APPENDIX H: SOCIOECONOMICS TECHNICAL INFORMATION

H1: Socioeconomics Technical Report

H2: Addendum and Final EIS Data Update

H1: Socioeconomics Technical Report

Socioeconomic Technical Report

Submitted to:

Louisiana Trustee Implementation Group

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April 2022

Draft, Subject to Change, Deliberative Process, and/or FOIA Exemption 5

Contents

Appendices

List of Acronyms and Abbreviations

ACS	American Community Survey
BOD	Basis of Design
BOEM	Bureau of Ocean Energy Management
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CASM	Comprehensive Aquatic Systems Model
CDP	census designated place
cfs	cubic feet per second
CPRA	Coastal Protection and Restoration Authority
DEIS	Draft Environmental Impact Statement
DWH	*Deepwater Horizon*
EIS	Environmental Impact Statement
EJ	environmental justice
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FYE	fiscal year end
GIS	geographic information system
HFIAA	Homeowner Flood Insurance Affordability Act of 2014
HSDRRS	Hurricane and Storm Damage Risk Reduction System
LDWF	Louisiana Department of Wildlife and Fisheries
LiDAR	Light Detection and Ranging
LOOP	Louisiana Offshore Oil Port
MBSD	Mid-Barataria Sediment Diversion
MLG	Mean Low Gulf
MLLW	Mean Lower Low Water
MRIP	Maine Recreational Information Program
MSA	metropolitan statistical area
NAA	No Action Alternative
NFIP	National Flood Insurance Program
NOV	New Orleans to Venice
NSFHWAR	National Survey of Fishing, Hunting, and Wildlife-Associated Recreation
OLS	Ordinary Least Squares:

PA	Preferred Alternative
RM	River Mile
RSLR	relative sea level rise
RV	recreational vehicle
SAV	submerged aquatic vegetation
SF	U.S. Census Bureau Summary File
WSE	water surface elevation

1. Introduction

The focus of this Socioeconomic Technical Report is to provide information and data relevant to the analysis of potential impacts to socioeconomic resources, including commercial fishing and recreation, from the Mid-Barataria Sediment Diversion (MBSD) project, a reasonable range of project alternatives, and the No Action Alternative (NAA), as evaluated in the MBSD Environmental Impact Statement (EIS). This Report also includes additional information that is relevant to certain sections of the Affected Environment in the EIS.

This document is organized as follows. Section 2 includes data and information relevant to the Affected Environment section of the EIS regarding socioeconomic resources. This includes additional information on communities and activities within the EIS defined project area that are most likely to experience impacts from the diversion project (e.g., project footprint, outfall, birdfoot delta areas). Section 3 evaluates the impacts of the MBSD on socioeconomic resource. Where possible each section addresses the impacts associated with the flow alternatives (50,000 cfs, 75,000 cfs and 150,000 cfs). The exception is commercial fishing and recreation sections which only evaluate the Applicant's Preferred Alternative (PA). The various terrace alternatives have not been evaluated at this time except for the economic impacts of construction (Section 3.13). For each alternative, impacts evaluated include the economic impacts of construction; the socioeconomic impacts tied to coastal land loss, storm surge and tidal flooding, commercial fishing and recreation and tourism, population and migration, and land use and property values; the socioeconomic effects from impacts to canals, waterways, navigation, oil and gas operations, and tax revenues; and public services, environmental justice (EJ), and community cohesion impacts.

2. Affected Environment

This section provides additional information and data that aid in the analysis of MBSD impacts. This includes parish and communities within areas of the EIS defined study area that are most likely to be impacted by the diversion project.

2.1. Parish and Community Descriptions

Plaquemines Parish

Plaquemines Parish is Louisiana's southernmost parish. The northern reaches of the parish are coastal marshland, while the southern and delta areas are part of the Mississippi River floodplain (NOAA, 2005a). Plaquemines Parish is part of the New Orleans-Metairie-Kenner metropolitan statistical area (MSA) due to its proximity to New Orleans, with its workforce in the northern part of the parish commuting within the metropolitan area. Geography further divides the primarily agricultural northern end of the parish from a fisheries-and-oilfield-dominated southern region. The Mississippi River bisects the parish into the east and west banks, connected by two ferry crossings. One ferry crosses the river at Belle Chasse and travels to Scarsdale. A second ferry crosses at Point a la Hache (east bank) to West Point a la Hache (west bank). There is no bridge across the Mississippi River in Plaquemines Parish; to travel across the river without using a ferry crossing requires travel to New Orleans on Highway 90. Everything downriver of Bohemia on the east side, and Venice on the west, is only accessible by boat or aircraft. Plaquemines Parish is a highly productive area for seafood, the hub of Louisiana's citrus industry, and a leading producer of oil and natural gas. The proposed MBSD Project is located in Plaquemines Parish on the west bank of the Mississippi River at River Mile (RM) 60.7 near Ironton.

The 972 square-mile parish is sparsely populated. In 2000, Plaquemines Parish had a population of approximately 26,800. Hurricane Katrina in 2005 devastated southern Plaquemines Parish, with many individuals and families relocating northward within the parish, primarily to the relatively unscathed Belle Chasse area, and to other areas outside of the parish (Austin et al., 2014a). Between 2005 and 2006, Plaquemines Parish lost approximately 27% of its population (7,229 residents; U.S. Census Bureau, 2018). Northward migrations in the wake of hurricanes and floods are a familiar pattern for the parish. By 2010, Plaquemines Parish had regained 85% of its pre-Katrina population, but the majority had shifted northward to Belle Chasse, which is located on the protected side of the West Bank and Vicinity Hurricane Protection Levee, part of the Hurricane and Storm Damage Risk Reduction System (HSDRRS). Between 2011 and 2017, the parish population had slightly increased, by 418 residents or 1.8% (Table 12.3-2 in the Mid-Barataria Sediment Diversion Project Draft Environmental Impact Statement (DEIS)).

Commercial fishing is an important economic activity with a large fishing fleet originating in the parish. Employment in the shipbuilding industry and seafood processing plants is also prevalent in lower Plaquemines Parish, which is linked directly to the oil and gas and commercial fishing sectors.

The *Deepwater Horizon* (DWH) oil spill in April 2010 had an impact on Plaquemines Parish. Plaquemines Parish was the nearest land mass to the Macondo well, and its marshes were first to be affected by the oil spill. Effects were most evident in ethnically diverse (e.g. Black, Native American, Asian, and Cajun and Creole) south Plaquemines, whose economy relies mainly on

the oil industry and fisheries (Austin et al., 2014a). It is common for families to include members employed in both fisheries and oil and gas, resulting in profound economic instability. Fishing closures in the region brought most seafood fishing and associated economic activity to a halt (e.g., servicing and provisioning fishing boats). As part of the response to the spill, freshwater was released through the Caernarvon and Davis Pond Freshwater Diversions in an attempt to keep oil from moving into the estuaries. The freshwater lowered the salinity in oyster-breeding grounds within close proximity to the diversion outfalls, resulting in adverse effects to some of the oyster harvests (Buskey, 2010; Austin et al., 2014b). In addition, the drilling moratorium for deep water wells following the spill affected oil and gas jobs in the region, as considerable economic activity in south Louisiana is linked with energy production. Some of the out-of-work people in oil, gas, and fisheries jobs were employed temporarily with the clean-up effort.

Hospital inpatient data, as well as, state survey data suggest that residents across the parish experience substantial levels of chronic health conditions such as hypertension, diabetes, obesity, and congestive heart failure, which not only reflect the health status of residents but also indicate a lack of adequate preventative care and chronic disease management in the region. Gulf Regional Health Outreach Program (GRHOP) stakeholders also pointed to mental health care stigma as priority issues in the community, and reveal primary care shortages as an access to care priority across the parish. This analysis also highlighted additional barriers to accessing health care that residents in the parish may experience, including transportation barriers and high cost of care, particularly for prescription drugs (Plaquemines Parish, 2014).

West Bank Communities

Several communities and unincorporated areas are located on the west bank of the Mississippi River in Plaquemines Parish including Belle Chasse, Live Oak, Ironton, Myrtle Grove, West Pointe a La Hache, Grand Bayou, Port Sulphur, Empire, Buras, Triumph, Boothville, and Venice, listed in order from north to south. Belle Chasse is the largest community in Plaquemines Parish with 13,600 residents in 2017 (U.S. Census Bureau, 2018), located in the northern part of the parish approximately 10-miles southeast of downtown New Orleans. Less than 1% of the employed labor force in Belle Chasse works in farming and fishing occupations.

Ironton, a former plantation, is located on both sides of Louisiana Highway 23. The Town of Ironton was founded by freed slaves during the Reconstruction era and the founders' descendants remain in this community. Ironton is almost entirely Black or African American and working class (Rich, 2014). According to the U.S. Census Bureau, there were four White residents in Ironton in 2000 and 2010, while the remaining population – 116 residents – were Black or African American (U.S. Census Bureau, 2010).

Myrtle Gove is a small community located to the west of the Mississippi River near the proposed diversion. The community includes several residential and recreational properties as well as a marina. The community is an important jump off spot for recreational and commercial fishers alike.

