2,146
2042	23	1,785	0.4533	809
2043	24	2,503	0.4380	1,096
2044	25	4,310	0.4231	1,824
2045	26	33,399	0.4088	13,655
2046	27	2,298	0.3950	908
2047	28	3,905	0.3817	1,491
2048	29	1,744	0.3687	643
2049	30	9,996	0.3563	3,561
2050	31	36,967	0.3442	12,725
2051	32	2,140	0.3326	712
2052	33	2,244	0.3213	721
2053	34	4,479	0.3105	1,391
2054	35	6,887	0.3000	2,066
2055	36	10,683	0.2898	3,096
2056	37	13,019	0.2800	3,646
2057	38	2,575	0.2706	697
2058	39	2,330	0.2614	609
2059	40	4,683	0.2526	1,183
2060	41	5,332	0.2440	1,301
2061	42	3,102	0.2358	731
2062	43	3,718	0.2278	847
2063	44	2,044	0.2201	450
2064	45	2,448	0.2127	521
2065	46	5,531	0.2055	1,137
2066	47	1,853	0.1985	368
2067	48	2,688	0.1918	516
2068	49	3,563	0.1853	660
2069	50	83,186	0.1791	14,895
Total:		328,815		117,827
FY 2014 Federal Discount Rate:			3.50%	
Amortization Factor:			0.04263	
Average Annual OMRR&R Costs:				\$ 5,023

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 31 C  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized  
Storm Surge Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	-	1.1420	-
2016	-3	-	1.1047	-
2017	-2	-	1.0686	-
2018	-1	-	1.0338	-
2019	0	-	1.0000	-
2020	1	236	0.9674	228
2021	2	1,744	0.9358	1,632
2022	3	2,203	0.9052	1,994
2023	4	3,563	0.8757	3,120
2024	5	1,987	0.8471	1,683
2025	6	3,382	0.8194	2,771
2026	7	3,753	0.7927	2,975
2027	8	2,076	0.7668	1,592
2028	9	2,203	0.7418	1,634
2029	10	5,147	0.7175	3,693
2030	11	4,909	0.6941	3,408
2031	12	2,609	0.6715	1,752
2032	13	3,595	0.6495	2,335
2033	14	2,660	0.6283	1,671
2034	15	2,448	0.6078	1,488
2035	16	5,043	0.5880	2,965
2036	17	1,923	0.5688	1,094
2037	18	3,119	0.5502	1,716
2038	19	3,563	0.5322	1,896
2039	20	2,877	0.5149	1,481
2040	21	5,791	0.4981	2,884
2041	22	4,575	0.4818	2,204
2042	23	1,785	0.4661	832
2043	24	2,503	0.4508	1,129
2044	25	4,310	0.4361	1,880
2045	26	33,399	0.4219	14,091
2046	27	2,298	0.4081	938
2047	28	3,905	0.3948	1,542
2048	29	1,744	0.3819	666
2049	30	9,996	0.3694	3,693
2050	31	36,967	0.3574	13,211
2051	32	2,140	0.3457	740
2052	33	2,244	0.3344	751
2053	34	4,479	0.3235	1,449
2054	35	6,887	0.3129	2,155
2055	36	10,683	0.3027	3,234
2056	37	13,019	0.2928	3,812
2057	38	2,575	0.2833	729
2058	39	2,330	0.2740	638
2059	40	4,683	0.2651	1,241
2060	41	5,332	0.2564	1,367
2061	42	3,102	0.2481	769
2062	43	3,718	0.2400	892
2063	44	2,044	0.2321	475
2064	45	2,448	0.2245	550
2065	46	5,531	0.2172	1,201
2066	47	1,853	0.2101	389
2067	48	2,688	0.2033	546
2068	49	3,563	0.1966	701
2069	50	83,186	0.1902	15,822
Total:		328,815		121,659
FY 2015 Federal Discount Rate:			3.375%	
Amortization Factor:			0.04168	
Average Annual OMRR&R Costs:			\$	5,070

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)



Table 32  
 1% AEP (100-year) Levee Alignment Alternative C  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages 2012 Prices (2020- 2070)	Equiv Annual With-Project Damages 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 177,193	\$ 91,832	\$ 85,361	\$ 87,922
First Costs				\$ 676,598
Interest During Construction				\$ 35,461
Annual Operation & Maintenance Costs				\$ 4,374
Total Annual Costs			\$ 31,160	\$ 32,124
B/C Ratio			2.74	2.74
Equivalent Annual Net Benefits - 2020 Base Year			\$ 54,201	\$ 55,798

Table 33  
 Berm 1  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 2,110	\$ 1,069	\$ 1,042	\$ 1,073
First Costs				\$ 14,280
Interest During Construction				\$ 250
Annual Operation & Maintenance Costs				\$ 223
Total Annual Costs			\$ 817	\$ 842
B/C Ratio			1.28	1.27
Equivalent Annual Net Benefits - 2020 Base Year			\$ 225	\$ 231

Table 34  
 Berm 2  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 905	\$ 683	\$ 222	\$ 229
First Costs				\$ 17,943
Interest During Construction				\$ 314
Annual Operation & Maintenance Costs				\$ 278
Total Annual Costs			\$ 1,025	\$ 1,057
B/C Ratio			0.22	0.22
Equivalent Annual Net Benefits - 2020 Base Year			\$ (803)	\$ (828)

Table 35  
 Berm 3  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 1,419	\$ 491	\$ 928	\$ 956
First Costs				\$ 14,218
Interest During Construction				\$ 249
Annual Operation & Maintenance Costs				\$ 223
Total Annual Costs			\$ 814	\$ 839
B/C Ratio			1.14	1.14
Equivalent Annual Net Benefits - 2020 Base Year			\$ 113	\$ 116

Table 36  
 Installation of Flap Gates on Culverts  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 3,677	\$ 2,590	\$ 1,087	\$ 1,119
First Costs				\$ 5,990
Interest During Construction				\$ 105
Annual Operation & Maintenance Costs				\$ 204
Total Annual Costs			\$ 450	\$ 464
B/C Ratio			2.42	2.41
Equivalent Annual Net Benefits - 2020 Base Year			\$ 637	\$ 656

Table 37  
 Structure Raising outside of Berms and Levee  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 2,411	\$ 187	\$ 2,223	\$ 2,290
First Costs				\$ 7,005
Interest During Construction				\$ -
Annual Operation & Maintenance Costs				\$ -
Total Annual Costs			\$ 290	\$ 299
B/C Ratio			7.68	7.67
Equivalent Annual Net Benefits - 2020 Base Year			\$ 1,934	\$ 1,991

Table 38 A  
 All of the Localized Storm Surge Risk Reduction Measures Outside of Levee Alignment  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 10,521	\$ 5,020	\$ 5,501	\$ 5,666
First Costs				\$ 59,436
Interest During Construction				\$ 918
Annual Operation & Maintenance Costs				\$ 928
Total Annual Costs			\$ 3,396	\$ 3,501
B/C Ratio			1.62	1.62
Equivalent Annual Net Benefits - 2020 Base Year			\$ 2,106	\$ 2,166

Note: Localized Storm Surge Risk Reduction measures outside of the levee alignment include the earthen berms, installation of flap gates on culverts and other localized Storm Surge Risk Reduction measures including structure raising and flood proofing.

Table 38 B  
 All of the Localized Storm Surge Risk Reduction Measures Outside of Levee Alignment Excluding Berm 2  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 9,617	\$ 4,337	\$ 5,279	\$ 5,438
First Costs				\$ 41,493
Interest During Construction				\$ 604
Annual Operation & Maintenance Costs				\$ 649
Total Annual Costs			\$ 2,370	\$ 2,444
B/C Ratio			2.23	2.23
Equivalent Annual Net Benefits - 2020 Base Year			\$ 2,909	\$ 2,994

Note: Localized Storm Surge Risk Reduction measures outside of the levee alignment include the earthen berms, installation of flap gates on culverts and other localized Storm Surge Risk Reduction measures including structure raising and flood proofing.

Table 39 A  
 1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures  
 Summation of Separate HEC-FDA Model Executions  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 187,714	\$ 96,852	\$ 90,862	\$ 93,588
First Costs				\$ 736,034
Interest During Construction				\$ 36,379
Annual Operation & Maintenance Costs				\$ 5,302
Total Annual Costs			\$ 34,556	\$ 35,625
B/C Ratio			2.63	2.63
Equivalent Annual Net Benefits - 2020 Base Year			\$ 56,306	\$ 57,963

Note: Future Development is not included in St. James Parish

Table 39 B  
 Recommended Plan  
 1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures Excluding Berm 2  
 Summation of Separate HEC-FDA Model Executions  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 186,809	\$ 96,169	\$ 90,640	\$ 93,359
First Costs				\$ 718,091
Interest During Construction				\$ 36,065
Annual Operation & Maintenance Costs				\$ 5,023
Total Annual Costs			\$ 33,531	\$ 34,568
B/C Ratio			2.70	2.70
Equivalent Annual Net Benefits - 2020 Base Year			\$ 57,109	\$ 58,791

Note: Future Development is not included in St. James Parish

Table 39 C  
Recommended Plan  
1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures Excluding Berm 2  
HEC-FDA Model Results for Combined Flood Risk Management System Components  
(2012 and 2014 Price Levels; 3.5% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study  
\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 189,112	\$ 94,738	\$ 94,374	\$ 97,205
First Costs				\$ 718,091
Interest During Construction				\$ 36,065
Annual Operation & Maintenance Costs				\$ 5,023
Total Annual Costs			\$ 33,531	\$ 34,568
B/C Ratio			2.81	2.81
Equivalent Annual Net Benefits - 2020 Base Year			\$ 60,843	\$ 62,637

Note: Future Development is not included in St. James Parish

Table 39 D  
Recommended Plan  
1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures Excluding Berm 2  
HEC-FDA Model Results for Combined Flood Risk Management System Components  
(2012 and 2014 Price Levels; 3.375% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study  
\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 189,785	\$ 94,796	\$ 94,990	\$ 97,840
First Costs				\$ 718,091
Interest During Construction				\$ 34,740
Annual Operation & Maintenance Costs				\$ 5,070
Total Annual Costs			\$ 32,933	\$ 33,951
B/C Ratio			2.88	2.88
Equivalent Annual Net Benefits - 2020 Base Year			\$ 62,057	\$ 63,888

Note: Future Development is not included in St. James Parish

Table 40  
Average Annual Costs

Hurricane Protection Levee  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.3108	76,903
2016	-3	124,713	1.2250	152,779
2017	-2	124,713	1.1449	142,784
2018	-1	124,713	1.0700	133,443
2019	0	124,713	1.0000	124,713
2020	1	-	0.9346	-
2021	2	-	0.8734	-
2022	3	-	0.8163	-
2023	4	-	0.7629	-
2024	5	-	0.7130	-
2025	6	-	0.6663	-
2026	7	7,441	0.6227	4,634
2027	8	7,441	0.5820	4,331
2028	9	-	0.5439	-
2029	10	17,008	0.5083	8,646
2030	11	8,504	0.4751	4,040
2031	12	8,504	0.4440	3,776
2032	13	-	0.4150	-
2033	14	-	0.3878	-
2034	15	-	0.3624	-
2035	16	-	0.3387	-
2036	17	-	0.3166	-
2037	18	-	0.2959	-
2038	19	-	0.2765	-
2039	20	-	0.2584	-
2040	21	-	0.2415	-
2041	22	-	0.2257	-
2042	23	-	0.2109	-
2043	24	-	0.1971	-
2044	25	-	0.1842	-
2045	26	19,284	0.1722	3,321
2046	27	9,642	0.1609	1,552
2047	28	9,642	0.1504	1,450
2048	29	-	0.1406	-
2049	30	-	0.1314	-
2050	31	-	0.1228	-
2051	32	-	0.1147	-
2052	33	-	0.1072	-
2053	34	-	0.1002	-
2054	35	-	0.0937	-
2055	36	-	0.0875	-
2056	37	-	0.0818	-
2057	38	-	0.0765	-
2058	39	-	0.0715	-
2059	40	-	0.0668	-
2060	41	15,807	0.0624	987
2061	42	7,904	0.0583	461
2062	43	7,904	0.0545	431
2063	44	-	0.0509	-
2064	45	-	0.0476	-
2065	46	-	0.0445	-
2066	47	-	0.0416	-
2067	48	-	0.0389	-
2068	49	-	0.0363	-
2069	50	-	0.0339	-
<b>Total:</b>		<b>676,598</b>		<b>664,248</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:			\$	48,131
Annual OMRR&R Costs:				178
Total Average Annual Costs:			\$	48,310

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 41  
Average Annual Costs

Berm 1  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1	7140	1.0700	7,640
2019	0	7140	1.0000	7,140
2020	1	-	0.9346	-
2021	2	-	0.8734	-
2022	3	-	0.8163	-
2023	4	-	0.7629	-
2024	5	-	0.7130	-
2025	6	-	0.6663	-
2026	7	-	0.6227	-
2027	8	-	0.5820	-
2028	9	-	0.5439	-
2029	10	-	0.5083	-
2030	11	-	0.4751	-
2031	12	-	0.4440	-
2032	13	-	0.4150	-
2033	14	-	0.3878	-
2034	15	-	0.3624	-
2035	16	-	0.3387	-
2036	17	-	0.3166	-
2037	18	-	0.2959	-
2038	19	-	0.2765	-
2039	20	-	0.2584	-
2040	21	-	0.2415	-
2041	22	-	0.2257	-
2042	23	-	0.2109	-
2043	24	-	0.1971	-
2044	25	-	0.1842	-
2045	26	-	0.1722	-
2046	27	-	0.1609	-
2047	28	-	0.1504	-
2048	29	-	0.1406	-
2049	30	-	0.1314	-
2050	31	-	0.1228	-
2051	32	-	0.1147	-
2052	33	-	0.1072	-
2053	34	-	0.1002	-
2054	35	-	0.0937	-
2055	36	-	0.0875	-
2056	37	-	0.0818	-
2057	38	-	0.0765	-
2058	39	-	0.0715	-
2059	40	-	0.0668	-
2060	41	-	0.0624	-
2061	42	-	0.0583	-
2062	43	-	0.0545	-
2063	44	-	0.0509	-
2064	45	-	0.0476	-
2065	46	-	0.0445	-
2066	47	-	0.0416	-
2067	48	-	0.0389	-
2068	49	-	0.0363	-
2069	50	-	0.0339	-
<b>Total:</b>		<b>14,280</b>		<b>14,780</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:			\$	1,071
Annual OMRR&R Costs:				163
Total Average Annual Costs:			\$	1,234