Grand Bayou village is home to around 40 residents of the Atakapa-Ishak/Chawasha tribe (Marshall, 2016). However, the U.S. Census Bureau block data only recorded 19 residents in 2000 and 14 residents in 2010 who identified as Native American or Alaska Native (U.S. Census Bureau, 2010a). The Atakapa-Ishak/Chawasha tribe trace their ancestry within the region back thousands of years. The community is accessible only by boat, and the residents are highly

dependent on their surrounding environment. Residents use the bayou for transportation, sustenance, and recreation. The community fishes, hunts, and traps local natural resources, including oysters, crab, softshell crab, nutria, alligator, and fish (Bethel et al., 2011). Most residents are commercial fishermen, while others work outside of Grand Bayou in the menhaden industry, schools, hospitals, or oil production (Austin et al., 2014a; Marshall, 2016). The community is spiritually tied to the land – the sense of place and self are irrevocably bound (Nienaber, 2012; Marshall, 2016). Similar to other communities in Plaquemines Parish, the population of the village is in decline as residents move to areas inland to avoid issues related to storm surge and inundation as well as greater employment and educational opportunities.

Port Sulphur is generally considered the beginning of lower Plaquemines Parish, the region hardest hit by repeated hurricanes. Port Sulphur has small retail businesses and residential areas, as well as canals and points of water access. The estuaries and canals west of Port Sulphur access the deeper waters of Barataria Bay and the Gulf of Mexico. The community was historically a small subsistence-oriented village (NOAA, 2005a). In 1932, the Freeport Sulphur Company set up operations after acquiring extraction rights to Lake Grande Ecaille's mineral resources (NOAA, 2005a). The town developed with the company, including schools, a hospital, clubhouses and lodges, and a park (NOAA, 2005a). Port Sulphur's sulfur-based economy declined when Freeport's operations slowed in the 1980s, and the company left Port Sulphur in 2000.

Port Sulphur is heavily dependent on fishing and felt the impact of the DWH oil spill (Austin et al., 2014a). Some local retail businesses lost employees to cleanup employment. In 2000, Port Sulphur's population was 3,115 people (U.S. Census Bureau, 2001). In 2005, Hurricane Katrina devastated Port Sulphur, destroying almost all of the single-family homes. After Hurricane Katrina, many residents relocated to other parts of Louisiana and the southeast United States. By 2010, the population was 1,760. The population has remained relatively stable at approximately 2,000 residents since 2012, and in 2017 was 1,934 residents (U.S. Census Bureau, 2017).

Current industries in Port Sulphur include oilfield support businesses, commercial fishing docks, seafood processing, sports fishing charters, trucking, and construction, among others. Port Sulphur has the only medical facility in lower Plaquemines Parish (Austin et al., 2014a). The main industries currently in Port Sulphur according to the U.S. Census Bureau are education, health, and social services (23.7%); and agriculture, fishing, hunting, and mining (including oil and gas; 19.2%). In 2017, 18.2% of the employed labor force was in farming and fishing occupations (U.S. Census Bureau, 2017). The community is primarily Black or African American (U.S. Census Bureau, 2017), with 82% of the population identifying as a minority race.

Empire and Venice (and Boothville and Buras) is often the top seafood-producing port in Louisiana (NOAA, 2017a). Empire is a small village located along the lower west bank of the Mississippi River, between Port Sulphur and Buras. Venice is the town at the end of Highway 23 and the point where the Mississippi River and the Tributaries Levee System ends. Buras and Boothville are also small communities located between Empire and Venice, adjacent to Highway 23.

Empire is an important gateway to Gulf fishing grounds on both sides of the Mississippi River (Austin et al., 2014a). The community includes a shipyard and marina. Empire's economy is based almost entirely on commercial and, to a smaller extent, sport fishing. Many west bank

oyster farmers have extensive oyster leases passed down for generations. Empire is also a primary landing area for Gulf shrimp and a shrimp wholesaler operates in the community. In addition, a menhaden fishing fleet and processing plant have operated there since the 1940s. The Delta Marina attracts a stream of recreational fishermen and charter boats, and holds annual tourist events such as rodeos.

Similar to other southern Plaquemines Parish communities, Hurricane Katrina had a devastating impact on this area. As of 2012, much of Empire's civic and public infrastructure, including a grocery store, gas station, hardware store, and civic center, had not been rebuilt (Austin et al., 2014a). As of 2018, it appears that a number of businesses have returned and/or opened; a church, marina, boat fuel and oil supplier, restaurant, bar, sportsman's lodge, recreational vehicle (RV) park and campground, and a number of wholesale seafood suppliers and processers are currently located in Empire. In addition, a seafood market, motel, and sportsman lodge are located just north of Empire.

The shrimp fishery in the Gulf of Mexico has been in decline since 2001 because of lower prices shrimpers receive at the dock because of market competition from imported shrimp and fluctuating costs of fuel and equipment. The number of commercial shrimp boats operating in the Gulf of Mexico declined after 2001 and was devastated during the hurricane season of 2005, when Hurricanes Katrina and Rita ravaged the northern Gulf (Ingles and McIlvaine-Newsad, 2007).

Empire's population was approximately 2,200 in 2000 (Table 12.3-1 in the DEIS). In 2010, Empire's population had decreased to 990; its population was 1,054 in 2017 (U.S. Census Bureau, 2018). In 2017, the portion of the population in Empire, Buras, Boothville, and Venice that identifies as a minority race was 57%, 17%, 52%, and 16%, respectively. There are primarily Asian (Vietnamese and Cambodian) and Black or African American populations in the area. In the early 1980s, Vietnamese and Cambodian refugees settled in the region, and the majority became shrimpers and crab fishermen (Austin et al., 2014a). A number of Vietnamese families became seafood processors and dock owners. Since Hurricane Katrina, many Vietnamese fishermen live in Plaquemines Parish only during the fishing season and spend the rest of the year in larger Vietnamese communities in the New Orleans MSA (Austin et al., 2014a).

East Bank Communities

Several small communities and unincorporated areas are also located on the east bank of the Mississippi in Plaquemines. Some of these communities and villages include Braithwaite, Scarsdale, Woodlawn, Wills Point, Phoenix, Davant, Bohemia, and Pointe à la Hache, listed here in order from north to south. The larger of these communities have a population that ranges from 200 to 400 residents each. The communities with the highest proportions of minority residents include Braithwaite, Phoenix, Davant, Bohemia, and Point à la Hache. In these communities, the population identifying as a minority race ranges from 40% to 100% of the community (U.S. Census Bureau, 2010b, 2017a). Most of the minority populations in Davant identify as Black or African American, with a very small population of Asian Americans (nine residents) in 2010. Most of the populations of Phoenix, Bohemia, and Point à la Hache identify as Black or African American. Forty-one percent of the population in Braithwaite identify as a minority race (most identify as Black or African American). Approximately 51% of the population of Pointe à la Hache, a census designated place (CDP), live below the poverty level.

Braithwaite is the northernmost community on the east bank in Plaquemines Parish. The Caernarvon Freshwater Diversion, authorized on October 27, 1965 by Public Law 89-298 of the 89th Congress to control salinity, is located close to Braithwaite. The diversion is authorized to operate and divert up to 8,000 cfs of Mississippi River water to Breton Sound. The Phoenix High School is located in Braithwaite, a K-12 school that serves the communities of Braithwaite, Bohemia, and Phoenix.

Scarsdale, Woodlawn, and Wills Point are small communities, located along Highway 39 adjacent to the Mississippi River. Phoenix, Davant, Pointe à la Hache, and Bohemia are farther south, also along Highway 39. The highway ends at Bohemia. The communities border the Caernarvon Marsh, which consists of thousands of acres of intricate waterways, canals, and lakes (NOAA, 2005a).

The area has always been subject to seasonal hurricane damage and storm events, which have destroyed the original parish courthouse and many historic homes and businesses. The 1915 New Orleans Hurricane, Hurricane Betsy in 1965, and Hurricane Katrina in 2005 devastated the region and, in particular, Pointe à la Hache. Once a busy agricultural and shipping center with a multinational population, the community – and the east bank in general – has shrunk over the last century. By the 1990s, Pointe à la Hache was described as a sleepy little village whose economy centered on fishing and a small furniture factory, and serves as the parish seat (Buras, 1991; Austin et al., 2014a). Hurricane Katrina further scattered its residents, and by 2010, Pointe à la Hache had 187 residents, the vast majority of whom were Black (Austin et al., 2014a). The population of Pointe à la Hache further decreased after the DWH oil spill in 2010 to 23 residents in 2012 (Austin et al., 2014a). Since then, the population has grown to 251 residents in 2017, although it has not returned to its 2000 population of 327 residents (U.S. Census Bureau, 2000a, 2017a). Hurricane Isaac in August 2012 had devastating effects on the region; it resulted in storm surges that overtopped the levees protecting Braithwaite, resulting in flooding throughout the area.

Fishing, especially oyster fishing, remains an important cultural, economic, and subsistence activity in the region and in Pointe à la Hache, in particular (Austin et al., 2014a). According to a report published by Bureau of Ocean Energy Management (BOEM), commercial fishermen in the area harbor their boats in Pointe à la Hache, which is known as the heart of Louisiana's Black fishing community (Austin et al., 2014b). These are primarily oyster harvesters who describe themselves as "little" fishermen. Many families have lived there for generations and maintain extensive, reciprocal kinship networks (Austin et al., 2014a).

The number of Black or African-American fishermen has dropped steadily in recent decades. Minority fishermen on the east bank comment that they are marginalized in an industry controlled by larger, politically influential oyster farmers who hold thousands of acres of leases (Austin et al., 2014a). Oysters are the primary commercial harvest, as the village is close to productive natural reefs in Breton Sound. Many locals have no oyster leases of their own. They either fish from public reefs in Breton Sound during the allotted season or work for leaseholders in return for a percentage of the crop (Austin et al., 2014a). The U.S. Census Bureau (2018) reports that there were no residents officially employed in the "farming, fishing and forestry" occupations in the community of Pointe à la Hache in 2017. Similarly, the two U.S. Census Block Groups that encompass the communities of Braithwaite, Scarsdale, Wills Point, Davant,

and Bohemia reported only a few people employed in farming and fishing in 2016 (U.S. Census Bureau, 2016).

Jefferson Parish

Jefferson Parish is elongated on a north-south axis from the southern shores of Lake Pontchartrain to the Gulf of Mexico. The 665-square-mile parish has a population just below half a million people. It is the second-most-populated parish in Louisiana and the most-populated parish in the Greater New Orleans area. Most of the population lives in the northern portion of Jefferson Parish on the east bank of the Mississippi River.

The northern third of the parish encompasses much of New Orleans MSA (NOAA, 2005b), including the fairly urban communities northeast of the Mississippi River and west of New Orleans, such as Kenner and Metairie, and communities southwest of the Mississippi River and directly south of downtown New Orleans including Gretna, the parish seat. The parish stretches to the Gulf of Mexico, encompassing bayous, cypress swamps, and wetlands.

Jefferson Parish includes the rich fishing grounds of Barataria Bay. The southern-most communities in Jefferson Parish adjacent to marshes just north of Barataria Bay include Lafitte, Jean Lafitte, Barataria, and Crown Point. These communities are located adjacent to the Harvey Canal, along highways 45 and 301/3257, on the east and west sides of the canal, respectively. Grand Isle is located in the southern extent of Jefferson Parish on the narrow barrier island at the southern tip of Highway 1. The Harvey Canal provides a connection between the Barataria Bay/Gulf of Mexico and the Port of New Orleans at the Mississippi River, serving as an important shipping route (JEDCO, 2018). The Harvey Canal is part of the Intracoastal Waterway System.

Major industries of employment in Jefferson Parish include healthcare, oil and gas, professional services, and chemical manufacturing (JEDCO, 2018). Fishing does not make up a large percentage of employment in Jefferson Parish as a whole, with only 1.7% of the population working in agriculture, forestry, fishing and hunting, and mining in 2017 (U.S. Census Bureau, 2018). However, subsistence hunting and fishing have been a long-lasting way of life for many in the southern parts of Jefferson Parish, and recreational fishing is extremely popular (NOAA, 2005b).

Jefferson Parish was hit particularly hard by Hurricane Katrina. Orleans and Jefferson parishes experienced the most extensive job losses in Louisiana following the hurricane. Employment in Jefferson Parish was almost 20% below pre-Katrina levels one year after the storm. However, employment has since rebounded (U.S. Bureau of Labor Statistics, 2007). After Hurricane Katrina, Jefferson Parish was the center of the recovery effort.

Westbank

Gretna and Westwego are the two cities on the westbank of Jefferson Parish. There are several unincorporated communities including Terrytown, Estelle, Woodmere, Harvey, Marrero, Bridge City and Timberlane. Gretna, Harvey, Terrytown and Timberlane are located just north and east of the Harvey Canal and are the southern suburbs of New Orleans. These westbank communities are home to restaurants, and retail stores, and serve as the home community for many commuters to New Orleans (NOAA, 2005b). Westwego, Marrero, Waggaman, and Bridge City are west of the Harvey Canal.

Gretna

Gretna is the largest city on the westbank of Jefferson Parish and is the parish seat. It had a population of 17,730 in 2017 (U.S. Census Bureau, 2018). Gretna is located in the northeastern portion of the parish on the West Bank of the Mississippi River, just south of New Orleans. Gretna is a racially diverse community: 48% White, 20% Black or African American, 8% Asian, 5% from other races, and 3% from two or more races. Hispanic or Latino of any race were 24% of the population. The economic base of the region includes a diverse mix of industries with large concentrations in Advanced & Traditional Manufacturing, Retail Trade & Food Services, Transportation & Warehousing, Health Care & Social Assistance, and Professional & Technical Services clusters. Emerging opportunities exist as well in Food Manufacturing, Information Technology, Computer Systems Design, and Motion Picture & Digital Media sectors.

Harvey

Harvey is the largest community (CDP) on the westbank with a majority-minority population of 20,311 in 2010 (U.S. Census, 2011). Harvey is located east of the Harvey Canal west of Gretna on the west bank of the Mississippi River and is racially diverse with 43% White, 41% African American, 6% Asian, and 6% other races. Hispanic or Latino of any race were 13% of the population. The casino in Harvey in an important economic hub.

Estelle, Woodmere, Avondale, Waggaman, and Bridge City, are unincorporated (CDPs) New Orleans suburbs located west of Gretna and Harvey. Estelle is bordered by the Jean Lafitte National Historical Park and Preserve, Barataria Preserve on the west, and Woodmere is bordered by the Harvey Canal on the east. Woodmere has an 86% minority population, with Black or African American, Asian, and Hispanic residents (U.S. Census Bureau, 2018).

Terrytown and Timberlane are southeast of Gretna and Harvey. Timberlane borders the southeast corner of Harvey, with 64% of its population identifying as a minority (U.S. Census Bureau, 2018). Agriculture, forestry, and fishing occupations account for 6.6% and 1.0% of the employed workforce in the communities of Estelle and Harvey, respectively (U.S. Census Bureau, 2018). There are no farming and fisheries employment opportunities in Woodmere, Terrytown, and Timberlane.

Southern Communities

The southern reaches of Jefferson Parish encompass a rural area that includes a number of coastal communities, including Lafitte, Jean Lafitte, Barataria, Crown Point, and Grand Isle. These communities are low-lying areas characterized by their proximity to the Barataria Bay.

Lafitte is located at the southern end of Highway 45. Barataria, Crown Point, and Jean Lafitte are just north of Lafitte, with Barataria on the west side of the Harvey Canal and Jean Lafitte on the east side of the Harvey Canal. These communities are often considered a single community, as they share a single church, school, and post office (NOAA, 2005b). These communities, located close to Barataria Bay, Lake Salvador, and coastal wetlands, are an important fishing and shrimping area (NOAA, 2005b). Commercial fishing is an important industry in these communities, with many residents claiming fishing as their primary occupation (NOAA, 2005b). Agriculture, forestry, and fishing are the largest industries in Lafitte, accounting for 20.1% of employed residents (U.S. Census Bureau, 2018). The Lafitte area has been heavily impacted by recent storms. In the eight years after Katrina, the small Town of Jean Lafitte had $9.3 million in

federal flood insurance payments. Hurricanes Katrina and Rita resulted in the destruction of over 150 houses in Lafitte (Sack and Schwartz, 2018).

Grand Isle is a barrier island in Jefferson Parish at the mouth of Barataria Bay. Much of Grand Isle is seasonally occupied a popular tourist destination and important to commercial fishing operations with three marinas: Bridgeside, Sanddollar and Wakeside, It is home to beach resorts, popular restaurants, and a large fishing pier (NOAA, 2005b). The Grand Isle Tarpon Rodeo is America's oldest fishing tournament and has been held in Grand Isle since 1932, a fishing event that attracts 15,000 visitors each year to Grand Isle (Rioux, 2011). The annual Grand Isle Migratory Bird Celebration, initiated in 1998, was created in part to support the purchase and management of the Grand Isle Sanctuary. Grand Isle was heavily impacted by Hurricane Katrina, with more than half of the homes on the island destroyed as the result of high winds and storm surge. However, the community has largely rebuilt in the aftermath (Buskey, 2007). Tourism was also impacted by cancellations of tourism-driving events in the year after the oil spill, such as the Grand Isle Tarpon Rodeo. Commercial and recreational fishing was grounds in federal and state waters were closed the summer after the spill leading to job losses during the traditionally busiest season of the year. As of the 2010 census, the town's resident population was 1,296, down from 1,541 in 2000; during summers, the population, including tourists and seasonal residents, sometimes increases to over 20,000.

Lafourche Parish

Lafourche Parish is located in southeast Louisiana, south-southwest of New Orleans. Bayou Lafourche provides a north-south waterway transportation to the Gulf of Mexico. The parish is accessible from the east and west via U.S. Highway 90.

Lafourche Parish encompasses 1,085 square miles of land and 388 square miles of water. Lafourche Parish has freshwater marsh in the northern reaches of the parish, while saltwater wetlands predominate in the south. The proposed MBSD diversion is located east of Lafourche Parish.