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 42  
Average Annual Costs

Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1	8972	1.0700	9,600
2019	0	8972	1.0000	8,972
2020	1		0.9346	-
2021	2		0.8734	-
2022	3		0.8163	-
2023	4		0.7629	-
2024	5		0.7130	-
2025	6		0.6663	-
2026	7		0.6227	-
2027	8		0.5820	-
2028	9		0.5439	-
2029	10		0.5083	-
2030	11		0.4751	-
2031	12		0.4440	-
2032	13		0.4150	-
2033	14		0.3878	-
2034	15		0.3624	-
2035	16		0.3387	-
2036	17		0.3166	-
2037	18		0.2959	-
2038	19		0.2765	-
2039	20		0.2584	-
2040	21		0.2415	-
2041	22		0.2257	-
2042	23		0.2109	-
2043	24		0.1971	-
2044	25		0.1842	-
2045	26		0.1722	-
2046	27		0.1609	-
2047	28		0.1504	-
2048	29		0.1406	-
2049	30		0.1314	-
2050	31		0.1228	-
2051	32		0.1147	-
2052	33		0.1072	-
2053	34		0.1002	-
2054	35		0.0937	-
2055	36		0.0875	-
2056	37		0.0818	-
2057	38		0.0765	-
2058	39		0.0715	-
2059	40		0.0668	-
2060	41		0.0624	-
2061	42		0.0583	-
2062	43		0.0545	-
2063	44		0.0509	-
2064	45		0.0476	-
2065	46		0.0445	-
2066	47		0.0416	-
2067	48		0.0389	-
2068	49		0.0363	-
2069	50		0.0339	-
<b>Total:</b>		<b>17,943</b>		<b>18,571</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:				\$ 1,346
Annual OMRR&R Costs:				223
Total Average Annual Costs:				\$ 1,569

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 43  
Average Annual Costs

Berm 3  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1	7109	1.0700	7,607
2019	0	7109	1.0000	7,109
2020	1		0.9346	-
2021	2		0.8734	-
2022	3		0.8163	-
2023	4		0.7629	-
2024	5		0.7130	-
2025	6		0.6663	-
2026	7		0.6227	-
2027	8		0.5820	-
2028	9		0.5439	-
2029	10		0.5083	-
2030	11		0.4751	-
2031	12		0.4440	-
2032	13		0.4150	-
2033	14		0.3878	-
2034	15		0.3624	-
2035	16		0.3387	-
2036	17		0.3166	-
2037	18		0.2959	-
2038	19		0.2765	-
2039	20		0.2584	-
2040	21		0.2415	-
2041	22		0.2257	-
2042	23		0.2109	-
2043	24		0.1971	-
2044	25		0.1842	-
2045	26		0.1722	-
2046	27		0.1609	-
2047	28		0.1504	-
2048	29		0.1406	-
2049	30		0.1314	-
2050	31		0.1228	-
2051	32		0.1147	-
2052	33		0.1072	-
2053	34		0.1002	-
2054	35		0.0937	-
2055	36		0.0875	-
2056	37		0.0818	-
2057	38		0.0765	-
2058	39		0.0715	-
2059	40		0.0668	-
2060	41		0.0624	-
2061	42		0.0583	-
2062	43		0.0545	-
2063	44		0.0509	-
2064	45		0.0476	-
2065	46		0.0445	-
2066	47		0.0416	-
2067	48		0.0389	-
2068	49		0.0363	-
2069	50		0.0339	-
<b>Total:</b>		<b>14,218</b>		<b>14,716</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:				\$ 1,066
Annual OMRR&R Costs:				178
Total Average Annual Costs:				\$ 1,245

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)



Table 44  
Average Annual Costs

Installation of Flap Gates on Culverts  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1	2995	1.0700	3,204
2019	0	2995	1.0000	2,995
2020	1		0.9346	-
2021	2		0.8734	-
2022	3		0.8163	-
2023	4		0.7629	-
2024	5		0.7130	-
2025	6		0.6663	-
2026	7		0.6227	-
2027	8		0.5820	-
2028	9		0.5439	-
2029	10		0.5083	-
2030	11		0.4751	-
2031	12		0.4440	-
2032	13		0.4150	-
2033	14		0.3878	-
2034	15		0.3624	-
2035	16		0.3387	-
2036	17		0.3166	-
2037	18		0.2959	-
2038	19		0.2765	-
2039	20		0.2584	-
2040	21		0.2415	-
2041	22		0.2257	-
2042	23		0.2109	-
2043	24		0.1971	-
2044	25		0.1842	-
2045	26		0.1722	-
2046	27		0.1609	-
2047	28		0.1504	-
2048	29		0.1406	-
2049	30		0.1314	-
2050	31		0.1228	-
2051	32		0.1147	-
2052	33		0.1072	-
2053	34		0.1002	-
2054	35		0.0937	-
2055	36		0.0875	-
2056	37		0.0818	-
2057	38		0.0765	-
2058	39		0.0715	-
2059	40		0.0668	-
2060	41		0.0624	-
2061	42		0.0583	-
2062	43		0.0545	-
2063	44		0.0509	-
2064	45		0.0476	-
2065	46		0.0445	-
2066	47		0.0416	-
2067	48		0.0389	-
2068	49		0.0363	-
2069	50		0.0339	-
Total:		5,990		6,199
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:			\$	449
Annual OMRR&R Costs:				163
Total Average Annual Costs:			\$	613

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 45  
Average Annual Costs

Other Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0	7005	1.0000	7,005
2020	1		0.9346	-
2021	2		0.8734	-
2022	3		0.8163	-
2023	4		0.7629	-
2024	5		0.7130	-
2025	6		0.6663	-
2026	7		0.6227	-
2027	8		0.5820	-
2028	9		0.5439	-
2029	10		0.5083	-
2030	11		0.4751	-
2031	12		0.4440	-
2032	13		0.4150	-
2033	14		0.3878	-
2034	15		0.3624	-
2035	16		0.3387	-
2036	17		0.3166	-
2037	18		0.2959	-
2038	19		0.2765	-
2039	20		0.2584	-
2040	21		0.2415	-
2041	22		0.2257	-
2042	23		0.2109	-
2043	24		0.1971	-
2044	25		0.1842	-
2045	26		0.1722	-
2046	27		0.1609	-
2047	28		0.1504	-
2048	29		0.1406	-
2049	30		0.1314	-
2050	31		0.1228	-
2051	32		0.1147	-
2052	33		0.1072	-
2053	34		0.1002	-
2054	35		0.0937	-
2055	36		0.0875	-
2056	37		0.0818	-
2057	38		0.0765	-
2058	39		0.0715	-
2059	40		0.0668	-
2060	41		0.0624	-
2061	42		0.0583	-
2062	43		0.0545	-
2063	44		0.0509	-
2064	45		0.0476	-
2065	46		0.0445	-
2066	47		0.0416	-
2067	48		0.0389	-
2068	49		0.0363	-
2069	50		0.0339	-
Total:		7,005		7,005
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:			\$	508
Annual OMRR&R Costs:				0
Total Average Annual Costs:			\$	508

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 46 A  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized  
Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.3108	76,903
2016	-3	124,713	1.2250	152,779
2017	-2	124,713	1.1449	142,784
2018	-1	150,928	1.0700	161,493
2019	0	157,933	1.0000	157,933
2020	1	-	0.9346	-
2021	2	-	0.8734	-
2022	3	-	0.8163	-
2023	4	-	0.7629	-
2024	5	-	0.7130	-
2025	6	-	0.6663	-
2026	7	7,441	0.6227	4,634
2027	8	7,441	0.5820	4,331
2028	9	-	0.5439	-
2029	10	17,008	0.5083	8,646
2030	11	8,504	0.4751	4,040
2031	12	8,504	0.4440	3,776
2032	13	-	0.4150	-
2033	14	-	0.3878	-
2034	15	-	0.3624	-
2035	16	-	0.3387	-
2036	17	-	0.3166	-
2037	18	-	0.2959	-
2038	19	-	0.2765	-
2039	20	-	0.2584	-
2040	21	-	0.2415	-
2041	22	-	0.2257	-
2042	23	-	0.2109	-
2043	24	-	0.1971	-
2044	25	-	0.1842	-
2045	26	19,284	0.1722	3,321
2046	27	9,642	0.1609	1,552
2047	28	9,642	0.1504	1,450
2048	29	-	0.1406	-
2049	30	-	0.1314	-
2050	31	-	0.1228	-
2051	32	-	0.1147	-
2052	33	-	0.1072	-
2053	34	-	0.1002	-
2054	35	-	0.0937	-
2055	36	-	0.0875	-
2056	37	-	0.0818	-
2057	38	-	0.0765	-
2058	39	-	0.0715	-
2059	40	-	0.0668	-
2060	41	15,807	0.0624	987
2061	42	7,904	0.0583	461
2062	43	7,904	0.0545	431
2063	44	-	0.0509	-
2064	45	-	0.0476	-
2065	46	-	0.0445	-
2066	47	-	0.0416	-
2067	48	-	0.0389	-
2068	49	-	0.0363	-
2069	50	-	0.0339	-
<b>Total:</b>		<b>736,034</b>		<b>725,519</b>
OMB Discount Rate:			0.0700	
Amortization Factor:			0.07246	
Average Annual Construction Costs:				52,571
Annual OMRR&R Costs:				4,182
Total Average Annual Costs:				56,753

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 46 B  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all Localized  
Storm Surge Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	Construction Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	58,669	1.3108	76,903
2016	-3	124,713	1.2250	152,779
2017	-2	124,713	1.1449	142,784
2018	-1	141,957	1.0700	151,894
2019	0	148,962	1.0000	148,962
2020	1	-	0.9346	-
2021	2	-	0.8734	-
2022	3	-	0.8163	-
2023	4	-	0.7629	-
2024	5	-	0.7130	-
2025	6	-	0.6663	-
2026	7	7,441	0.6227	4,634
2027	8	7,441	0.5820	4,331
2028	9	-	0.5439	-
2029	10	17,008	0.5083	8,646
2030	11	8,504	0.4751	4,040
2031	12	8,504	0.4440	3,776
2032	13	-	0.4150	-
2033	14	-	0.3878	-
2034	15	-	0.3624	-
2035	16	-	0.3387	-
2036	17	-	0.3166	-
2037	18	-	0.2959	-
2038	19	-	0.2765	-
2039	20	-	0.2584	-
2040	21	-	0.2415	-
2041	22	-	0.2257	-
2042	23	-	0.2109	-
2043	24	-	0.1971	-
2044	25	-	0.1842	-
2045	26	19,284	0.1722	3,321
2046	27	9,642	0.1609	1,552
2047	28	9,642	0.1504	1,450
2048	29	-	0.1406	-
2049	30	-	0.1314	-
2050	31	-	0.1228	-
2051	32	-	0.1147	-
2052	33	-	0.1072	-
2053	34	-	0.1002	-
2054	35	-	0.0937	-
2055	36	-	0.0875	-
2056	37	-	0.0818	-
2057	38	-	0.0765	-
2058	39	-	0.0715	-
2059	40	-	0.0668	-
2060	41	15,807	0.0624	987
2061	42	7,904	0.0583	461
2062	43	7,904	0.0545	431
2063	44	-	0.0509	-
2064	45	-	0.0476	-
2065	46	-	0.0445	-
2066	47	-	0.0416	-
2067	48	-	0.0389	-
2068	49	-	0.0363	-
2069	50	-	0.0339	-
<b>Total:</b>		<b>718,091</b>		<b>706,947</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual Construction Costs:				\$ 51,225
Annual OMRR&R Costs:				3,959
Total Average Annual Costs:				\$ 55,184

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 47  
Average Annual Costs

Hurricane Protection Levee  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3	0	1.2250	-
2017	-2	0	1.1449	-
2018	-1	0	1.0700	-
2019	0	0	1.0000	-
2020	1	50	0.9346	47
2021	2	1558	0.8734	1,360
2022	3	1558	0.8163	1,271
2023	4	3377	0.7629	2,576
2024	5	1558	0.7130	1,111
2025	6	2737	0.6663	1,824
2026	7	3567	0.6227	2,221
2027	8	1890	0.5820	1,100
2028	9	1558	0.5439	847
2029	10	4377	0.5083	2,225
2030	11	4723	0.4751	2,244
2031	12	1964	0.4440	872
2032	13	3409	0.4150	1,415
2033	14	2474	0.3878	959
2034	15	1558	0.3624	565
2035	16	4857	0.3387	1,645
2036	17	1737	0.3166	550
2037	18	2474	0.2959	732
2038	19	3377	0.2765	934
2039	20	2037	0.2584	526
2040	21	5146	0.2415	1,243
2041	22	4389	0.2257	991
2042	23	1599	0.2109	337
2043	24	1858	0.1971	366
2044	25	3377	0.1842	622
2045	26	33213	0.1722	5,719
2046	27	1653	0.1609	266
2047	28	3719	0.1504	559
2048	29	1558	0.1406	219
2049	30	2474	0.1314	325
2050	31	36781	0.1228	4,516
2051	32	1954	0.1147	224
2052	33	1599	0.1072	171
2053	34	4293	0.1002	430
2054	35	1558	0.0937	146
2055	36	10038	0.0875	879
2056	37	12833	0.0818	1,050
2057	38	2389	0.0765	183
2058	39	1685	0.0715	120
2059	40	3843	0.0668	257
2060	41	5146	0.0624	321
2061	42	2457	0.0583	143
2062	43	3532	0.0545	193
2063	44	1858	0.0509	95
2064	45	1558	0.0476	74
2065	46	5345	0.0445	238
2066	47	1667	0.0416	69
2067	48	2043	0.0389	79
2068	49	3377	0.0363	123
2069	50	72782	0.0339	2,471
Total:		286,561		47,454
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:			\$	3,439

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 48  
Average Annual Costs

Berm 1  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0		1.0000	-
2020	1	64	0.9346	60
2021	2	64	0.8734	56
2022	3	221	0.8163	180
2023	4	64	0.7629	49
2024	5	147	0.7130	105
2025	6	221	0.6663	147
2026	7	64	0.6227	40
2027	8	64	0.5820	37
2028	9	221	0.5439	120
2029	10	264	0.5083	134
2030	11	64	0.4751	30
2031	12	221	0.4440	98
2032	13	64	0.4150	27
2033	14	64	0.3878	25
2034	15	305	0.3624	111
2035	16	64	0.3387	22
2036	17	64	0.3166	20
2037	18	221	0.2959	65
2038	19	64	0.2765	18
2039	20	288	0.2584	74
2040	21	221	0.2415	53
2041	22	64	0.2257	14
2042	23	64	0.2109	14
2043	24	221	0.1971	44
2044	25	320	0.1842	59
2045	26	64	0.1722	11
2046	27	221	0.1609	36
2047	28	64	0.1504	10
2048	29	64	0.1406	9
2049	30	2579	0.1314	339
2050	31	64	0.1228	8
2051	32	64	0.1147	7
2052	33	221	0.1072	24
2053	34	64	0.1002	6
2054	35	1827	0.0937	171
2055	36	221	0.0875	19
2056	37	64	0.0818	5
2057	38	64	0.0765	5
2058	39	221	0.0715	16
2059	40	288	0.0668	19
2060	41	64	0.0624	4
2061	42	221	0.0583	13
2062	43	64	0.0545	3
2063	44	64	0.0509	3
2064	45	305	0.0476	15
2065	46	64	0.0445	3
2066	47	64	0.0416	3
2067	48	221	0.0389	9
2068	49	64	0.0363	2
2069	50	3567	0.0339	121
Total:		14,491		2,463
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:			\$	178