The parish is divided geographically, with the north focused on agriculture and service industries, and the south focused on maritime industries (Austin et al., 2014a). Heading south, first farming and then fishing communities are situated along the banks of Bayou Lafourche. In the 1820s, sugarcane became a prominent crop that supported much of the parish's economy. In addition, cotton, corn, rice, and peas were important crops in the parish. Marshland and periodic flooding from hurricanes limited farming in the lower reaches of the parish; fishing, hunting, and trapping were the primary activities in these lower reaches (Austin et al., 2014a).

Fishing, shrimping, crabbing, and oystering are long-standing practices, especially in the southern part of the parish. Similar to Plaquemines, Lafourche Parish's economy is highly dependent on natural resources common to the area. The agriculture, forestry, fishing and hunting, and mining (includes oil and gas) sectors accounted for around 10% of the employed labor force in 2017. Commercial fishing and agricultural production occupations account for 1.4% of the employed labor force in 2017. Although farming and fishing are still important parts of the parish's culture and economy, the discovery of onshore oil and gas in the 1930s, and offshore oil and gas in the 1940s and 1950s, have significantly reshaped the area's landscape and economy (Austin et al., 2014a).

Between 1940 and 1980, Lafourche Parish's population nearly doubled with an expansion of offshore oil production (NOAA, 2005a). In recent decades, growth has slowed, in part due to a slow-down in offshore production. In 2000, Lafourche Parish had a population of approximately 90,000. The population continued to grow throughout the following two decades: by 2010 the population grew 7.1% to 96,318 and, by 2017, the population grew another 1.9% to 98,112 (U.S. Census Bureau, 2018).

The parish has a history of devastating hurricanes including Rita, Gustav and Isaac. Damages from Hurricane Katrina, however, were moderate, especially compared to the devastation in Plaquemines Parish and in and around New Orleans (Dennis and Zeringue, 2005). The parish had downed trees and powerlines, as well as damaged roofs and broken windows (Dennis and Zeringue, 2005). In addition, the hurricane damaged infrastructure that supported commercial fishing; employment in select seafood processing and offloading facilities decreased by 33% between April 2004 and April 2006 (Impact Assessment, 2007; Austin et al., 2014a). The DWH oil spill in April 2010 also significantly impacted Lafourche Parish, with the southern part of the parish more adversely affected by the spill. Port Fourchon, a shallow draft port at the mouth of Bayou Lafourche on the Gulf of Mexico, is the single largest oilfield support facility in the Gulf of Mexico. The moratorium on deep water well development and reduction in number of permits affected the economic production at Port Fourchon (Austin et al., 2014a). The beach at Port Fourchon was closed for all of 2010. State waters were opened and closed multiple times to recreational and commercial fishing, sometimes with very short notice, which led to economic losses for fishermen and marinas (Austin et al., 2014b).

A Community Health Assessment Profile for Lafourche Parish conducted in 2013 (Lafourche Parish, 2014) in response to the DWH oil spill revealed some key health and health care needs across the parish. Data gathered from the Gulf State Population Survey and existing national and state sources suggest that residents in the parish are vulnerable to socio-economic and environmental factors, such as the DWH oil spill and hurricanes. Occupational and environmental health were a major concern among stakeholders, and data on work related hospitalizations reflects the stated need for culturally appropriate occupational health training in the parish. Hospital inpatient data, as well as state survey data, suggest that residents across the parishes experience substantial levels of chronic health conditions such as diabetes, obesity, and congestive heart failure, which not only reflect the health status of residents but also indicate a lack of adequate preventative care in the region. In fact, HPSA data analyzed in this report points to primary care shortages as an access to care priority across the parish. Stakeholders also pointed to fragmented mental health care and mental health case management as priority issues in the community. State survey data and vital statistics highlighted higher levels of depression, anxiety, and suicide among parish residents compared to the state, particularly for White residents. This analysis also highlighted additional barriers to accessing health care that residents in rural parishes may experience, which included substantial drive times to a primary care clinic for low-income residents and a designated mental health service provider shortage.

Northern Communities

The northern communities in Lafourche Parish include Thibodaux, St. Charles, Raceland, Des Allemands, Mathews, Lockport, and Gheens. Thibodaux is the parish's largest city and the parish seat. It is located at the intersection of Louisiana Highways 1 and 308, which run along Bayou Lafourche, and Louisiana Highway 20 (NOAA, 2005a). Thibodaux is home to Nicholls

State University and is served by the Thibodaux Municipal Airport. The community is a densely populated urban area and has a bustling downtown area with shops; a museum, boardwalk, and art gallery; and historic buildings and homes (NOAA, 2005a).

Historically, Thibodaux was an agricultural community, with sugar production as a mainstay of the economy. Sugarcane farming is still an important industry, as well as petrochemical production and associated services (NOAA, 2005a). Tourism has also become increasingly important to Thibodaux's economy, including recreational fishing, hunting and bayou tours (NOAA, 2005a). The community is not in close proximity to the Gulf; however, recreational fishing is popular in the area and anglers tend to access Lakes Des Allemands and Boeuf, and points of access south of Houma (NOAA, 2005a). Many commercial fishing families reside in the northern reaches of Thibodaux, while others reside throughout the town (NOAA, 2005a).

Raceland is located in the north part of Lafourche Parish at the junction of Louisiana Highways 1 and 308. The community is not in close proximity to the Gulf; however, recreational fishing and duck hunting in nearby wetland areas are popular (NOAA, 2005a).

Lockport is located on Highway 1 along Bayou Lafourche between Raceland and Cut Off. Lockport is named after the lock built at the link of Bayou Lafourche and the Mississippi River. The lock was built as part of the creation of a canal across Bayou Lafourche to link Bayou Terrebonne to New Orleans in 1947. The canal brought economic development into the area, which led to some of present-day Lockport's distinctive features, including brick sidewalks, an iron bridge over the Bayou, and a grid layout with a central business district (NOAA, 2005a). Agriculture, forestry, fishing and hunting, and mining are the four largest industries in Lockport (8.9% of employed civilians); after manufacturing; educational, health, and social services; and retail trade (18.4%, 18.3%, and 13.8% of civilians employed, respectively; U.S. Census Bureau, 2018).

Des Allemands is located along Bayou Des Allemands, which forms the boundary of Lafourche and St. Charles parishes. It is known as the "Catfish Capital of the Universe," and it hosts the Louisiana Catfish Festival each year. However, fishing is not among the top five industries of employment in Des Allemands (U.S. Census Bureau, 2018).

Mathews is located in the central part of Lafourche Parish and is bordered by Lockport and Raceland. Agriculture, forestry, fishing and hunting, and mining and manufacturing are the biggest industries of employment in Mathews, with 16.0% of the population employed in each sector (U.S. Census Bureau, 2018).

St. Charles and Gheens are small communities within the northern part of the parish. Gheens is located east of Mathews along Highway 308. St. Charles is located along Bayou Lafourche southeast of Thibodaux. Gheens is an unincorporated community with a population of 1,029, and St. Charles is a CDP with a population of 475 (U.S. Census Bureau, 2018).

Southern Communities

The southern communities in Lafourche Parish include Larose, Cut Off, Galliano, Golden Meadow, Leeville, and Port Fourchon. Larose, Cut Off, Galliano, and Golden Meadow combine to form a type of linear "supra-community" situated along the banks of Bayou Lafourche between Houma and New Orleans. The boundaries between these towns are difficult to differentiate as they are unincorporated CDPs, and they share services and cultural activities

(NOAA, 2005a). All four communities are supported by the fishing and petroleum industries, as well as the sugar cane industry (NOAA, 2005a); and these communities are home to a notable population of Vietnamese fishermen (Austin et al., 2014a). Hurricane Katrina was damaging to the economy of these connected communities because it flattened sugar cane crops and damaged commercial fishing infrastructure (Austin et al., 2014a).

Leeville is located along Louisiana Highway 1 south of Golden Meadow and northwest of Grand Isle. Culturally, Leeville is closely associated to Golden Meadow. Leeville is a small town with no post office, and residences have Golden Meadow addresses (NOAA, 2005a). Leeville began as a subsistence-oriented community in the late nineteenth century and was later destroyed by a hurricane in 1915. The community recovered during the 1930s, in part due to the region's oil industry (NOAA, 2005a). The oil industry remains crucial to the town's economy today, but the transport canals carved through the area by energy companies weakened wetlands and accelerated land loss. Around 70% of the town's surrounding wetlands have become open water since 1932 (Jervis, 2013). Because it is a low-lying community that is susceptible to frequent flooding, nearly all structures in Leeville are elevated (NOAA, 2005a). Leeville is a town outside of the levee system, making it particularly susceptible to hurricanes (Jervis, 2013). Land loss, coupled with the DWH oil spill in April 2010 and several hurricanes, have threatened Leeville's survival in recent years. Once home to several hundred residents, Leeville's population is now less than 100 (Fletcher, 2015). Between 2000 and 2010, the population decreased from approximately 71 residents to 44 (U.S. Census Bureau, 2018).

Port Fourchon is located in southern Lafourche Parish where Bayou Lafourche and the Gulf of Mexico meet. This location makes Port Fourchon an industrial center for the Gulf of Mexico's deep water petroleum exploration and development. Port Fourchon supplies nearly 20% of oil and gas in the United States, is connected to nearly 50% of the nation's refining capacity, and is a supply point for about 90% of offshore drilling vessels in the Gulf (Reckdahl, 2017). A 2012 assessment by the United States Department of Homeland Security determined that a 90-day closure of Port Fourchon could result in up to a $7.8 billion loss in gross domestic product; and the low-lying, two-lane road into the port is vulnerable to closure from storms and sea level rise. Currently, a project is underway to elevate the road and construct a new highway into the port (Kennedy and Dahlman, 2015).

Port Fourchon is also important to other critical oil and gas infrastructure in the Gulf. The nation's only super port, the Louisiana Offshore Oil Port (LOOP), and the central point of distribution for supertankers in the Gulf region is located 19 miles southeast of Port Fourchon (NOAA, 2005a). Although it is offshore, the LOOP handles 13% of the nation's foreign oil. A booster station located in Port Fourchon is important to the LOOP and all the oil is stored in the salt caverns in Galliano.

While the oil industry dominates Port Fourchon's economy, the commercial and recreational fishing industry also contributes to Port Fourchon's activity. The port has a small marina and serves as a harbor for deep sea charter boats and offshore shrimp trawlers (NOAA, 2005a).

2.2. Environmental Justice

This section describes minority and low-income populations that may be affected by the proposed Project. This evaluation builds from the data and information that were included in the

draft Affected Environment section of the EIS. Additional information was collected through a literature review (Appendix A) and interviews (Appendix B).

The Project Area, as defined by the Draft MBSD Affected Environment and locations of the parishes, is shown in Figure 2-1. The communities potentially affected by the Project are shown in Figure 2-2 and are described in Table 3.13-8 in the DEIS.

Additional data was obtained for communities identified in Table 3.13-8 of the DEIS that are likely to be impacted by the MBSD Project such as those dependent on industries that may be impacted by the Project (e.g., commercial fishing). The focus of this effort was on 41 communities in Plaquemines, Lafourche and Jefferson parishes that could be adversely impacted through impacts to commercial, recreational, and subsistence fishing (see Table 2-4). This section provides a description of the parish-level socioeconomic and minority data that is followed by a data summary for communities in the study area.

Figure 2-1. Parishes within the MBSD Project Area

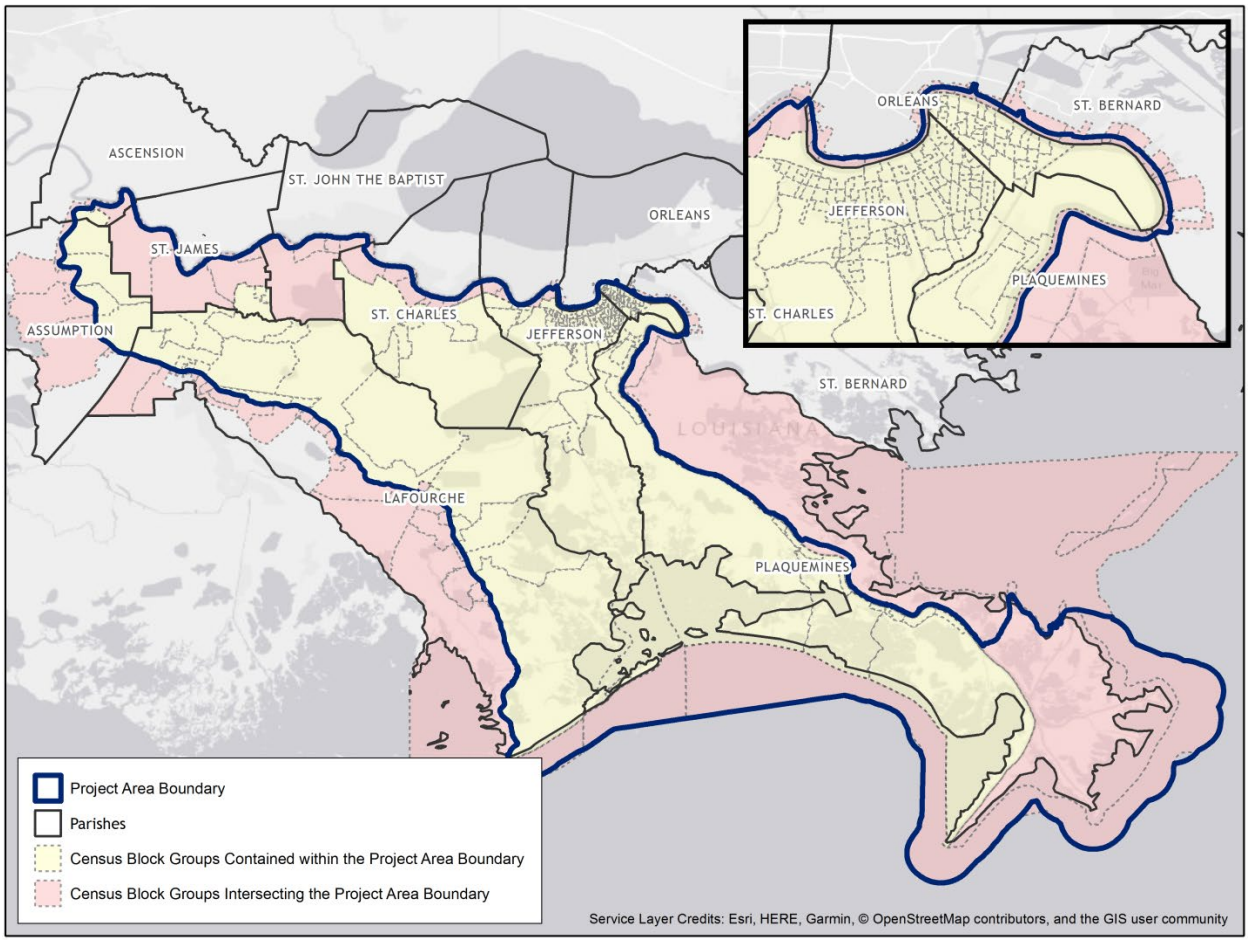
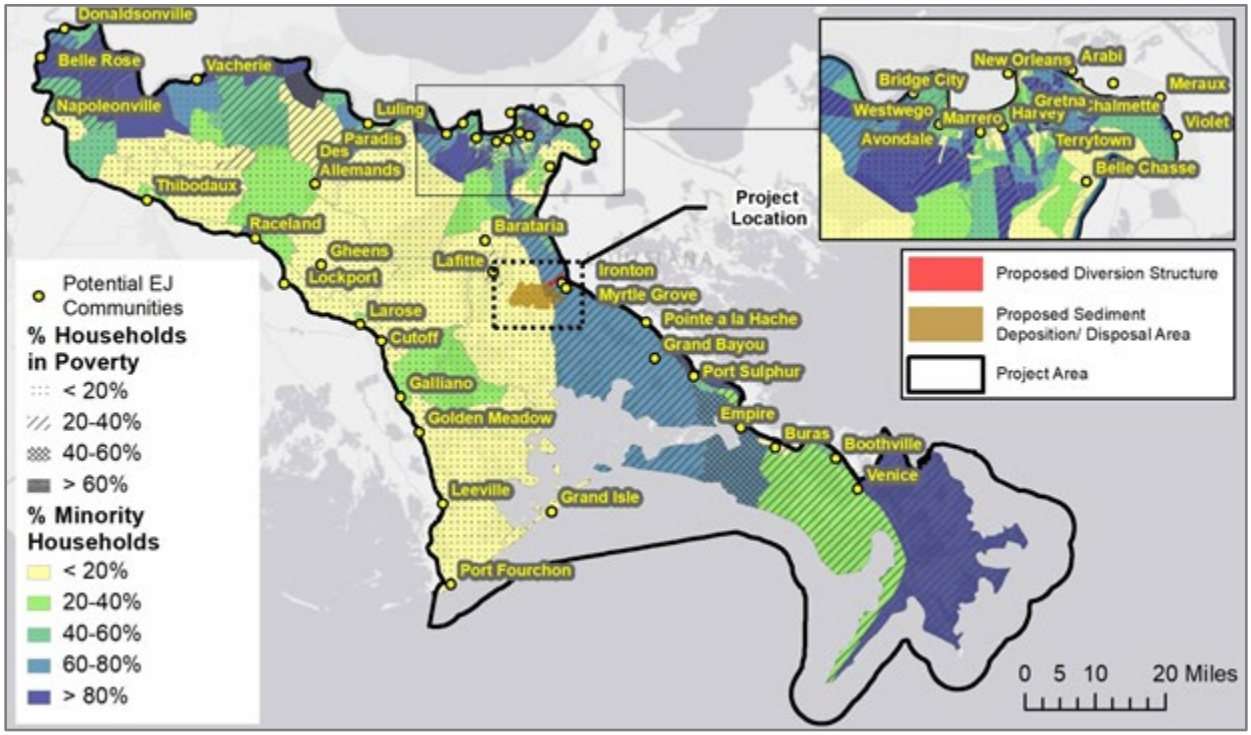


Figure 2-2. Communities in the Project Area



Source: Mid-Barataria Sediment Diversion Project DEIS, Chapter 3, Affected Environment (Version 3). May 11, 2018.