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 49  
Average Annual Costs

Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0		1.0000	-
2020	1	80	0.9346	75
2021	2	80	0.8734	70
2022	3	277	0.8163	226
2023	4	80	0.7629	61
2024	5	184	0.7130	131
2025	6	277	0.6663	185
2026	7	80	0.6227	50
2027	8	80	0.5820	47
2028	9	277	0.5439	151
2029	10	330	0.5083	168
2030	11	80	0.4751	38
2031	12	277	0.4440	123
2032	13	80	0.4150	33
2033	14	80	0.3878	31
2034	15	381	0.3624	138
2035	16	80	0.3387	27
2036	17	80	0.3166	25
2037	18	277	0.2959	82
2038	19	80	0.2765	22
2039	20	359	0.2584	93
2040	21	277	0.2415	67
2041	22	80	0.2257	18
2042	23	80	0.2109	17
2043	24	277	0.1971	55
2044	25	400	0.1842	74
2045	26	80	0.1722	14
2046	27	277	0.1609	45
2047	28	80	0.1504	12
2048	29	80	0.1406	11
2049	30	3224	0.1314	424
2050	31	80	0.1228	10
2051	32	80	0.1147	9
2052	33	277	0.1072	30
2053	34	80	0.1002	8
2054	35	2284	0.0937	214
2055	36	277	0.0875	24
2056	37	80	0.0818	7
2057	38	80	0.0765	6
2058	39	277	0.0715	20
2059	40	359	0.0668	24
2060	41	80	0.0624	5
2061	42	277	0.0583	16
2062	43	80	0.0545	4
2063	44	80	0.0509	4
2064	45	381	0.0476	18
2065	46	80	0.0445	4
2066	47	80	0.0416	3
2067	48	277	0.0389	11
2068	49	80	0.0363	3
2069	50	4459	0.0339	151
Total:		18,122		3,081
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:			\$	223

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 50  
Average Annual Costs

Berm 3  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0		1.0000	-
2020	1	64	0.9346	60
2021	2	64	0.8734	56
2022	3	221	0.8163	180
2023	4	64	0.7629	49
2024	5	147	0.7130	105
2025	6	221	0.6663	147
2026	7	64	0.6227	40
2027	8	64	0.5820	37
2028	9	221	0.5439	120
2029	10	264	0.5083	134
2030	11	64	0.4751	30
2031	12	221	0.4440	98
2032	13	64	0.4150	27
2033	14	64	0.3878	25
2034	15	305	0.3624	111
2035	16	64	0.3387	22
2036	17	64	0.3166	20
2037	18	221	0.2959	65
2038	19	64	0.2765	18
2039	20	288	0.2584	74
2040	21	221	0.2415	53
2041	22	64	0.2257	14
2042	23	64	0.2109	14
2043	24	221	0.1971	44
2044	25	320	0.1842	59
2045	26	64	0.1722	11
2046	27	221	0.1609	36
2047	28	64	0.1504	10
2048	29	64	0.1406	9
2049	30	2,579	0.1314	339
2050	31	64	0.1228	8
2051	32	64	0.1147	7
2052	33	221	0.1072	24
2053	34	64	0.1002	6
2054	35	1,827	0.0937	171
2055	36	221	0.0875	19
2056	37	64	0.0818	5
2057	38	64	0.0765	5
2058	39	221	0.0715	16
2059	40	288	0.0668	19
2060	41	64	0.0624	4
2061	42	221	0.0583	13
2062	43	64	0.0545	3
2063	44	64	0.0509	3
2064	45	305	0.0476	15
2065	46	64	0.0445	3
2066	47	64	0.0416	3
2067	48	221	0.0389	9
2068	49	64	0.0363	2
2069	50	3,567	0.0339	121
Total:		14,491		2,463
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:			\$	178

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 51  
Average Annual Costs

Installation of Flap Gates on Culverts  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0		1.0000	-
2020	1	58	0.9346	54
2021	2	58	0.8734	51
2022	3	203	0.8163	166
2023	4	58	0.7629	44
2024	5	135	0.7130	96
2025	6	203	0.6663	135
2026	7	58	0.6227	36
2027	8	58	0.5820	34
2028	9	203	0.5439	110
2029	10	242	0.5083	123
2030	11	58	0.4751	28
2031	12	203	0.4440	90
2032	13	58	0.4150	24
2033	14	58	0.3878	22
2034	15	280	0.3624	101
2035	16	58	0.3387	20
2036	17	58	0.3166	18
2037	18	203	0.2959	60
2038	19	58	0.2765	16
2039	20	264	0.2584	68
2040	21	203	0.2415	49
2041	22	58	0.2257	13
2042	23	58	0.2109	12
2043	24	203	0.1971	40
2044	25	293	0.1842	54
2045	26	58	0.1722	10
2046	27	203	0.1609	33
2047	28	58	0.1504	9
2048	29	58	0.1406	8
2049	30	2,364	0.1314	311
2050	31	58	0.1228	7
2051	32	58	0.1147	7
2052	33	203	0.1072	22
2053	34	58	0.1002	6
2054	35	1,675	0.0937	157
2055	36	203	0.0875	18
2056	37	58	0.0818	5
2057	38	58	0.0765	4
2058	39	203	0.0715	15
2059	40	264	0.0668	18
2060	41	58	0.0624	4
2061	42	203	0.0583	12
2062	43	58	0.0545	3
2063	44	58	0.0509	3
2064	45	280	0.0476	13
2065	46	58	0.0445	3
2066	47	58	0.0416	2
2067	48	203	0.0389	8
2068	49	58	0.0363	2
2069	50	3,270	0.0339	111
Total:		13,272		2,254
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:				\$ 163

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 52  
Average Annual Costs

Other Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4		1.3108	-
2016	-3		1.2250	-
2017	-2		1.1449	-
2018	-1		1.0700	-
2019	0		1.0000	-
2020	1	-	0.9346	-
2021	2	-	0.8734	-
2022	3	-	0.8163	-
2023	4	-	0.7629	-
2024	5	-	0.7130	-
2025	6	-	0.6663	-
2026	7	-	0.6227	-
2027	8	-	0.5820	-
2028	9	-	0.5439	-
2029	10	-	0.5083	-
2030	11	-	0.4751	-
2031	12	-	0.4440	-
2032	13	-	0.4150	-
2033	14	-	0.3878	-
2034	15	-	0.3624	-
2035	16	-	0.3387	-
2036	17	-	0.3166	-
2037	18	-	0.2959	-
2038	19	-	0.2765	-
2039	20	-	0.2584	-
2040	21	-	0.2415	-
2041	22	-	0.2257	-
2042	23	-	0.2109	-
2043	24	-	0.1971	-
2044	25	-	0.1842	-
2045	26	-	0.1722	-
2046	27	-	0.1609	-
2047	28	-	0.1504	-
2048	29	-	0.1406	-
2049	30	-	0.1314	-
2050	31	-	0.1228	-
2051	32	-	0.1147	-
2052	33	-	0.1072	-
2053	34	-	0.1002	-
2054	35	-	0.0937	-
2055	36	-	0.0875	-
2056	37	-	0.0818	-
2057	38	-	0.0765	-
2058	39	-	0.0715	-
2059	40	-	0.0668	-
2060	41	-	0.0624	-
2061	42	-	0.0583	-
2062	43	-	0.0545	-
2063	44	-	0.0509	-
2064	45	-	0.0476	-
2065	46	-	0.0445	-
2066	47	-	0.0416	-
2067	48	-	0.0389	-
2068	49	-	0.0363	-
2069	50	-	0.0339	-
Total:		-		-
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:				\$ -

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 53 A  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all  
Localized Storm Surge Risk Reduction Measures  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	-	1.3108	-
2016	-3	-	1.2250	-
2017	-2	-	1.1449	-
2018	-1	-	1.0700	-
2019	0	-	1.0000	-
2020	1	316	0.9346	295
2021	2	1,824	0.8734	1,593
2022	3	2,480	0.8163	2,024
2023	4	3,643	0.7629	2,779
2024	5	2,171	0.7130	1,548
2025	6	3,659	0.6663	2,438
2026	7	3,833	0.6227	2,387
2027	8	2,156	0.5820	1,255
2028	9	2,480	0.5439	1,349
2029	10	5,477	0.5083	2,784
2030	11	4,989	0.4751	2,370
2031	12	2,886	0.4440	1,281
2032	13	3,675	0.4150	1,525
2033	14	2,740	0.3878	1,063
2034	15	2,829	0.3624	1,025
2035	16	5,123	0.3387	1,735
2036	17	2,003	0.3166	634
2037	18	3,396	0.2959	1,005
2038	19	3,643	0.2765	1,007
2039	20	3,236	0.2584	836
2040	21	6,068	0.2415	1,466
2041	22	4,655	0.2257	1,051
2042	23	1,865	0.2109	393
2043	24	2,780	0.1971	548
2044	25	4,710	0.1842	868
2045	26	33,479	0.1722	5,765
2046	27	2,575	0.1609	414
2047	28	3,985	0.1504	599
2048	29	1,824	0.1406	256
2049	30	13,220	0.1314	1,737
2050	31	37,047	0.1228	4,548
2051	32	2,220	0.1147	255
2052	33	2,521	0.1072	270
2053	34	4,559	0.1002	457
2054	35	9,171	0.0937	859
2055	36	10,960	0.0875	959
2056	37	13,099	0.0818	1,072
2057	38	2,655	0.0765	203
2058	39	2,607	0.0715	186
2059	40	5,042	0.0668	337
2060	41	5,412	0.0624	338
2061	42	3,379	0.0583	197
2062	43	3,798	0.0545	207
2063	44	2,124	0.0509	108
2064	45	2,829	0.0476	135
2065	46	5,611	0.0445	250
2066	47	1,933	0.0416	80
2067	48	2,965	0.0389	115
2068	49	3,643	0.0363	132
2069	50	87,645	0.0339	2,975
<b>Total:</b>		<b>346,937</b>		<b>57,716</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:				\$ 4,182

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 53 B  
Average Annual Costs  
1% AEP (100-year) Levee Alignment Alternative C including all  
Localized Storm Surge Risk Reduction Measures Except Berm 2  
West Shore Lake Pontchartrain, La. Feasibility Study

Year	Analysis Year	OMRR&R Costs (\$1000's)	Present Value Factor	Present Value of Costs (\$1000's)
2015	-4	-	1.3108	-
2016	-3	-	1.2250	-
2017	-2	-	1.1449	-
2018	-1	-	1.0700	-
2019	0	-	1.0000	-
2020	1	236	0.9346	221
2021	2	1,744	0.8734	1,523
2022	3	2,203	0.8163	1,798
2023	4	3,563	0.7629	2,718
2024	5	1,987	0.7130	1,416
2025	6	3,382	0.6663	2,253
2026	7	3,753	0.6227	2,337
2027	8	2,076	0.5820	1,208
2028	9	2,203	0.5439	1,198
2029	10	5,147	0.5083	2,617
2030	11	4,909	0.4751	2,332
2031	12	2,609	0.4440	1,158
2032	13	3,595	0.4150	1,492
2033	14	2,660	0.3878	1,032
2034	15	2,448	0.3624	887
2035	16	5,043	0.3387	1,708
2036	17	1,923	0.3166	609
2037	18	3,119	0.2959	923
2038	19	3,563	0.2765	985
2039	20	2,877	0.2584	744
2040	21	5,791	0.2415	1,399
2041	22	4,575	0.2257	1,033
2042	23	1,785	0.2109	377
2043	24	2,503	0.1971	494
2044	25	4,310	0.1842	794
2045	26	33,399	0.1722	5,751
2046	27	2,298	0.1609	370
2047	28	3,905	0.1504	587
2048	29	1,744	0.1406	245
2049	30	9,996	0.1314	1,313
2050	31	36,967	0.1228	4,539
2051	32	2,140	0.1147	246
2052	33	2,244	0.1072	241
2053	34	4,479	0.1002	449
2054	35	6,887	0.0937	645
2055	36	10,683	0.0875	935
2056	37	13,019	0.0818	1,065
2057	38	2,575	0.0765	197
2058	39	2,330	0.0715	166
2059	40	4,683	0.0668	313
2060	41	5,332	0.0624	333
2061	42	3,102	0.0583	181
2062	43	3,718	0.0545	203
2063	44	2,044	0.0509	104
2064	45	2,448	0.0476	117
2065	46	5,531	0.0445	246
2066	47	1,853	0.0416	77
2067	48	2,688	0.0389	104
2068	49	3,563	0.0363	129
2069	50	83,186	0.0339	2,824
<b>Total:</b>		<b>328,815</b>		<b>54,634</b>
OMB Discount Rate:			7.00%	
Amortization Factor:			0.07246	
Average Annual OMRR&R Costs:				\$ 3,959

Note: Costs are in October 2014 Price Levels (Fiscal Year 2015)

Table 54  
 1% AEP (100-year) Levee Alignment Alternative C  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages 2012 Prices (2020- 2070)	Equiv Annual With-Project Damages 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 161,666	\$ 91,108	\$ 70,558	\$ 72,675
First Costs				\$ 676,598
Interest During Construction				\$ 73,101
Annual Operation & Maintenance Costs				\$ 178
Total Annual Costs			\$ 46,860	\$ 48,310
B/C Ratio			1.51	1.50
Equivalent Annual Net Benefits - 2020 Base Year			\$ 23,697	\$ 24,365

Table 55  
 Berm 1  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 1,704	\$ 861	\$ 843	\$ 869
First Costs				\$ 14,280
Interest During Construction				\$ 500
Annual Operation & Maintenance Costs				\$ 178
Total Annual Costs			\$ 1,197	\$ 1,234
B/C Ratio			0.70	0.70
Equivalent Annual Net Benefits - 2020 Base Year			\$ (354)	\$ (366)

Table 56  
 Berm 2  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 725	\$ 546	\$ 179	\$ 184
First Costs				\$ 17,943
Interest During Construction				\$ 628
Annual Operation & Maintenance Costs				\$ 223
Total Annual Costs			\$ 1,522	\$ 1,569
B/C Ratio			0.12	0.12
Equivalent Annual Net Benefits - 2020 Base Year			\$ (1,343)	\$ (1,385)

Table 57  
 Berm 3  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 1,172	\$ 400	\$ 772	\$ 795
First Costs				\$ 14,218
Interest During Construction				\$ 498
Annual Operation & Maintenance Costs				\$ 178
Total Annual Costs			\$ 1,207	\$ 1,245
B/C Ratio			0.64	0.64
Equivalent Annual Net Benefits - 2020 Base Year			\$ (436)	\$ (450)



Table 58  
Installation of Flap Gates on Culverts  
(2012 and 2014 Price Levels; 7% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study  
\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 2,841	\$ 1,952	\$ 889	\$ 915
First Costs				\$ 5,990
Interest During Construction				\$ 210
Annual Operation & Maintenance Costs				\$ 163
Total Annual Costs			\$ 594	\$ 613
B/C Ratio			1.50	1.49
Equivalent Annual Net Benefits - 2020 Base Year			\$ 295	\$ 303

Table 59  
Structure Raising Outside of Berms and Levee  
(2012 and 2014 Price Levels; 7% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study  
\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 1,948	\$ 145	\$ 1,803	\$ 1,857
First Costs				\$ 7,005
Interest During Construction				\$ -
Annual Operation & Maintenance Costs				\$ -
Total Annual Costs			\$ 492	\$ 508
B/C Ratio			3.66	3.66
Equivalent Annual Net Benefits - 2020 Base Year			\$ 1,311	\$ 1,350

Table 60 A  
 All of the Localized Flood Risk Reduction Measures Outside of Levee Alignment  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 8,390	\$ 3,904	\$ 4,486	\$ 4,620
First Costs				\$ 59,436
Interest During Construction				\$ 1,835
Annual Operation & Maintenance Costs				\$ 728
Total Annual Costs			\$ 5,013	\$ 5,168
B/C Ratio			0.89	0.89
Equivalent Annual Net Benefits - 2020 Base Year			\$ (527)	\$ (548)

Note: Localized Flood Risk Reduction Measures outside of the levee alignment include the earthen berms, installation of flap gates on culverts and other localized flood risk reduction measures including structure raising and flood proofing.

Table 60 B  
 All of the Localized Flood Risk Reduction Measures Outside of Levee Alignment Excluding Berm 2  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 7,665	\$ 3,358	\$ 4,307	\$ 4,436
First Costs				\$ 41,493
Interest During Construction				\$ 1,207
Annual Operation & Maintenance Costs				\$ 505
Total Annual Costs			\$ 3,491	\$ 3,599
B/C Ratio			1.23	1.23
Equivalent Annual Net Benefits - 2020 Base Year			\$ 816	\$ 837

Note: Localized Flood Risk Reduction Measures outside of the levee alignment include the earthen berms, installation of flap gates on culverts and other localized flood risk reduction measures including structure raising and flood proofing.

Table 61 A  
 1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures  
 Summation of Separate HEC-FDA Model Executions  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 170,056	\$ 95,012	\$ 75,044	\$ 77,295
First Costs				\$ 736,034
Interest During Construction				\$ 74,936
Annual Operation & Maintenance Costs				\$ 4,182
Total Annual Costs			\$ 55,050	\$ 56,753
B/C Ratio			1.36	1.36
Equivalent Annual Net Benefits - 2020 Base Year			\$ 19,993	\$ 20,542

Note: Future Development is not included in St. James Parish

Table 61 B  
 Recommended Plan  
 1% AEP (100-year) Levee Alignment Alternative C Including All Localized Flood Risk Reduction Measures Excluding Berm 2  
 Summation of Separate HEC-FDA Model Executions  
 (2012 and 2014 Price Levels; 7% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 169,331	\$ 94,466	\$ 74,865	\$ 77,111
First Costs				\$ 718,091
Interest During Construction				\$ 74,308
Annual Operation & Maintenance Costs				\$ 3,959
Total Annual Costs			\$ 53,529	\$ 55,184
B/C Ratio			1.40	1.40
Equivalent Annual Net Benefits - 2020 Base Year			\$ 21,336	\$ 21,927

Note: Future Development is not included in St. James Parish

**Table 61 C**  
**Recommended Plan**  
**1% AEP (100-year) Levee Alignment Alternative C Including All Localized Flood Risk Reduction Measures Excluding Berm 2**  
**HEC-FDA Model Results for Combined Flood Risk Management System Components**  
**(2012 and 2014 Price Levels; 7% Discount Rate)**  
**Total Equivalent Annual Net Benefits**  
**West Shore Lake Pontchartrain, LA Feasibility Study**  
**\$1000s**

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020- 2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 173,332	\$ 93,385	\$ 79,947	\$ 82,346
First Costs				\$ 718,091
Interest During Construction				\$ 74,308
Annual Operation & Maintenance Costs				\$ 3,959
Total Annual Costs			\$ 53,529	\$ 55,184
B/C Ratio			1.49	1.49
Equivalent Annual Net Benefits - 2020 Base Year			\$ 26,419	\$ 27,161

Note: Future Development is not included in St. James Parish

Table 62  
 Westshore Lake Pontchartrain, LA Feasibility Study  
 Regional Economic Development Analysis (RED)  
 Impact Region Profile and Summary of Impacts

County	Area (sq. mi)	Population	Households	Total Personal Income (in millions)
Ascension	303	104,702	37,280	\$3,916
Assumption	365	23,632	8,552	\$799
East Baton Rouge	469	429,211	166,068	\$18,149
East Feliciana	456	21,057	6,827	\$695
Iberville	653	32,987	10,770	\$1,035
Jefferson	496	439,261	169,681	\$19,446
Lafourche	1,177	93,768	33,790	\$3,954
Livingston	703	122,404	43,929	\$3,848
Orleans	349	326,968	124,294	\$15,261
Plaquemines	1,041	27,039	9,364	\$895
Pointe Coupee	591	23,137	8,750	\$784
St Bernard	488	29,365	11,218	\$1,224
St Charles	410	53,810	18,475	\$1,969
St Helena	410	10,582	4,004	\$336
St James	258	22,227	7,460	\$689
St John The Baptist	348	48,996	16,546	\$1,618
St Tammany	1,110	240,775	87,796	\$10,406
Terrebonne	1,480	111,202	38,980	\$4,268
West Baton Rouge	205	23,108	8,375	\$805
West Feliciana	426	15,503	3,846	\$421
<b>Total</b>	<b>11,737</b>	<b>2,199,734</b>	<b>816,005</b>	<b>\$90,517</b>

Table 62  
(Continued)  
Westshore Lake Pontchartrain, LA Feasibility Study  
Regional Economic Development Analysis (RED)  
Impact Region Profile and Summary of Impacts

Impact	Regional	State	National
	<b>Direct Impact</b>		
Output (\$000)	962,423	1,004,928	1,063,136
Labor Years (Jobs)	9,741	10,107	10,846
Income (\$000)	571,651	610,273	639,606
GRP (\$000)	657,907	700,201	732,939
	<b>Secondary Impact</b>		
Output (\$000)	781,556	832,937	1,824,677
Labor Years (Jobs)	6,032	6,516	11,434
Income (\$000)	281,832	296,964	602,444
GRP (\$000)	472,137	498,267	1,039,021
	<b>Total Impact</b>		
Output (\$000)	1,743,979	1,837,865	2,887,813
Labor Years (Jobs)	15,773	16,623	22,280
Income (\$000)	853,483	907,237	1,242,049
GRP (\$000)	1,130,044	1,198,467	1,771,959

Table 63  
 2% AEP (50-year) Levee Alignment Alternative C  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages 2012 Prices (2020- 2070)	Equiv Annual With- Project Damages 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2014 Prices (2020- 2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	190,330.0	122,646.0	67,684.0	\$ 69,715
First Costs				\$ 542,522
Interest During Construction				\$ 28,584
Annual Operation & Maintenance Costs				\$ 2,067
Total Annual Costs			\$ 21,830	\$ 22,505
B/C Ratio			3.10	3.10
Equivalent Annual Net Benefits - 2020 Base Year			\$ 45,854	\$ 47,210

Note: Calculations based on preliminary cost estimates prepared prior to MII Cost and Risk Analysis.

Table 64  
 1% AEP (100-year) Levee Alignment Alternative C  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With- Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2014 Prices (2020- 2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	190,330.0	98,839.0	91,491.0	\$ 94,236
First Costs				\$ 556,971
Interest During Construction				\$ 27,066
Annual Operation & Maintenance Costs				\$ 2,067
Total Annual Costs			\$ 22,488	\$ 23,184
B/C Ratio			4.07	4.06
Equivalent Annual Net Benefits - 2020 Base Year			\$ 69,003	\$ 71,052

Note: Calculations based on preliminary cost estimates prepared prior to MII Cost and Risk Analysis.

Table 65  
 0.5% AEP (200-year) Levee Alignment Alternative C  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With- Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2014 Prices (2020- 2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	190,330.0	82,485.0	107,845.0	\$ 111,080
First Costs				\$ 1,036,405
Interest During Construction				\$ 54,347
Annual Operation & Maintenance Costs				\$ 2,067
Total Annual Costs			\$ 43,380	\$ 44,722
B/C Ratio			2.49	2.48
Equivalent Annual Net Benefits - 2020 Base Year			\$ 64,465	\$ 66,358

Note: Calculations based on preliminary cost estimates prepared prior to MII Cost and Risk Analysis.



Table 66  
 1% AEP (100-year) Levee Alignment Alternative C Without Future Development  
 Sensitivity Analysis  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages 2012 Prices (2020- 2070)	Equiv Annual With-Project Damages 2012 Prices (2020- 2070)	Equiv Annual Benefits 2012 Prices (2020- 2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 94,317	\$ 24,805	\$ 69,511	\$ 72,124
First Costs				\$ 676,598
Interest During Construction				\$ 35,461
Annual Operation & Maintenance Costs				\$ 4,374
Total Annual Costs			\$ 31,160	\$ 32,124
B/C Ratio			2.23	2.25
Equivalent Annual Net Benefits - 2020 Base Year			\$ 38,351	\$ 40,000

Note: Inducements of \$215,110 attributed to the 0.01 AEP Level of Risk Reduction Structural System are included in the analysis.

Table 67  
 1% AEP (100-year) Levee Alignment Alternative C including all Localized Storm Surge Risk Reduction Measures without Future Development  
 Summation of Separate HEC-FDA Model Executions  
 Sensitivity Analysis  
 (2012 and 2014 Price Levels; 3.5% Discount Rate)  
 Total Equivalent Annual Net Benefits  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020- 2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 104,838	\$ 29,825	\$ 75,013	\$ 77,832
First Costs				\$ 736,034
Interest During Construction				\$ 36,379
Annual Operation & Maintenance Costs				\$ 5,302
Total Annual Costs			\$ 34,556	\$ 35,625
B/C Ratio			2.17	2.18
Equivalent Annual Net Benefits - 2020 Base Year			\$ 40,457	\$ 42,207

**Table 68**  
**1% AEP (100-year) Levee Alignment Alternative C Without Future Development**  
**Summation of Separate HEC-FDA Model Executions**  
**Sensitivity Analysis**  
**(2012 and 2014 Price Levels; 7% Discount Rate)**  
**Total Equivalent Annual Net Benefits**  
**West Shore Lake Pontchartrain, LA Feasibility Study**  
**\$1000s**

Item	Equiv Annual W/O Project Damages 2012 Prices (2020- 2070)	Equiv Annual With-Project Damages 2012 Prices (2020- 2070)	Equiv Annual Benefits 2012 Prices (2020- 2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 83,919	\$ 25,202	\$ 58,717	\$ 60,924
First Costs				\$ 676,598
Interest During Construction				\$ 73,101
Annual Operation & Maintenance Costs				\$ 178
Total Annual Costs			\$ 46,860	\$ 48,310
B/C Ratio			1.25	1.26
Equivalent Annual Net Benefits - 2020 Base Year			\$ 11,857	\$ 12,614

**Table 69 A**  
**1% AEP (100-year) Levee Alignment Alternative C including all Localized Storm Surge Risk Reduction Measures without Future Development**  
**Summation of Separate HEC-FDA Model Executions**  
**Sensitivity Analysis**  
**(2012 and 2014 Price Levels; 7% Discount Rate)**  
**Total Equivalent Annual Net Benefits**  
**West Shore Lake Pontchartrain, LA Feasibility Study**  
**\$1000s**

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020- 2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 92,309	\$ 29,106	\$ 63,203	\$ 65,578
First Costs				\$ 736,034
Interest During Construction				\$ 74,936
Annual Operation & Maintenance Costs				\$ 4,182
Total Annual Costs			\$ 55,050	\$ 56,753
B/C Ratio			1.15	1.16
Equivalent Annual Net Benefits - 2020 Base Year			\$ 8,153	\$ 8,825

Table 69 B  
Recommended Plan Without Future Development  
Summation of Separate HEC-FDA Model Executions  
Sensitivity Analysis  
(2012 and 2014 Price Levels; 3.5% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study

\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 103,933	\$ 29,143	\$ 74,790	\$ 77,601
First Costs				\$ 718,091
Interest During Construction				\$ 36,065
Annual Operation & Maintenance Costs				\$ 5,023
Total Annual Costs			\$ 33,531	\$ 34,568
B/C Ratio			2.23	2.24
Equivalent Annual Net Benefits - 2020 Base Year			\$ 41,260	\$ 43,033

Note: Includes structural alignment and localized Storm Surge Risk Reduction measures excluding Berm 2.

Table 69 C  
Recommended Plan Without Future Development  
Summation of Separate HEC-FDA Model Executions  
Sensitivity Analysis  
(2012 and 2014 Price Levels; 7% Discount Rate)  
Total Equivalent Annual Net Benefits  
West Shore Lake Pontchartrain, LA Feasibility Study

\$1000s

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 91,584	\$ 28,560	\$ 63,024	\$ 65,393
First Costs				\$ 718,091
Interest During Construction				\$ 74,308
Annual Operation & Maintenance Costs				\$ 3,959
Total Annual Costs			\$ 53,529	\$ 55,184
B/C Ratio			1.18	1.18
Equivalent Annual Net Benefits - 2020 Base Year			\$ 9,496	\$ 10,208

Note: Includes structural alignment and localized Storm Surge Risk Reduction measures excluding Berm 2.