Plaquemines Parish

Plaquemines Parish's economy is highly dependent on the natural resources common to this region. Agriculture, forestry, fishing and hunting, and mining (includes oil and gas) sectors account for around 10% of the employment. Commercial fishing and agricultural production are also important sectors of the local economy and deeply rooted in the parish's geography and culture (Plaquemines Parish, 2016), accounting for approximately 4.5% of the employed labor force in 2017.

Over the last two decades, the percent of the population living below the poverty level has fluctuated between 9.4% and 19.3%, with 19.3% of the population living below the poverty level in the parish in 2017 (Table 2.1). Median and mean household income in 2017 was $49,635 and $68,790, respectively (U.S. Census Bureau, 2017). Since 2011, the percent of minorities living below the poverty level has been increasing in Plaquemines Parish (Austin et al., 2014a). Across Plaquemines Parish in 2017, approximately 35% of the population identified as a minority race or ethnicity (Table 2.1).

Table 2-1. Socioeconomic Indicators in Plaquemines Parish for 2000 and from 2010 to 2017

	2000	2010	2011	2012	2013	2014	2015	2016	2017
Population	26,757	23,042	22,976	23,220	23,385	23,545	23,599	23,584	23,394
Employed labor force	9,960	9,614	10,154	10,227	9,894	10,004	9,777	9,919	9,849
Percent minority	31.2%	32.2%	32.1%	32.2%	32.5%	33.0%	33.5%	33.8%	34.8%
Percent living below poverty level	18.0%	11.6%	9.4%	11.0%	12.7%	13.7%	16.2%	17.2%	19.3%
Percent of employment in agriculture, forestry, fishing and hunting, mining industry[a]	12.2%	5.3%	5.4%	8.8%	9.8%	12.0%	10.4%	10.9%	9.4%
Percent of employment in farming, fishing, and forestry occupations[b]	NA	NA	NA	NA	NA	NA	5.3%	5.6%	4.5%

[a] Industry data describe the type of business conducted by a person's employing organization. The U.S. Census Bureau reports the agriculture, forestry, fishing and hunting, and mining (includes oil and gas) industries as one category. Plaquemines Parish (2016) notes that the employment data in the agriculture, forestry, fishing and hunting, and mining industries are likely to be under-reported because some commercial fishing operations are undocumented and other activities related to seafood preparation and packaging are recorded as part of the manufacturing industry.

[b] Occupation data describe the type of work or activities a person performs on the job. The U.S. Census Bureau reports occupations in farming, fishing, and forestry independently from occupations in mining (which includes oil and gas).

Sources: All 2000 data from U.S. Census Bureau Summary File (SF) 1, 2010 data for population and percent minority from SF3; 2010 poverty data and all 2011 through 2016 data from U.S. Census Bureau, American Community Survey (ACS) 5-Year Estimates for 2006–2010, 2007–2011, 2008–2012, 2009–2013, 2010–2014, 2011–2015, and 2012–2016.

Jefferson Parish

The 665-square-mile parish has a population just under half a million people. It is the second-most populated parish in Louisiana; and most of the population lives in the northern portion of Jefferson Parish. In 2017, around 47% of the population identified as non-White or minorities. The percent of the population living below the poverty level was approximately 16% in 2017, up slightly since 2000 and 2010 (Table 2-2). The agriculture, forestry, fishing and hunting, and mining (includes oil and gas) industries accounts for around 1.7% of the employed population, with many of the residents in the southern portion of the parish involved with commercial and recreational fishing, and oil and gas industries and activities. Less than 1% of the employed labor force is employed in forestry, fishing, and agriculture occupations (Table 2-2).

Table 2-2. Socioeconomic Indicators in Jefferson Parish for 2000 and from 2010 to 2017

	2000	2010	2011	2012	2013	2014	2015	2016	2017
Population	455,466	432,552	432,310	432,706	433,477	434,528	435,092	435,204	437,038
Employed labor force	212,477	209,432	211,488	210,366	209,519	208,694	210,346	209,868	210,435
Percent minority	34.6%	44.0%	43.2%	43.9%	44.5%	45.1%	45.6%	45.9%	46.6%
Percent living below poverty level	13.7%	14.2%	15.1%	15.3%	16.5%	16.8%	16.8%	16.1%	16.3%
Percent of employment in agriculture, forestry, fishing and hunting, mining industry[a]	1.9%	1.9%	1.8%	1.8%	2.0%	2.0%	1.9%	1.9%	1.7%
Percent of employment in farming, fishing, and forestry occupations[b]	0.4%	NA	NA	NA	NA	NA	0.4%	0.5%	0.5%

[a] Industry data describe the type of business conducted by a person's employing organization. The U.S. Census Bureau reports the agriculture, forestry, fishing and hunting, and mining (includes oil and gas) industries as one category.

[b] Occupation data describe the type of work a person does on the job. The U.S. Census Bureau reports occupations in farming, fishing, and forestry independently from occupations in mining (which includes oil and gas).

Source: All 2000 data from U.S. Census Bureau SF1, 2010 data for population and percent minority from SF3; 2010 poverty data and all 2011 through 2016 data from U.S. Census Bureau, ACS 5-Year Estimates for 2006–2010, 2007–2011, 2008–2012, 2009–2013, 2010–2014, 2011–2015, 2012–2016, and 2013–2017.

Lafourche Parish

In 2017, approximately 23% of the population identified as a minority race or ethnicity (Table 2-3). The Houma, the largest Native American tribe in Louisiana, are not a federally recognized tribe, which severely limits the federal health and welfare resources available to them. The majority of Houma reside along Highway 1 in south Lafourche Parish, between Larose and Golden Meadow; and on the western boundary of Lafourche Parish, in the area around the City of Houma (Hemmerling and Colten, 2004). The tribe has approximately 17,000 enrolled tribal citizens residing across several parishes encompassing 4,750 square miles including, Lafourche, Jefferson, Plaquemines, Terrebonne and St. Bernard parishes (Ellis, 2013). As many of tribal communities are in coastal areas and depend on the swamps and bayous as a source of food and economic resource, they have been severely affected by the continuing coastal erosion and loss of wetlands due to a number of industrial and natural causes, including dredging of navigation canals by shipping and oil companies, leading to increased salt water intrusion and loss of wetlands plants. The community of Isle de Jean Charles has suffered severe erosion; scientists estimate that the island will be lost by 2030 if no restoration takes place. Coastal erosion has adversely affected the quality of fishing. The tribe has suffered from a decrease in fish, as saltwater intrusion has destroyed many of the old fishing holes (United Houma Nation, 2019).

The majority of Black or African Americans reside in Thibodaux, as well as in Larose and Lockport (Hemmerling and Colten, 2004). In addition, recent immigrants to south Louisiana and Lafourche Parish include Southeast Asians, particularly Vietnamese. Many Southeast Asians are employed in the seafood industry (Hemmerling and Colten, 2004). Over the last two decades, the percent of the population living below the poverty level was between 14% and 16% (Table 2-3). Less than 2% of the workforce has occupations in fishing and farming in the parish.

Table 2-3. Socioeconomic Indicators in Lafourche Parish for 2000 and from 2010 to 2017

	2000	2010	2011	2012	2013	2014	2015	2016	2017
Population	89,974	96,318	95,895	96,453	96,755	97,235	97,474	97,688	98,112
Employed labor force	37,207	42,698	42,623	43,616	43,445	43,367	43,542	43,290	42,975
Percent minority	17.8%	22.0%	21.6%	21.9%	22.3%	22.7%	23.0%	22.9%	23.1%
Percent living below poverty level	16.5%	15.6%	15.5%	14.5%	14.1%	14.6%	14.8%	15.4%	16.0%
Percent of employment in agriculture, forestry, fishing and hunting, mining industry[a]	8.2%	8.8%	7.9%	8.1%	9.5%	9.4%	9.7%	9.9%	9.9%
Percent of employment in farming, fishing, and forestry occupations[b]	1.7%	NA	NA	NA	NA	NA	1.3%	1.5%	1.4%

[a] Industry data describe the type of business conducted by a person's employing organization. The U.S. Census Bureau reports the agriculture, forestry, fishing and hunting, and mining (includes oil and gas) industries as one category.

[b] Occupation data describe the type of work a person does on the job. The U.S. Census Bureau reports occupations in farming, fishing, and forestry independently from occupations in mining (includes oil and gas).

Source: All 2000 data from U.S. Census Bureau SF1, 2010 data for population and percent minority from SF3; 2010 poverty data and all 2011 through 2016 data from U.S. Census Bureau, ACS 5-Year Estimates for 2006–2010, 2007–2011, 2008–2012, 2009–2013, 2010–2014, 2011–2015, 2012–2016, and 2013–2017.

Communities and unincorporated areas with environmental justice populations in Plaquemines, Jefferson, and Lafourche parishes that could be affected by the Project include:

- Plaquemines Parish: Belle Chasse, Live Oak, Ironton, Myrtle Grove, Pointe à la Hache, West Pointe a la Hache, Grand Bayou, Port Sulphur, Empire, Buras, Triumph, Boothville, Venice, Braithwaite, Scarsdale, Woodlawn, Wills Point, Phoenix, Davant, and Bohemia
- Jefferson Parish: Barataria, Lafitte, Jean Lafitte, Estelle, Woodmere, Harvey, Timberlane, Crown Point, and Grand Isle
- Lafourche Parish: Thibodaux, St. Charles, Des Allemands, Raceland, Gheens, Mathews, Lockport, Larose, Cut Off, Galliano, Golden Meadow, Leeville, and Port Fourchon.