**Table 69 D**  
**Recommended Plan**  
**1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures Excluding Berm 2**  
**HEC-FDA Model Results for Combined Flood Risk Management System Components**  
**Sensitivity Analysis**  
**(2012 and 2014 Price Levels; 3.5% Discount Rate)**  
**Total Equivalent Annual Net Benefits**  
**West Shore Lake Pontchartrain, LA Feasibility Study**  
**\$1000s**

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 112,169	\$ 30,584	\$ 81,584	\$ 84,032
First Costs				\$ 718,091
Interest During Construction				\$ 36,065
Annual Operation & Maintenance Costs				\$ 5,023
Total Annual Costs			\$ 33,531	\$ 34,568
B/C Ratio			2.43	2.43
Equivalent Annual Net Benefits - 2020 Base Year			\$ 48,053	\$ 49,464

**Table 69 E**  
**Recommended Plan**  
**1% AEP (100-year) Levee Alignment Alternative C Including All Localized Storm Surge Risk Reduction Measures Excluding Berm 2**  
**HEC-FDA Model Results for Combined Flood Risk Management System Components**  
**Sensitivity Analysis**  
**(2012 and 2014 Price Levels; 7% Discount Rate)**  
**Total Equivalent Annual Net Benefits**  
**West Shore Lake Pontchartrain, LA Feasibility Study**  
**\$1000s**

Item	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits and Costs 2012 Prices (2020-2070)	Equiv Annual Benefits and Costs 2014 Prices (2020-2070)
Damage Category				
Residential & Commercial - Structure/Content/Vehicles	\$ 99,793	\$ 29,517	\$ 70,276	\$ 72,385
First Costs				\$ 718,091
Interest During Construction				\$ 74,308
Annual Operation & Maintenance Costs				\$ 3,959
Total Annual Costs			\$ 53,529	\$ 55,184
B/C Ratio			1.31	1.31
Equivalent Annual Net Benefits - 2020 Base Year			\$ 16,748	\$ 17,201

West Shore Lake Pontchartrain  
Sea Level Rise Sensitivity Analysis  
Table 70

Alternative C - Levee Alignment

	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020-2070)	Annual Costs	B/C Ratio	Net Benefits
Calculations based on with and without intermediate sea level rise including future development as of 2014.	\$ 190,330	\$ 105,399	\$ 84,931	\$ 87,479	\$ 23,184	3.77	\$ 64,295
Estimate of low sea level rise benefits based on percent change from draft report. Preliminary costs are based on providing a 50 year level or risk reduction.	\$ 151,057	\$ 83,651	\$ 67,406	\$ 69,428	\$ 22,505	3.09	\$ 46,923
Estimate of high sea level rise benefits based on percent change from previous analysis . Preliminary costs are based on providing a 200 year level or risk reduction.	\$ 348,448	\$ 192,961	\$ 155,487	\$ 160,152	\$ 44,722	3.58	\$ 115,430

Note: Calculations based on preliminary cost estimates prepared prior to MII Cost and Risk Analysis.

West Shore Lake Pontchartrain  
Sea Level Rise Sensitivity Analysis

Table 71

Alternative C - Levee Alignment - Without Future Development

	Equiv Annual W/O Project Damages (2020-2070)	Equiv Annual With-Project Damages (2020-2070)	Equiv Annual Benefits 2012 Prices (2020-2070)	Equiv Annual Benefits 2014 Prices (2020-2070)	Annual Costs	B/C Ratio	Net Benefits
Calculations based with and without intermediate sea level rise without future development as of 2014.	\$ 104,663	\$ 35,437	\$ 69,226	\$ 71,303	\$ 23,184	3.08	\$ 48,119
Estimate of low sea level rise benefits based on percent change from draft report. Preliminary costs are based on providing a 50 year level or risk reduction.	\$ 83,067	\$ 28,125	\$ 54,942	\$ 56,590	\$ 22,505	2.51	\$ 34,085
Estimate of high sea level rise benefits based on percent change from previous analysis . Preliminary costs are based on providing a 200 year level or risk reduction.	\$ 191,612	\$ 64,877	\$ 126,736	\$ 130,538	\$ 44,722	2.92	\$ 85,816

Note: Calculations based on preliminary cost estimates prepared prior to MII Cost and Risk Analysis.

Table 72  
 Risk Analysis  
 Probability that Equivalent Annual Benefits Exceed Annual Costs  
 (2014 Price Level; 3.5% Discount Rate)  
 West Shore Lake Pontchartrain, LA Feasibility Study  
 \$1000s

Component	Equivalent Annual Damages Reduced (2014 prices)	Probability Damage Reduced Exceeds Indicated Values (2014 price levels)			Annual Costs (2014 price levels)	Probability Benefits Exceed Costs
		0.75	0.50	0.25		
0.01 AEP (100-year) Level of Risk Reduction						
Structural System	87,922	61,436	84,331	110,252	32,124	Greater than 75 percent
Berm 1	1,073	524	981	1,567	842	Between 50 and 75 percent
Berm 2	229	108	209	348	1,057	Less than a 75 percent
Berm 3	956	267	762	1,477	839	Between 25 and 50 percent
Installation of Flapgates on Culverts	1,119	834	1,107	1,437	464	Greater than 75 percent
Structure Raising outside of Berms and Levee	2,290	1,017	2,028	3,290	299	Greater than 75 percent
Reduction Measures	93,588	69,516	93,923	121,604	35,625	Greater than 75 percent
Recommended Plan which excluding Berm 2	93,359	69,409	93,714	121,257	34,568	Greater than 75 percent





Table 73 cont.  
Levee Alignment C  
With Project  
2020

Study Area Reach	Target Stage	Geo Tech	Target Stage Annual Exceedance		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events						
			Median	Expected	10	30	50	0.10	0.04	0.02	0.01	0.004	0.002	
SA 1	5.480		0.8360	0.8345	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 10	4.710		0.0078	0.0080	0.0767	0.2129	0.3290	0.9996	0.9996	0.9996	0.6860	0.1637	0.0496	
SA 11	7.600		0.0403	0.0416	0.3461	0.7204	0.8804	0.9977	0.4958	0.1890	0.0968	0.0452	0.0277	
SA 12	6.510		0.6189	0.6192	0.9999	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 13	5.740		0.0678	0.0687	0.5094	0.8819	0.9716	0.7980	0.2121	0.1191	0.0654	0.0109	0.0024	
SA 14	8.100		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 15	9.370		0.8521	0.8502	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 16	5.340		0.9221	0.9147	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 17	3.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 18	3.550		0.0082	0.0080	0.0769	0.2134	0.3297	0.9997	0.9997	0.9997	0.7405	0.0776	0.0153	
SA 19	4.950		0.0001	0.0001	0.0010	0.0031	0.0052	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 2	5.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 20	3.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 21	4.010		0.1733	0.1718	0.8482	0.9965	0.9999	0.0597	0.0041	0.0000	0.0000	0.0000	0.0000	
SA 22	5.130		0.9821	0.9771	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 23	6.400		0.7989	0.7982	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 24	6.510		0.0583	0.0606	0.4646	0.8466	0.9560	0.8991	0.2452	0.0992	0.0195	0.0035	0.0000	
SA 25	4.080		0.4751	0.4716	0.9983	1.0000	1.0000	0.0059	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 26	4.220		0.0004	0.0011	0.0105	0.0312	0.0514	0.9998	0.9998	0.9998	0.9980	0.9466	0.8295	
SA 27	3.060		0.0070	0.0107	0.1024	0.2768	0.4173	0.9997	0.9788	0.8094	0.6296	0.3306	0.2015	
SA 28X	4.040		0.0007	0.0015	0.0148	0.0438	0.0720	0.9998	0.9998	0.9995	0.9935	0.9017	0.7495	
SA 28Y	3.640		0.0018	0.0032	0.0314	0.0912	0.1473	0.9998	0.9998	0.9898	0.9457	0.7227	0.5232	
SA 29	5.170		0.0001	0.0005	0.0054	0.0160	0.0266	0.9997	0.9997	0.9997	0.9997	0.9994	0.9921	
SA 29C	3.500		0.8639	0.8603	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 3	13.600		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 30	4.170		0.0005	0.0012	0.0118	0.0351	0.0578	0.9998	0.9998	0.9998	0.9964	0.9345	0.8082	
SA 30C	4.290		0.0003	0.0009	0.0093	0.0275	0.0455	0.9998	0.9998	0.9998	0.9988	0.9590	0.8559	
SA 31	5.960		0.0001	0.0002	0.0024	0.0073	0.0121	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 31C	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 32	4.780		0.0003	0.0006	0.0064	0.0191	0.0316	0.9996	0.9996	0.9996	0.9996	0.9892	0.9330	
SA 33	5.460		0.0001	0.0001	0.0010	0.0030	0.0050	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 34	4.770		0.0010	0.0031	0.0304	0.0885	0.1431	0.9998	0.9954	0.9799	0.9273	0.7760	0.6418	
SA 35	4.880		0.0001	0.0004	0.0039	0.0116	0.0192	0.9997	0.9997	0.9997	0.9997	0.9997	0.9987	
SA 36	5.510		0.0001	0.0002	0.0017	0.0052	0.0086	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	
SA 37	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 38	5.320		0.0003	0.0004	0.0036	0.0109	0.0181	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 39	6.560		0.0001	0.0002	0.0022	0.0066	0.0109	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	
SA 39C	8.220		0.0001	0.0002	0.0020	0.0061	0.0102	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	
SA 4	11.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 40P	3.560		0.0022	0.0037	0.0364	0.1051	0.1690	0.9997	0.9997	0.9836	0.9256	0.6769	0.4781	
SA 41	4.560		0.0001	0.0005	0.0051	0.0152	0.0252	0.9998	0.9998	0.9998	0.9998	0.9965	0.9787	
SA 41P	5.030		0.0001	0.0005	0.0050	0.0149	0.0247	0.9998	0.9998	0.9998	0.9998	0.9987	0.9859	
SA 42P	6.140		0.0001	0.0004	0.0043	0.0128	0.0213	0.9998	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 43P	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 44C	1.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 5	11.720		0.7625	0.7615	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 6	12.100		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 7	5.920		0.1958	0.2049	0.8991	0.9990	1.0000	0.0522	0.0035	0.0000	0.0000	0.0000	0.0000	
SA 8	8.020		0.0265	0.0352	0.3014	0.6590	0.8336	0.9458	0.7108	0.3656	0.1323	0.0207	0.0036	
SA 9	4.200		0.2056	0.2130	0.9089	0.9992	1.0000	0.0253	0.0000	0.0000	0.0000	0.0000	0.0000	



Table 73 cont.  
 Localized Storm Surge Risk Reduction Measures  
 With Project  
 2020

Study Area Reach	Target Stage	Geo Tech	Target Stage Annual Exceedance		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events					
			Median	Expected	10	30	50	0.10	0.04	0.02	0.01	0.004	0.002
1	2.980		0.1022	0.1008	0.6544	0.9587	0.9951	0.4795	0.0841	0.0078	0.0028	0.0015	0.0000
10	6.500 L		0.0066	0.0075	0.0724	0.2019	0.3133	0.9998	0.9998	0.9856	0.8288	0.1407	0.0105
11	6.500 L		0.0286	0.0310	0.2700	0.6110	0.7927	0.9899	0.9082	0.1500	0.0322	0.0029	0.0002
12	6.500 L		0.0286	0.0332	0.2866	0.6369	0.8152	0.9900	0.9059	0.1456	0.0286	0.0022	0.0003
13	4.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	4.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	6.500 L		0.0034	0.0035	0.0346	0.1004	0.1616	0.9995	0.9995	0.9995	0.9995	0.6633	0.1600
16	6.500 L		0.0200	0.0247	0.2211	0.5275	0.7133	0.9790	0.8683	0.5006	0.2671	0.0918	0.0335
17	3.200		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	3.360		0.0709	0.0739	0.5359	0.9001	0.9785	0.7666	0.2006	0.0445	0.0112	0.0032	0.0018
20	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	6.500 L		0.0058	0.0066	0.0645	0.1814	0.2837	0.9996	0.9995	0.9856	0.7760	0.3672	0.2144
22	4.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	4.200		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	3.070		0.0938	0.0968	0.6387	0.9529	0.9938	0.5688	0.0916	0.0260	0.0076	0.0023	0.0014
25	6.500 L		0.0200	0.0247	0.2211	0.5275	0.7133	0.9790	0.8683	0.5006	0.2671	0.0918	0.0335
26	6.500 L		0.0200	0.0247	0.2211	0.5275	0.7133	0.9790	0.8683	0.5006	0.2671	0.0918	0.0335
27	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	3.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	3.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	6.500 L		0.0071	0.0078	0.0757	0.2103	0.3254	0.9995	0.9995	0.9849	0.8266	0.1050	0.0095
31	6.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	4.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	3.710		0.0523	0.0519	0.4132	0.7980	0.9304	0.9960	0.3452	0.1357	0.0431	0.0149	0.0098
34	2.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	2.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	6.500 L		0.0058	0.0065	0.0634	0.1783	0.2791	0.9998	0.9996	0.9899	0.7657	0.3831	0.2511
37	6.500 L		0.0071	0.0078	0.0755	0.2098	0.3246	0.9998	0.9998	0.9858	0.8289	0.1017	0.0074
38	4.200		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	6.900 L		0.0022	0.0025	0.0243	0.0712	0.1159	0.9995	0.9995	0.9995	0.9995	0.9201	0.4207
4	4.600		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	6.500 L		0.0034	0.0035	0.0346	0.1004	0.1616	0.9995	0.9995	0.9995	0.9995	0.6633	0.1600
41	2.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	6.500 L		0.0286	0.0330	0.2850	0.6345	0.8132	0.9896	0.9069	0.1502	0.0310	0.0027	0.0002
43	4.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
44	2.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
45	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
46	6.500 L		0.0062	0.0070	0.0678	0.1900	0.2961	0.9998	0.9997	0.9824	0.7271	0.3570	0.2320
47	2.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	4.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
49	4.600		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	6.500 L		0.0169	0.0189	0.1734	0.4353	0.6142	0.9995	0.9635	0.6186	0.2093	0.0781	0.0314
50	3.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
51	3.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52	4.800		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
53	3.500		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54	3.520		0.0677	0.0682	0.5067	0.8799	0.9708	0.8978	0.2221	0.0614	0.0227	0.0113	0.0083
55	6.500 L		0.0050	0.0058	0.0564	0.1599	0.2520	0.9997	0.9997	0.9914	0.8356	0.4177	0.2448
56	6.500 L		0.0058	0.0066	0.0641	0.1801	0.2818	0.9997	0.9997	0.9853	0.7716	0.3678	0.2179
57	3.630		0.0539	0.0614	0.4693	0.8506	0.9579	0.7595	0.4048	0.1965	0.0927	0.0414	0.0273
58	3.250		0.0787	0.0770	0.5512	0.9096	0.9818	0.6121	0.2831	0.1520	0.0732	0.0313	0.0202
6	4.000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	6.500 L		0.0066	0.0075	0.0721	0.2010	0.3121	0.9996	0.9996	0.9848	0.8281	0.1421	0.0124
8	6.500 L		0.0066	0.0075	0.0721	0.2010	0.3121	0.9996	0.9996	0.9848	0.8281	0.1421	0.0124
9	6.500 L		0.0066	0.0075	0.0725	0.2020	0.3135	0.9997	0.9997	0.9856	0.8287	0.1405	0.0104

Table 74  
Project Performance by Study Area Reach  
Levee Alignment C  
Without Project  
2070

Study Area Reach	Target Stage	Geo Tech	Target Stage Annual Exceedance		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events					
			Median	Expected	10.0000	30.0000	50.0000	0.1000	0.0400	0.0200	0.0100	0.0040	0.0020
SA 1	6.2300		0.0857	0.0898	0.6097	0.9405	0.9909	0.6030	0.1602	0.0031	0.0000	0.0000	0.0000
SA 10	6.1500		0.0397	0.0547	0.4304	0.8152	0.9401	0.8949	0.5254	0.0097	0.0027	0.0000	0.0000
SA 11	9.2900		0.0236	0.0233	0.2104	0.5078	0.6931	0.9998	0.9889	0.3481	0.0730	0.0207	0.0122
SA 12	8.0700		0.0382	0.0469	0.3816	0.7636	0.9096	0.9802	0.6079	0.0253	0.0050	0.0021	0.0000
SA 13	7.2300		0.0358	0.0399	0.3344	0.7052	0.8694	0.9875	0.8281	0.0237	0.0068	0.0031	0.0025
SA 14	8.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 15	10.2400		0.0667	0.0709	0.5209	0.8900	0.9748	0.7878	0.2351	0.0238	0.0000	0.0000	0.0000
SA 16	8.4200		0.0336	0.0353	0.3022	0.6603	0.8346	0.9987	0.8391	0.0827	0.0288	0.0136	0.0089
SA 17	4.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 18	3.4600		0.9675	0.9627	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 19	5.1400		0.1045	0.1012	0.6559	0.9593	0.9952	0.4612	0.0922	0.0000	0.0000	0.0000	0.0000
SA 2	7.1200		0.1398	0.1292	0.7492	0.9842	0.9990	0.3165	0.0495	0.0000	0.0000	0.0000	0.0000
SA 20	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 21	5.0000		0.1685	0.1599	0.8250	0.9946	0.9998	0.1458	0.0101	0.0000	0.0000	0.0000	0.0000
SA 22	5.6100		0.4914	0.4893	0.9988	1.0000	1.0000	0.0146	0.0058	0.0000	0.0000	0.0000	0.0000
SA 23	8.4400		0.0338	0.0356	0.3043	0.6633	0.8371	0.9984	0.9013	0.0398	0.0086	0.0026	0.0019
SA 24	7.0700		0.0551	0.0615	0.4699	0.8510	0.9581	0.8974	0.3353	0.0213	0.0085	0.0044	0.0033
SA 25	4.0700		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 26	4.6500		0.1540	0.1478	0.7980	0.9918	0.9997	0.1359	0.0049	0.0000	0.0000	0.0000	0.0000
SA 27	3.5400		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 28X	4.5200		0.1665	0.1618	0.8288	0.9950	0.9999	0.0864	0.0026	0.0000	0.0000	0.0000	0.0000
SA 28Y	3.5600		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 29	6.4500		0.0611	0.0741	0.5371	0.9008	0.9787	0.6809	0.3003	0.0000	0.0000	0.0000	0.0000
SA 29C	5.2300		0.1395	0.1339	0.7626	0.9866	0.9992	0.1952	0.0128	0.0000	0.0000	0.0000	0.0000
SA 3	13.6000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 30	5.0600		0.1436	0.1389	0.7758	0.9887	0.9994	0.1455	0.0039	0.0000	0.0000	0.0000	0.0000
SA 30C	4.3200		0.1820	0.1847	0.8703	0.9978	1.0000	0.0359	0.0000	0.0000	0.0000	0.0000	0.0000
SA 31	6.2400		0.0874	0.0884	0.6036	0.9377	0.9902	0.5680	0.1547	0.0000	0.0000	0.0000	0.0000
SA 31C	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 32	5.5800		0.1320	0.1246	0.7357	0.9815	0.9987	0.2755	0.0338	0.0000	0.0000	0.0000	0.0000
SA 33	5.9800		0.1070	0.1033	0.6640	0.9621	0.9957	0.4407	0.0819	0.0027	0.0000	0.0000	0.0000
SA 34	5.1500		0.1631	0.1541	0.8124	0.9934	0.9998	0.1505	0.0148	0.0000	0.0000	0.0000	0.0000
SA 35	5.1500		0.1628	0.1541	0.8124	0.9934	0.9998	0.1553	0.0162	0.0000	0.0000	0.0000	0.0000
SA 36	5.9700		0.1075	0.1043	0.6676	0.9633	0.9959	0.4435	0.0805	0.0038	0.0000	0.0000	0.0000
SA 37	11.3900		0.0175	0.0168	0.1555	0.3977	0.5705	0.9997	0.9997	0.5809	0.2455	0.1021	0.0583
SA 38	5.5500		0.1492	0.1363	0.7690	0.9877	0.9993	0.2672	0.0393	0.0044	0.0027	0.0020	0.0000
SA 39	8.0500		0.0368	0.0423	0.3507	0.7263	0.8846	0.9873	0.6508	0.0699	0.0268	0.0140	0.0100
SA 39C	9.6200		0.0271	0.0262	0.2329	0.5486	0.7344	0.9997	0.9615	0.2294	0.0909	0.0425	0.0276
SA 4	11.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 40P	3.5000		0.9989	0.9989	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 41	4.7400		0.1968	0.2175	0.9140	0.9994	1.0000	0.0736	0.0057	0.0000	0.0000	0.0000	0.0000
SA 41P	5.0500		0.1392	0.1344	0.7638	0.9868	0.9993	0.1833	0.0100	0.0000	0.0000	0.0000	0.0000
SA 42P	6.1700		0.0951	0.0940	0.6272	0.9482	0.9928	0.5257	0.1167	0.0019	0.0000	0.0000	0.0000
SA 43P	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 44C	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 5	11.6600		0.8540	0.8509	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 6	12.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 7	7.9000		0.0359	0.0402	0.3367	0.7081	0.8716	0.9897	0.7947	0.0261	0.0070	0.0030	0.0024
SA 8	9.3700		0.0298	0.0294	0.2578	0.5911	0.7747	0.9998	0.9997	0.0329	0.0023	0.0000	0.0000
SA 9	5.6400		0.0656	0.0738	0.5357	0.8999	0.9784	0.7281	0.2632	0.0034	0.0000	0.0000	0.0000

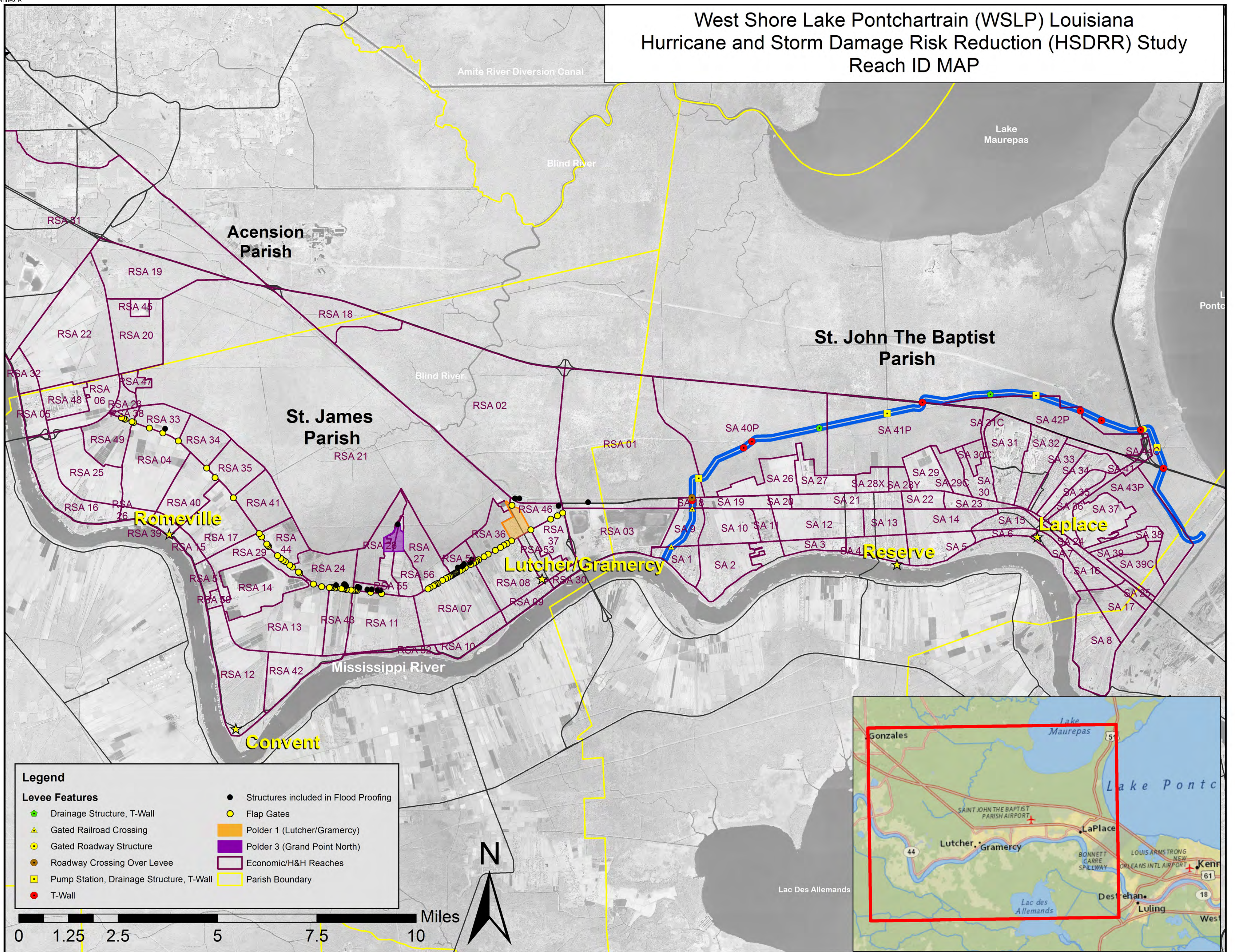
Table 74 cont.  
Levee Alignment C  
With Project  
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Study Area Reach	Target Stage	Geo Tech	Target Stage Annual Exceedance		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events						
			Median	Expected	10.0000	30.0000	50.0000	0.1000	0.0400	0.0200	0.0100	0.0040	0.0020	
SA 1	5.4800		0.8360	0.8345	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SA 10	4.7100		0.0078	0.0080	0.0767	0.2129	0.3290	0.9996	0.9996	0.9996	0.6860	0.1637	0.0496	
SA 11	7.6000		0.0403	0.0416	0.3461	0.7204	0.8804	0.9977	0.4958	0.1890	0.0968	0.0452	0.0277	
SA 12	6.5100		0.6189	0.6192	0.9999	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 13	5.7400		0.0678	0.0687	0.5094	0.8819	0.9716	0.7980	0.2121	0.1191	0.0654	0.0109	0.0024	
SA 14	8.1000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 15	9.3700		0.8521	0.8502	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 16	5.3400		0.9221	0.9147	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 17	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 18	3.5500		0.0082	0.0080	0.0769	0.2134	0.3297	0.9997	0.9997	0.9997	0.7405	0.0776	0.0153	
SA 19	4.9500		0.0001	0.0001	0.0010	0.0031	0.0052	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 2	5.8000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 20	3.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 21	4.0100		0.1733	0.1723	0.8491	0.9966	0.9999	0.0576	0.0037	0.0000	0.0000	0.0000	0.0000	
SA 22	5.1300		0.9821	0.9771	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 23	6.4000		0.7989	0.7982	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 24	6.5100		0.0583	0.0606	0.4646	0.8466	0.9560	0.8991	0.2452	0.0992	0.0195	0.0035	0.0000	
SA 25	4.0800		0.4751	0.4716	0.9983	1.0000	1.0000	0.0059	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 26	4.2200		0.0004	0.0011	0.0105	0.0312	0.0514	0.9998	0.9998	0.9998	0.9980	0.9466	0.8295	
SA 27	3.0600		0.0070	0.0107	0.1024	0.2768	0.4173	0.9997	0.9788	0.8094	0.6296	0.3306	0.2015	
SA 28X	4.0400		0.0007	0.0015	0.0148	0.0438	0.0720	0.9998	0.9998	0.9995	0.9935	0.9017	0.7495	
SA 28Y	3.6400		0.0018	0.0032	0.0314	0.0912	0.1473	0.9998	0.9998	0.9898	0.9457	0.7227	0.5232	
SA 29	5.1700		0.0001	0.0005	0.0054	0.0160	0.0265	0.9998	0.9998	0.9998	0.9998	0.9995	0.9922	
SA 29C	3.5000		0.8639	0.8610	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 3	13.6000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 30	4.1700		0.0005	0.0012	0.0119	0.0353	0.0581	0.9997	0.9997	0.9996	0.9963	0.9341	0.8082	
SA 30C	4.2900		0.0003	0.0009	0.0092	0.0275	0.0454	0.9998	0.9998	0.9998	0.9989	0.9590	0.8562	
SA 31	5.9600		0.0001	0.0002	0.0024	0.0073	0.0121	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 31C	2.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 32	4.7800		0.0003	0.0006	0.0064	0.0190	0.0315	0.9998	0.9998	0.9998	0.9998	0.9896	0.9338	
SA 33	5.4600		0.0001	0.0001	0.0010	0.0030	0.0050	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 34	4.7700		0.0010	0.0031	0.0304	0.0885	0.1431	0.9998	0.9954	0.9799	0.9273	0.7760	0.6418	
SA 35	4.8800		0.0001	0.0004	0.0038	0.0115	0.0191	0.9997	0.9997	0.9997	0.9997	0.9997	0.9988	
SA 36	5.5100		0.0001	0.0002	0.0017	0.0052	0.0086	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	
SA 37	2.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 38	5.3200		0.0003	0.0004	0.0036	0.0108	0.0180	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 39	6.5600		0.0001	0.0002	0.0022	0.0066	0.0109	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	
SA 39C	8.2200		0.0001	0.0002	0.0020	0.0061	0.0102	0.9995	0.9995	0.9995	0.9995	0.9995	0.9995	
SA 4	11.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 40P	3.5600		0.0022	0.0037	0.0364	0.1051	0.1690	0.9997	0.9997	0.9836	0.9256	0.6769	0.4781	
SA 41	4.5600		0.0001	0.0005	0.0051	0.0152	0.0252	0.9998	0.9998	0.9998	0.9998	0.9965	0.9787	
SA 41P	5.0300		0.0001	0.0005	0.0050	0.0149	0.0247	0.9998	0.9998	0.9998	0.9998	0.9987	0.9859	
SA 42P	6.1400		0.0001	0.0004	0.0043	0.0128	0.0213	0.9998	0.9997	0.9997	0.9997	0.9997	0.9997	
SA 43P	2.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 44C	1.0000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 5	11.7200		0.7625	0.7615	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 6	12.1000		0.9990	0.9990	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
SA 7	5.9200		0.1958	0.2049	0.8991	0.9990	1.0000	0.0522	0.0035	0.0000	0.0000	0.0000	0.0000	
SA 8	8.0200		0.0265	0.0353	0.3022	0.6603	0.8346	0.9450	0.7091	0.3644	0.1318	0.0208	0.0037	
SA 9	4.2000		0.2056	0.2130	0.9089	0.9992	1.0000	0.0253	0.0000	0.0000	0.0000	0.0000	0.0000	