Table 2-4 summarizes the EJ characteristics associated with these communities. If available, the table summarizes data for Census Designated Place (CDP) and communities that are CDP's are identified in the table. Because of their size, not all communities listed in Table 2-4 are CDP's and thus data on minority and low-income populations was obtained for the census block where each non-CDP community is located. The census block data often covers a geographic area larger than the identified community. For example, the census block that includes Myrtle Grove also includes areas outside of the boundaries of Myrtle Grove, and consequently the data in the table includes populations outside this specific community. This is the result of a limitation in the available data.

Table 2-4. Environmental Justice Characteristics Associated with Communities in Plaquemines, Jefferson and Lafourche Parishes Potentially Affected by the Diversion

Parish	Community	Census Block (2010)	Population	Percent Minority	Minority Populations	Below Poverty Level (%)
Plaquemines Parish (35% minority; 19% living below poverty level)	Belle Chasse CDP		13,585	21%	Black or African American; Asian; American Indian; Hispanic	12%
	Live Oak	Census Tract 504, Block Group: 1, Block 1045, 1046, 1047, 1048, 1049, 1050, 1052, 1063, 1064, 1065, 1066, 1067, 1068, 1070, 1071, 1072, 1073, 1074, 1076, 1077, 1078, 1079, 1078, 1079, 1080, 1081, 1664, 1665, 1666; Census Tract 504, Block Group: 2, Block: 2003, 2005, 2006, 2007, 2008, 2009, 2012, 2013, 2013, 2014, 2015, 2020, 2021, 2022, 2024, 2025, 2026, 2030, 2037, 2039, 2040, 2042, 2043, 2045, 2046, 2053, 2057, 2058, 2059, 2060, 2061, 2062, 2065, 2069, 2070, 2073, 2074, 2075, 2082, 2083, 2084, 2085, 2087, 2088, 2089, 2090, 2091, 2092	2,830	29%	Black or African America; Native America; Asian	25%
	Ironton	Census Tract 504, Block Group: 1, Block 1061, 1166, 1164, 1168, 1660	120	97%	Black or African American	25%
	Myrtle Grove	Census Tract 504, Block Group: 1, Block 1057, 1059, 1132, 1133, 1142, 1159, 1160, 1162, 1169, 1170, 1198	86	19%	Black or African American	25%
	Grand Bayou	Census Tract 504, Block Group 1, Block: 1357, 1379, 1384	44	43%	American Indian	25%

Parish	Community	Census Block (2010)	Population	Percent Minority	Minority Populations	Below Poverty Level (%)
	Port Sulphur CDP		1,934	82%	Black or African American	51%
	Empire CDP		1,054	57%	Black or African American; Asian (Vietnamese	32%
	Buras CDP		877	17%	Asian (Vietnamese); some other race	14%
	Triumph CDP		447	16%	Asian; two or more races	14%
	Boothville CDP		701	52%	Black or African American; Asian (Vietnamese)	36%
	Venice CDP		269	16%	Hispanic; American Indian	19%
	Braithwaite	Census Tract 501, Block Group 2, Block: 2002, 2003, 2004, 2005, 2017, 2026, 2028, 2030, 2033, 2035, 2083, 2084	263	41%	Black or African American	23%
	Scarsdale	Census Tract 501, Block Group 2, Block: 2025, 2036	66	2%	Some other race	23%
	Woodlawn	Census Tract 501, Block Group 2, Block: 2055, 2057	37	8%	Black or African American	23%
	Wills Point	Census Tract 501, Block Group 2, Block: 2060, 2061, 2062, 2063	196	26%	Black or African American	23%
	Phoenix	Census Tract 501, Block Group 1, Block: 1897,1899, 1907	386	99%	Black or African American	28%
	Davant	Census Tract 501, Block Group 1, Block: 1914	318	94%	Black or African American; Asian	28%
	Pointe à la Hache CDP		251	100%	Black or African American	51%
	Bohemia	Census Tract 501, Block Group 1, Block: 1905,1910	33	97%	Black or African American	28%
Jefferson Parish (47% minority; 16% living below poverty level)	Estelle CDP		16,791	52%	Black or African American; Hispanic; Asian	13%
	Woodmere CDP		11,114	86%	Black or African American; Asian; Hispanic	22%

Parish	Community	Census Block (2010)	Population	Percent Minority	Minority Populations	Below Poverty Level (%)
	Harvey CDP		20,311	64%	Black or African American; Asian; Hispanic; Asian	20%
	Timberlane CDP		10,655	64%	Black or African American; Asian; Hispanic; Asian	8%
	Crown Point	Census Tract 278.09, Block Group 4, Block: 4037, 4039; Census Tract 280, Block Group 1, Block: 1033, 1044, 1045, 1046, 1047, 1049, 1054, 1055, 1056, 1059	797	17%	Black or African American; American Indian	22%
	Jean Lafitte (town), CDP		1,839	14%	American Indian; Hispanic	13%
	Barataria CDP		1,090	14%	Two or more races; Black or African American	8%
	Lafitte CDP		823	0%	NA	33%
	Grand Isle CDP		760	0%	NA	14%
Lafourche Parish (23% minority; 16% living below poverty level)	Thibodaux City CDP		14,488	37%	Black or African American	19%
	St. Charles	Census Tract 209, Block Group 1, Block: 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1028, 1032; Census Tract 209.02, Block Group 2, Block: 2002; Census Tract 209.02, Block Group 3, Block: 3012, 3014	475	13%	Black or African American	14%
	Raceland CDP		10,322	38%	Black or African American	21%
	Des Allemands CDP		1,462	16%	Black or African American; two or more races	6%
	Gheens	Census Tract 210, Block Group 2, Block 2028, 2029, 2030, 2041, 2045, 2058, 2059, 2010, 2012, 2020, 2021,	1,029	4%	Black or African American; American Indian; Asian; two or more races	15%

Parish	Community	Census Block (2010)	Population	Percent Minority	Minority Populations	Below Poverty Level (%)
		2022, 2023, 2025, 2026				
	Mathews CDP		2,556	5%	Asian; two or more races	5%
	Lockport CDP		2,678	11%	Hispanic; Black or African American	19%
	Larose CDP		7,732	20%	Hispanic; Asian	15%
	Cut Off CDP		5,503	23%	Hispanic; two or more races	10%
	Galliano CDP		7,650	24%	Hispanic; American Indian	14%
	Golden Meadow CDP		1,912	17%	Hispanic	18%
	Leeville	Census Tract 211, Block Group 1, Block: 1253; Census Tract 212, Block Group 2, Block: 2075, 2101, 2103, 2104, 2107, 2108, 2112, 2114	44	14%	Some other race	16%
	Port Fourchon*	Census Tract 211, Block Group 1, Block: 1237, 1241, 1252, 1266, 1267, 1268, 1269, 1270, 1271, 1279, 1282	25	20%	American Indian; some other race; two or more races	8%

Sources:
CDPs use socioeconomic statistics currently available from the U.S. Census Bureau's 2017 ACS five-year estimates from 2013 to 2017. Minority data for the non-CDP communities were obtained for 2010 from the U.S. Census Bureau for Block-level data for U.S. Census Blocks that include and encompass the community. The percentage of individuals living below the poverty level for non-CDP communities was obtained for the Census Block Group in which the community is located.

Subsistence Activities

In order to evaluate the potential impacts of the Project on subsistence activities, it is necessary to define what is meant by "subsistence." Popular references to these types of activities include such ideas as meeting minimal dietary needs, living off the land, and harvests intended for one's household use (Regis and Walton, 2018). Researchers have narrowed the definition of subsistence to include activities that occur outside those that are industrial, technologically intensive, or market-based. For purposes of this socioeconomic analysis, the definition of subsistence discussed in Regis and Walton (2018, p.55) will be adapted: "subsistence might most usefully describe a diverse array of activities (or practices) which are governed by non-market logics, have goals other than generating profit, and, while contributing to food needs, also contribute to the pleasure of producing fresh, flavorful, valued foods and sharing those with friends and family" :that contribute to food needs and also contributes to the pleasure of producing foods and sharing those with friends and family." This definition expands subsistence beyond nutritional needs to include activities that strengthen social ties to family, neighbors, and

coworkers. Studies have indicated that subsistence in this form is very common for many households across coastal Louisiana, where many residents participate in a hybrid economy that includes traditional types of employment with firms operating in a market economy while also engaging in various self-provisioning activities.

Regis and Walton (2018) evaluated subsistence habits in Lafourche and Terrebonne parishes and identified a number of foods that were harvested, exchanged, or shared among households. Those items relevant to the proposed MBSD impact analysis include 12 types of fish; common forms of seafood (crabs, shrimp, oysters, and some crawfish); and game including deer, wild hog, rabbit, squirrel, duck, and other waterfowl. Regis and Walton (2018) also indicated in their study that loss of access to hunting and harvesting can have EJ implications, with poorer households impacted most heavily. In lower Plaquemines Parish, subsistence fishing occurs regularly; local people depend on the Barataria Basin to feed their families and for social networks (Austin et al., 2014a).