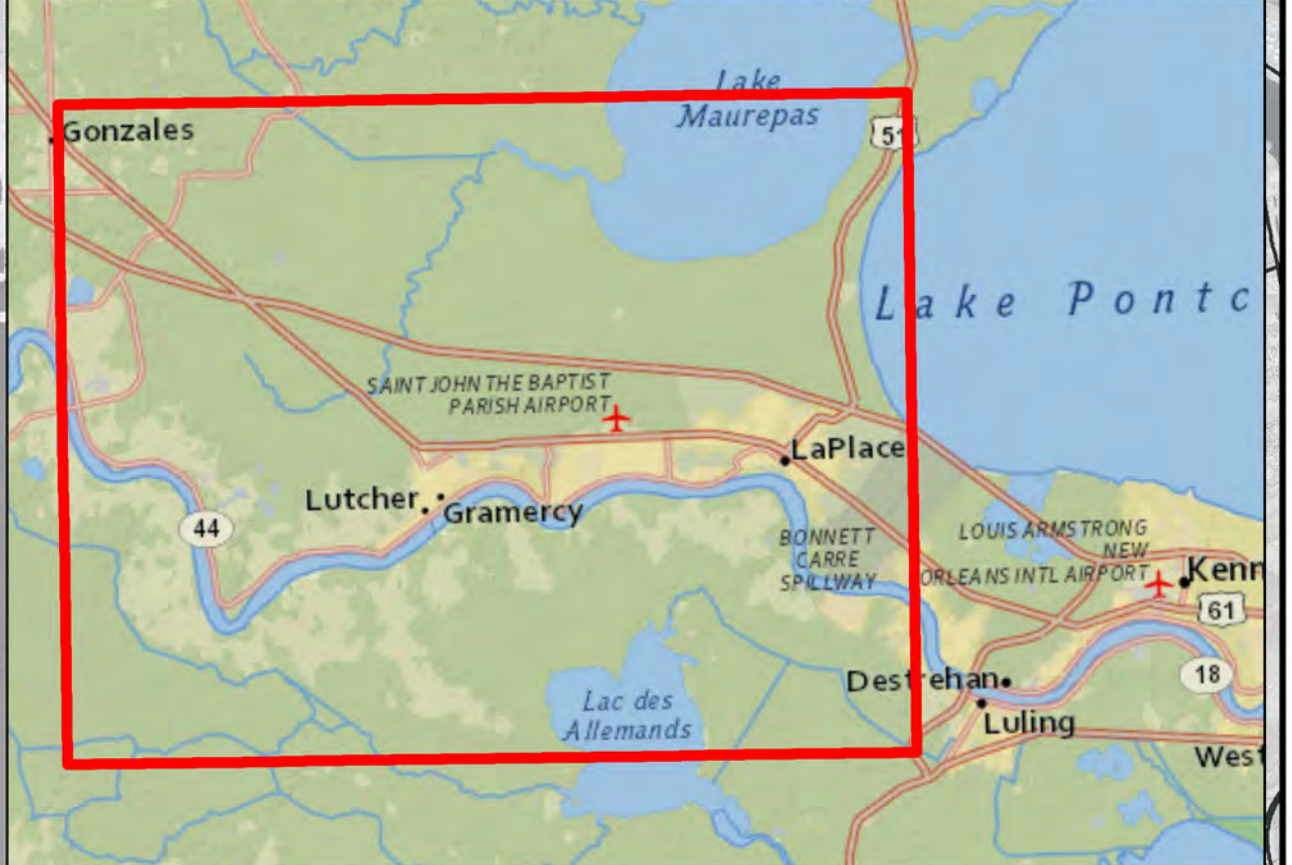
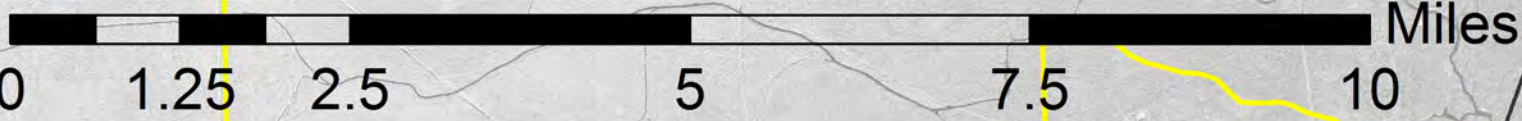


# West Shore Lake Pontchartrain (WSLP) Louisiana Hurricane and Storm Damage Risk Reduction (HSDRR) Study Reach ID MAP



**Legend**

Levee Features	
	Drainage Structure, T-Wall
	Gated Railroad Crossing
	Gated Roadway Structure
	Roadway Crossing Over Levee
	Pump Station, Drainage Structure, T-Wall
	T-Wall
	Structures included in Flood Proofing
	Flap Gates
	Polder 1 (Lutchier/Gramercy)
	Polder 3 (Grand Point North)
	Economic/H&H Reaches
	Parish Boundary





West Shore Lake Pontchartrain, Louisiana  
Feasibility Report  
Annex B: Other Social Effects Appendix

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## I. INTRODUCTION

This appendix presents a socioeconomic evaluation of the alternatives being considered for storm surge risk reduction for the West Shore of Lake Pontchartrain study area, which includes portions of three parishes in the state of Louisiana. It was prepared in accordance with Engineering Regulation (ER) 1105-2-100, Planning Guidance Notebook, ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies, and Engineering Circular (EC) 1105-2-409.

### Purpose

The purpose of this appendix is to describe the Other Social Effects (OSE) account of the the project. The OSE account considers the potential social ramifications of Corps actions so that decision makers and stakeholders are able to evaluate the social implications of each alternative and choose an alternative that will be judged as complete, effective, and fair.

### Study Area

The study area is located in Louisiana about 30 miles west of the city of New Orleans and includes parts of St. Charles, St. John the Baptist, and St. James Parishes. Communities in the study area include the Montz, Laplace, Gramercy, Lutcher, Grand Point, Reserve, Convent and Romeville. Parts of the parishes have historically suffered hurricane and tropical storm surge damages due to insufficient hurricane and storm damage risk reduction features. The impact of preparing for, mitigating, and recovering from these damages has placed a significant physical and emotional burden on individuals and has been devastating for impacted communities. The goals of the proposed project are to reduce property damage risks in the study area from the effects of hurricane/tropical storm surges.

### Overview of Other Social Effects

While federal water resources planning guidance has long called for an examination of the social effects associated with USACE water resources projects, the tendency has been to discount the social impacts of Corps projects during the planning process and focus instead on the economic analysis (USACE, 2008). EC 1105-2-409, however, states that “all Corps planning studies will evaluate, display and compare the full range of alternative plans’ effects across all four Principles and Guidelines’ accounts (National Economic Development (NED), Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE)” (USACE, 2008 pg. 4).

The OSE account ensures that adequate attention is paid to the beneficial and adverse social effects of Corps projects during the planning process. This appendix follows the guidance set forth by the USACE Institute for Water Resources (IWR) in the Handbook on Applying "Other Social Effects" Factors in Corps of Engineers Water Resources Planning (USACE, 2008). The handbook describes the procedures for analyzing and using OSE criteria in the planning process and identifies social factors that affect individual and group definitions of satisfaction and well-being.

### Organization of Appendix

The OSE appendix is organized as follows:

- Section 1 provides an introduction to OSE.
- Section 2 describes the existing and future without-project socioeconomic characteristics and other social factors of the study area.
- Section 3 provides an OSE analysis of the project alternatives.

## II. OTHER SOCIAL EFFECTS STUDY AREA CHARACTERISTICS

This section provides a description of the existing and future without-project socioeconomic characteristics and other social factors of the study area.

### Socioeconomic Characteristics of the Study Area

In this section, socioeconomic data for St. Charles, St. John the Baptist, and St. James Parishes are presented in order to provide a context from which to evaluate the potential social impacts of the proposed project.

### Population and Households.

Population characteristics such as size and change constitute important areas of consideration in that they determine consumption patterns, land uses, and future development patterns. Table 1 displays the population in each of the parishes for the years 1970, 1980, 1990, 2000, and 2010, as well as projections for the year 2020 and the year 2070, the years that were modeled and used to calculate damages and benefits. Population projections are based on the Moody's County Forecast Database, which has population projections to the year 2038. Moody's projections were extended by New Orleans District from the year 2030 to the year 2080 based on the growth rate forecasted by Moody's for the years 2018 through 2038. As shown in Table 1, St. Charles, St. James and St. John Parishes experienced a steady increase in population between 1980 and 2010.

Table 1: Parish-wide populations (in 1000s). (U.S. Census 2013)

<b>Parish</b>	<b>1970</b>	<b>1980</b>	<b>1990</b>	<b>2000</b>	<b>2010</b>
St. Charles	29.5	37.5	42.5	48.2	52.8
St. John the Baptist	23.8	32.3	40.1	43.1	45.9
St. James	19.7	21.6	20.8	21.4	22.1
<b>Total</b>	<b>73.0</b>	<b>91.4</b>	<b>103.4</b>	<b>112.7</b>	<b>120.8</b>

According to U.S. Census data, the population of St. Charles Parish was 48,200 in 2000 and 52,800 in 2010, an increase of 4,600 residents. During the same time, the population of St. John the Baptist Parish increased from 43,100 to 45,900, an increase of 2,800 residents. During the same period, the population of St. James Parish increased from 21,400 to 22,100, an increase of 700 residents.

Parish populations are projected to maintain this steady growth, with St. Charles Parish expected to have roughly 56,200 residents in 2020 and approximately 65,500 residents in the year 2070. St. John the Baptist Parish is expected to grow with an estimated population of roughly 51,700 in 2020 and 60,200 in 2070. The total population in the study area is projected to grow to 95,900 by 2080.

Table 2: Number of households in study area (in 1000s). (U.S. Census 2013)

Parish	1970	1980	1990	2000	2010	2020	2080
St. Charles	7.59	11.6	14.4	16.5	17.2	18.3	22.0
St. James	4.63	6.1	6.4	7.0	6.9	7.2	8.7
St. John the Baptist	5.77	9.4	12.7	14.3	15.1	16.3	19.6
<b>Total</b>	<b>17.99</b>	<b>27.1</b>	<b>33.5</b>	<b>37.8</b>	<b>39.2</b>	<b>41.8</b>	<b>50.3</b>

Table 2 shows the number of households in each parish in 1970, 1980, 1990, 2000, and 2010 and projections for the years 2020 and 2080. The projected number of households was based on Moody's County Forecast Database and extended from the year 2038 to 2080 by the New Orleans District based on the growth rate forecasted by Moody's for the years 2018 through 2038.

The total number of households in the three Parishes experienced a steady increase between 1970 and 2010, which parallels the growth in population. This increase, which was commensurate with the population growth experienced by the entire Gulf Coast region during the same period, can be attributed to increases in the petrochemical industry and area ports. Similar to the projected population growth in the area, the number of households is expected to continue increasing through the year 2080. St. Charles Parish is projected to have approximately 18,300 households in the year 2020, while St. John the Baptist Parish is projected to have 16,300 households, and St. James Parish is projected to have 7,200 households. By the year 2080, the number of households in St. Charles Parish is expected to reach approximately 22,000 while the number in St. John the Baptist Parish is expected to reach to approximately 19,600 and St. James Parish is expected to reach 8,700. In total, the parishes are projected to have approximately 50,200 households in the year 2080.

#### Employment.

Table 3 shows the total non-farm employment by parish for the years 1970, 1980, 1990, 2000, 2010. Employment trends in the area have historically moved with the activity of the petrochemical industry, river ports and agriculture.

Table 3: Historical parish-wide non-farm employment (in 1000s). (Moody's 2013)

Parish	1970	1980	1990	2000	2010
St. Charles	9.0	18.1	18.5	20.1	24.3
St. John the Baptist	5.4	9.8	9.4	7.6	8.1
St. James	4.2	9.4	11.0	13.4	15.0
<b>Total</b>	<b>18.5</b>	<b>37.2</b>	<b>39.0</b>	<b>41.1</b>	<b>47.4</b>

In addition to the petrochemical industry, there are two other sectors of the economy that are important to the region: ports and agriculture. The Port of South Louisiana is the largest volume port in the western hemisphere. The area grows and processes sugarcane and other farm products that are used both domestically and abroad.

## Social Profile of the Study Area

This section provides a baseline profile of the social characteristics of the study area. Data for the profile are from a variety of sources including 2010 U.S. Census records, the 2006-2010 U.S. Census Bureau's American Community Survey (ACS) estimates, ESRI data, and aerial photography. Baseline characteristics are considered the existing and future-without project conditions.

### Health and Safety

Severe flood events threaten the health and safety of residents living in the study area. Loss of life, injury, and post flood health hazards may occur in the event of catastrophic flooding. For example, while the study area was not directly impacted by Hurricane Katrina, the Louisiana Recovery Authority estimated (as of November 2006) that 1,464 fatalities occurred associated with Hurricane Katrina with 135 more residents declared missing. Hurricanes Gustav and Ike were less costly in terms of lives lost, but still claimed 98 deaths. When facilities that provide critical care or emergency services are impacted by flood events, residents are at an even greater risk for experiencing negative health outcomes. Hurricanes reduce the previous availability of health facilities and services and require additional fire and police protection. During storms, some police stations are required to relocate because of flooding. In addition to the damages to hospitals, police stations, and fire stations, many employees providing related services lost their homes reducing the staff needed to operate health and safety services.

The number of medical facilities, police stations, and fire stations located in the study area were obtained using 2010 ESRI data (latest year available).

### Medical Care Facilities

There are no hospitals, nursing homes, or health care service facilities in the part of St. Charles Parish included in the study area. St. John the Baptist Parish has 8 medical care facilities (e.g., 2 hospitals, 1 Outpatient Clinic, and 5 nursing homes). St. James Parish has 4 medical care facilities.

### Police Stations

St. Charles Parish has no police stations in the study area, St. John the Baptist Parish has 2 police stations, and St. James Parish has 3 police stations/sheriff's offices, according to ESRI data.

### Fire Stations

There are 23 fire stations located in the study area; 1 in St. Charles Parish, 12 in St. John the Baptist Parish, and 10 in St. James Parish.

### Social Connectedness

The degree to which communities are able to instill a shared sense of belonging and purpose among residents is in large part determined by the community's civic infrastructure. The presence of social institutions such as libraries, places of worship, and schools provide residents an opportunity for civic participation and engagement which allows residents to come together and work toward a common goal. The number of libraries, places of worship, and schools located within the study area were obtained using 2010 ESRI data (latest year available).

### Civic Infrastructure

According to Google Earth's Mapping data and individual parish governmental websites, the portion of St. Charles Parish in the study area has no libraries, 1 place of worship, and no schools.

The data shows 3 libraries, 32 places of worship, and 19 schools within the study area in St. John the Baptist Parish. St. James Parish has 1 library, 11 places of worship, and 6 schools located in the study area

Leisure and Recreation

Having personal leisure time available and having access to recreational areas contributes to residents’ quality of life and is therefore an important aspect of well-being. The number of recreational areas within the study area was obtained using individual parish governmental websites.

Recreational Areas

St. Charles Parish has 1 recreational area located in the study area, Montz Park. St. John the Baptist Parish has 8 recreational areas in the study area; Regala Park; Emily C. Watkins Park; Cambridge Park; Hwy 51 Park; Stephanie Wilking Park; Greenwood Park; Belle Pointe Park and Ezekiel Jackson Park. St. James Parish has 5 recreational areas in the study area; St. James Parish Fitness Center; Gramercy Park; Lutcher Park; Paulina Park; and Romeville Park.

Recreational fishing and hunting are very important in the area. The high quality of the recreational fishery, especially an abundance of freshwater and estuarine species, has made this an important leisure activity for residents. Inland saltwater fish species, crabs, and shrimp are available in nearby lakes. Game species hunted in the area include waterfowl, deer, rabbit, and squirrels.

Social Vulnerability/Resiliency

The devastation of Hurricane Katrina brought attention to the salience of the related concepts of social vulnerability and resiliency when evaluating water resources projects (USACE, 2008). Social vulnerability is a characteristic of groups or communities that limits or prevents their ability to withstand adverse impacts from hazards to which they are exposed. Resiliency, in turn, refers to the ability of groups or communities to cope with and recover from adverse events. The factors that contribute to vulnerability often reduce the ability of groups or communities to recover from a disaster; therefore, more socially vulnerable groups or communities are typically less resilient.

Several factors have been shown to contribute to an area’s vulnerability/resiliency, including poverty, racial/ethnic composition, education levels and proportion of the population over the age of 65.

Poverty Rate

High poverty rates negatively impact the social welfare of residents and undermine the community’s ability to assist residents in times of need. The 2006-2010 U.S. Census data indicate that 13 percent of the population of St. Charles Parish, 15 percent of the population in St. John the Baptist Parish and 15 percent of the population in St. James Parish fell below the poverty line. In contrast, 18.1 percent of the population in the state of Louisiana and 13.8 percent in the nation overall fell below the poverty line during the same period.

Table 4: St. Charles Parish communities percent minority and low income.

	<b>St. Charles Parish*</b>	<b>Montz</b>
Total Population	52,880	1,918
% Minority	35%	22%

% Low Income	13%	0%
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\*Includes total parish percent minority and low income.

Table 5: St. John the Baptist Parish communities percent minority and low income.

	<b>St. John the Baptist Parish*</b>	<b>Laplace</b>	<b>Reserve</b>	<b>Garyville</b>
Total Population	45,824	29,872	9,766	2,811
% Minority	61%	59%	65%	54%
% Low Income	15%	9%	20%	8%

\*Includes total parish percent minority and income.

Table 6: St. James Parish communities percent minority and low income.

	<b>St. James Parish*</b>	<b>Gramercy</b>	<b>Lutcher</b>	<b>Grand Point</b>	<b>Convent</b>
Total Population	22,102	3,613	3,559	2,473	711
% Minority	53%	49%	54%	27%	69%
% Low Income	15%	13%	21%	8%	10%

\*Includes total parish population demographics.

### Racial / Ethnic Composition

Race/ethnicity plays an important role in the everyday lives of Americans. Unequal access to social resources and language barriers may affect preparing for and recovering from flood events for certain groups. Tables 4, 5, and 6 show the racial and ethnic characteristics of the Parishes, according to the 2010 U.S. Census. In St. John the Baptist and St. James Parishes, the majority of the population is minority. In St. Charles Parish the majority of the population is non-minority.

### Education Attainment

Education attainment has important implications for the social vulnerability/resiliency of communities. More educated individuals have less difficulty accessing information and navigating the sometimes complex process of recovery after flood events (e.g., obtaining government assistance, insurance claims, permits, etc.) According to 2006-2010 ACS data, the percentage of the population age 25 and older in St. Charles Parish with a high school diploma is 86.3 percent and 20 percent have a bachelor's degree or higher. Similarly, 82.2 percent of the population 25 and older in St. John the Baptist Parish has a high school diploma and 12.7 percent have a bachelor's degree or higher. In St. James Parish 82.2 percent of the population 25 and older has a high school diploma and 12.7 percent have a bachelor's degree or higher. In Louisiana 81.0% have a high school diploma and 20.9% have a bachelor's degree or higher and the nation overall 85.0% have a high school diploma and 27.9% have a bachelor's degree or higher.

### Age

Age is another important factor to consider when examining the social vulnerability/resiliency of a community. For example, elderly residents may have special needs or mobility issues and require

more social resources before, during, and after flood events. According to 2010 U.S. Census data, the proportion aged 65 and older in St. Charles Parish is 10.7 percent, in St. John the Baptist Parish is 11.4 percent, and 14.1 percent in St. James Parish. The state of Louisiana and the nation overall have roughly the same proportion of the population over the age of 65 (12.3% and 13.0%, respectively).

### Social Vulnerability Index

The University of South Carolina's Hazards and Vulnerability Research Institute created an index that compares the social vulnerability of U.S. counties/parishes to environmental hazards. The variables in the index are based on previous research which has found that certain characteristics (e.g., poverty, racial/ethnic composition, educational attainment, and proportion over the age of 65) contribute to a community's vulnerability when exposed to hazards. According to the IWR OSE handbook (USACE, 2008), the Social Vulnerability Index (SoVI®) is a valuable tool that can be used in the planning process to identify areas that are socially vulnerable and whose residents may be less able to withstand adverse impacts from hazards.

The SoVI® is a comparative measure of social vulnerability for all counties/parishes in the U.S., with higher scores indicating more social vulnerability than lower scores. St. Charles Parish has a SoVI® 2005-09 score of -1.20 (0.29 national percentile), St. John the Baptist Parish has a SoVI® 2005-09 score of -1.20 (0.29 national percentile), and St. James Parish has a SoVI® 2005-09 score of -1.08 (0.31 national percentile). Stated another way, St. Charles and St. John the Baptist Parishes are less socially vulnerable than roughly 70 percent of counties/parishes in the U.S. In comparison, Orleans Parish—known for enduring levels of high poverty—has a SoVI® 2005-09 score of 2.06 with only 18 percent of counties/parishes in the nation ranked more socially vulnerable.

The study area's social vulnerability, however, is expected to increase over time if subsidence and sea level rise continue to occur, and the population in the study area increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for flood events will increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure that these socially vulnerable populations have access to resources before, during, and after flood events.

## III. OTHER SOCIAL EFFECTS EVALUATION OF ALTERNATIVES

### Social Implications of the Alternatives

This section provides an OSE analysis of the project alternatives. The evaluation is based on the differential impact that each alternative is expected to have on the socioeconomic characteristics and other social factors of the study area presented in the previous section.

The analysis was conducted based on a comparison of without-project conditions to each of three alternative plans. The performance of the alternatives is summarized generally as follows:

- No Action - provides no additional risk reduction to any study area communities.
- Alternative A – reduces risk to St. Charles and St. John the Baptist communities with a levee system and to parts of St. James Parish through earthen berms, culvert flap gates, elevating structures, and limited property acquisitions.
- Alternative C – provides the same risk reduction as Alternative A.
- Alternative D – reduces risk to three parishes with a levee system.



Table 7 shows the risk reduction of the No Action Alternative, and Alternatives A, C, and D.

Table 7: Performance comparison of plans

<b>Alternative</b>	<b>Structures in the System</b>	<b>Communities in the System</b>
No Action	0	None
A	16,919	Montz, Laplace, Reserve, Garyville
C	16,919	Montz, Laplace, Reserve, Garyville
D	21,840	Montz, Laplace, Reserve, Garyville, Lutchter, Grammercy, Grand Point

Population and Housing

No Action Alternative

Under this scenario all structures in the study area would remain vulnerable to hurricane/tropical storm surge impacts. The No Action Alternative would not reduce risk in the study area. Risks would increase over time due to sea level rise. A catastrophic flood would result in severe negative impacts to residents and significantly damage structures. Communities would not be able to benefit from discounted flood insurance premiums offered by the National Flood Insurance Program (NFIP) should the flood rate insurance maps be updated to reflect increases in flood risk over time due to sea level rise.

Alternative A

Under this alternative, 16,919 structures would be at a reduced risk for adverse impacts as a result of 1% ACE events. Additionally, many residents in these communities would be able to benefit from discounted flood insurance premiums offered by the NFIP (should the flood insurance rate maps be updated to reflect increases in flood risk over time due to sea level rise).

Alternative C

Under this alternative, 16,919 structures would be at a reduced risk for adverse impacts as a result of 1% ACE events. Additionally, many residents in these communities would be able to benefit from discounted flood insurance premiums offered by the NFIP (should the flood insurance rate maps be updated to reflect increases in flood risk over time due to sea level rise).

Alternative D

Under this alternative, 21,840 structures would be at a reduced risk for adverse impacts as a result of 1% ACE events. Additionally, many residents in these communities would be able to benefit from discounted flood insurance premiums offered by the NFIP (should the flood insurance rate maps be updated to reflect increases in flood risk over time due to sea level rise).

## Health and Safety

### No Action Alternative

All medical care facilities (e.g., hospitals, medical centers, home health care services, and nursing homes), police/sheriff offices, and fire stations in the area would remain at risk. The potential for loss of life and injuries for any residents that remain in the area during storms, and the risks of post flood health hazards, are greater under the No Action Alternative as compared to the action alternatives. Residents are at an even greater risk for experiencing negative health outcomes when facilities that provide critical care or emergency services are impacted by flood events. The No Action Alternative has a higher potential for reducing the availability of health facilities and services and requiring additional fire and police protection than the project alternatives.

### Alternative A

Medical care facilities, police/sheriff offices, and fire stations in the area would face lower hurricane/tropical storm surge damage risks. The potential for loss of life and injuries for any residents that remain in the area during storms, and the risks of post flood health hazards, remains. The Alternative would increase the availability of health facilities and services and fire and police protection after storms as compared to the No Action Alternative.

### Alternative C

This alternative would reduce risk for the same number of facilities as Alternative A.

### Alternative D

This alternative would reduce risk for all of the health and safety facilities in the study area.

## Social Connectedness

### No Action Alternative

The study area includes 4 libraries, 44 places of worship, and 25 schools. Under the No Action alternative all of these structures would remain at risk to hurricane/tropical storm surge damages. The risk would increase over time due to relative sea level rise.

### Alternative A

This alternative would reduce risk for libraries, places of worship and schools within the levee system. Facilities outside of levees would remain vulnerable.

### Alternative C

This alternative would reduce risk for the same number of libraries, places of worship and schools as Alternative A.

### Alternative D

This alternative would reduce risk for all libraries, places of worship and schools in the area.

### Leisure and Recreation

#### No Action Alternative

Under this alternative all area recreational sites and facilities would remain at risk to hurricane/tropical storm surge damages. The risk would increase over time due to relative sea level rise.

#### Alternative A

This alternative would reduce risk for sites within the levee system. Facilities outside of levees would remain vulnerable.

#### Alternative C

This alternative would reduce risk for the same number of recreation sites as Alternative A.

#### Alternative D

This alternative would reduce risk for all of the recreation sites in the study area.

### Social Vulnerability and Resiliency

#### No Action Alternative

Social vulnerability in the area is expected to increase over time as the absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for flood events increases with subsidence, sea level rise, and population growth. Under the No Action Alternative, the area would remain vulnerable to flooding, and long term resiliency would be hampered by the continued local efforts necessary to prepare for, and react to, flood events.

#### Alternative A

This alternative would reduce risk to socially vulnerable populations in St. Charles Parish, St. John the Baptist Parish, and parts of St. James Parish covered by the localized storm surge risk reduction measures. Over time the communities covered by the localized storm surge risk reduction measures will experience increasing storm surge flooding risks as relative sea level rise impacts the area.

#### Alternative C

This alternative would reduce risk to socially vulnerable populations to the same degree as Alternative A.

#### Alternative D

This alternative would reduce risk to socially vulnerable populations in St. Charles Parish, St. John the Baptist Parish, and St. James Parish.

### Summary of Alternative Analysis

The study examined four alternatives: the No Action Alternative, Alternative A, Alternative C, and Alternative D. The OSE analysis evaluated the differential impact that each alternative is expected to have on the socioeconomic characteristics and other social factors of the study area. After first providing a description of the existing and future without-project socioeconomic characteristics and other social factors of the study area, an analysis of the impacts to population and housing,

medical/emergency facilities, civic infrastructure, and recreational areas under the three alternatives was conducted. The analysis was conducted based on without-project overflow and depth-of-flooding data for the years 2020 and 2070. Results show significant differences between the alternatives with important implications for the overall social well-being of the study area.

The No Action Alternative would not reduce the risk associated with hurricane and tropical storm damage to the study area. Therefore, there is a high potential for hurricane and tropical storm damage to continue in the area. The relative sea level rise that is taking place in the area, coupled with the anticipated population growth, is expected to magnify future flooding problems. As a result, subsequent flooding events could cause even more damage to housing units, public facilities, and commercial structures than has previously been experienced. Under this alternative, residents would remain at a higher risk for adverse health impacts such as loss of life and injury, as well as post flood health hazards. The area would remain vulnerable to flooding, and long term resiliency would be hampered by the continued local efforts necessary to prepare for, and react to, flood events.

#### Alternative A

The alternative would reduce the risk associated with hurricane and tropical storm surge damage to the study area. There is a lower potential for hurricane and tropical storm surge damages in the area with the levee alignment. Flooding events could still cause damage to housing units, public facilities, and commercial structures. Under this alternative, residents would remain at risk for adverse health impacts such as loss of life and injury, as well as post flood health hazards. As with all other alternatives, residents should heed public safety warnings and evacuate to avoid storm hazards. However, the area would be less vulnerable to flooding, and long term resiliency would be enhanced with a levee in place.

#### Alternative C

This alternative would reduce risk in the study area to the same degree as Alternative A.

#### Alternative D

This alternative would result in the greatest potential for reduced flooding in the study area. It would reduce the risks associated with damages to housing units, public facilities, and commercial structures and provide increased protection to the health and safety of residents. The area's social vulnerability would be reduced under this alternative, and thus, the potential for long-term growth and sustainability would be enhanced. Also, under this alternative, the area would be at a reduced risk of incurring the costs associated with clean-up, debris removal, and building and infrastructure repair as a result of flood events.

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