While various subsistence activities are very important and entwined in the culture and lifestyles of many coastal Louisiana households, there is evidence that these practices are even more important to specific cultural and indigenous groups. Cajun culture and identity increasingly signify a subsistence fishing and trapping lifestyle that incorporates long-standing, intimate connections with the south Louisiana wetland landscape (Wiley, 2002; Bernard, 2003; Austin et al., 2014a). Subsistence fishing is also crucial in Native American and Vietnamese communities (Austin et al., 2014a). For example, the Natural Resources Defense Council (Austin et al., 2014b) found in their 2010 survey after the DWH oil spill that some Gulf Coast communities, especially Vietnamese-American and Native American fishing communities in Mississippi and Louisiana, ate between 3.6 and 12.1 times more shrimp and twice as much oysters and crabs than assumed in the federal risk assessment, which was based on the 90th percentile of seafood consumers nationally.

Unlike many other areas in the United States, fishing and hunting to meet household food needs and for bartering is widespread throughout the region, particularly in south Louisiana, and not just among commercial fishermen. Game and seafood also play important roles in many social occasions and events along the coast. For example, seafood boils provide a very common locus for community gatherings. Locally fished and hunted seafood and game are important in more formal social occasions (e.g., religious holidays and local festivals; Austin et al., 2014a).

Commercial Fishing Activities Important to Environmental Justice Populations

Commercial fisheries and seafood processing have a long history, are prevalent in coastal Louisiana communities, and are important to minority and low-income populations. The commercial fishing industry in Louisiana includes four principal fisheries: shrimp, oysters, crabs, and finfish; with menhaden, grouper, red snapper, and yellowfin tuna making up a large proportion of the regional finfish catch.

Many minority communities are heavily involved with the shrimping industry. Austin et al, (2014b, p. 23) state, “Since the late 1970s Vietnamese-Americans have taken a prominent place in the Gulf of Mexico shrimp industry, today operating a large number of the fishery’s steel-hulled freezer boats that work the open Gulf for a month at a time and shrimp buying docks in communities where Vietnamese shrimpers are numerous (Austin et al., 2014b).” Since Hurricane Katrina, many Vietnamese fishermen live in Plaquemines Parish only during the fishing season

and spend the rest of the year in larger Vietnamese communities in the New Orleans MSA (Austin et al., 2014b).

Among the EJ communities identified earlier in this section, those with measureable shrimp landings from Barataria Basin in 2014 include Port Sulphur (38 commercial fishing license holders landing shrimp), Empire (12 commercial license holders landing shrimp), Boothville (includes Buras and Fort Jackson; 113 commercial licenses holders landing shrimp), Lafitte (42 commercial license holders landing shrimp), and Leeville and Golden Meadow (11 commercial license holders landing shrimp). The Empire-Venice community has been heavily involved in the commercial shrimp fishery, with the majority of the fishers of Asian descent (Ingles and McIlvaine-Newsad, 2007). Lafitte, located close to Barataria Bay, Lake Salvador, and coastal wetlands, is an important fishing and shrimping area, with many residents claiming fishing as their primary occupation (NOAA, 2005b).

The majority of the members of the Houma Nation reside along Highway 1 in south Lafourche Parish, between Larose and Golden Meadow; and on the western boundary of Lafourche Parish, in the area around the City of Houma. The Houma have retained traditional practices, and many in the area continue to make a living from shrimping (Hemmerling and Colten, 2004) in both the Barataria and Terrebonne Basins.

Oyster farming is also prevalent in these coastal Louisiana communities. Two-thirds of the Gulf's oysters are landed in Louisiana. The Louisiana Department of Wildlife and Fisheries (LDWF) leases water bottoms for oyster cultivation to individuals and maintains public seed grounds (Deseran and Riden, 2000; Austin et al., 2014b).

Some fishermen in coastal Louisiana are also involved in the processing industry in the area, shucking and selling wholesale oysters, and processing shrimp and crab catches. Processors typically have had difficulties obtaining labor for oyster shucking, crab picking, or shrimp processing (Austin et al., 2014b). Processors turned to Southeast Asian immigrant women in the 1970s and 1980s (Austin et al., 2014b) and, increasingly, to Hispanic immigrants, some of them temporary agricultural (H-2A) visa workers, in the 1990s and 2000s (Austin et al., 2014b).

These natural resource-based industries, especially oyster harvesting from leased water bottoms, tie their employees and communities to the waters where these resources and the processing infrastructure are located. Larger-scale oyster harvesters with bigger boats and more leases tend to rely exclusively on oysters for income, while smaller-scale oystermen often work side jobs, most commonly in other commercial fisheries, when they are not oystering (Deseran and Riden, 2000; Austin et al., 2014b). The oyster fishing community in Plaquemines Parish includes fishers of Croatian descent (Deseran and Riden, 2000; Austin et al., 2014b). There is also a significant community of Black or African-American and Creole oyster harvesters in Port Sulphur in lower Plaquemines Parish (Austin et al., 2014b).

Prevalent coastal Louisiana EJ communities with oyster landings in Barataria Basin in 2014 include Port Sulphur (including Grand Bayou, Myrtle Grove, and Ironton; 38 commercial license holders landing oysters); Empire (8 commercial license holders landing oysters), and Boothville (includes Buras and Fort Jackson; 39 commercial license holder landing oysters).

Grand Bayou village in Plaquemines Parish is home to approximately 40 residents of the Atakapa-Ishak/Chawasha tribe (Marshall, 2016). The community is accessible only by boat, and

the residents are highly dependent on their surrounding environment. The community fishes, hunts, and traps local, natural resources, including various fish species, oysters, crab, nutria, and alligator (Bethel et al., 2011); most residents are commercial fishermen.

Social Vulnerability

NOAA's National Marine Fisheries Service has developed a suite of Community Social Vulnerability Indicators (CSVIs) that include measures of social vulnerability in coastal communities, including:

- Labor force structure: characterizes the strength and stability of the labor force and employment opportunities that may exist;
- Housing characteristics: measures infrastructure vulnerability and includes factors that indicate housing that may be vulnerable to coastal hazards;
- Poverty: based on different poverty variables that cover all facets of the concept of poverty including the elderly, young, and families in poverty, along with the general percent of population receiving assistance;
- Population composition: indicates presence of populations traditionally considered more vulnerable due to circumstances often associated with low incomes and fewer resources; and
- Personal disruption: factors that disrupt a community member's ability to respond to change because of personal circumstances affecting family life, educational levels, or propensity to be affected by poverty.

The methodology for developing the CSVIs is described in Jepson and Colburn 2013. Data included in the indicators includes U.S. Census American Community Survey (ACS), fisheries landings data and recreational data from NOAA or the relevant state agency as well as environmental risk data for sea level rise and storm surge risk. Sea level rise data comes from NOAA digital elevation models and the National Elevation Dataset. Storm surge risk is derived from the Sea Lake and Overland Surges from Hurricanes program. NOAA's CSVIs data includes over 4,000 coastal communities across the United States. However, not all communities within the Project area are included in the CSVI dataset. Some communities do not have data available to develop an indicator score.

CSVIs are ranked from low to high based on a normalized scale with 0 as the mean. Higher CSVI scores indicate a more vulnerable population. Based on CSVIs, several communities in the Project Area experience high vulnerability for a variety of social and economic issues as well as sea-level rise risk (Table 2-5). The social indicators with the most communities ranking high including housing characteristics, poverty and personal disruption.

Table 2-5. Community Social Vulnerability Indices by Coastal Community, 2016

Coastal Community	Social Vulnerability Indices[a]					Sea-Level Rise Risk Index
	Labor Force	Housing Characteristics	Poverty	Population Composition	Personal Disruption	
Jefferson Parish						
Avondale	Medium	Medium	High	High	High	Low
Barataria	Low	N/A	Medium	Low	High	High
Bridge City	Low	High	High	High	High	Low
Grand Isle	Medium High	Medium High	Medium	Low	Low	High
Gretna	Medium	Medium High	Medium	Medium High	Medium High	Low
Lafitte	High	N/A	High	Low	Medium	High
Jean Lafitte	Low	Medium High	Medium	Low	Medium	High
Terrytown	Low	Medium	Medium High	High	Medium High	Low
Westwego	Medium	Medium High	High	Medium	High	Low
Lafourche Parish						
Cut Off	Medium	Medium High	Low	Low	Medium	Low
Galliano	Medium High	High	Low	Medium	Medium	Low
Lockport	Medium	High	Medium	Low	Medium High	High
Raceland	Low	High	Medium	Medium	High	High
Thibodaux	Medium	Medium High	Medium	Medium	High	Medium
Golden Meadow	Medium High	High	Medium High	Low	Medium High	Low
Larose	Medium	High	Medium	Medium	Medium	High
Orleans Parish						
New Orleans	Low	Medium	High	Medium High	Medium High	Medium
Plaquemines Parish						
Belle Chasse	Low	Medium	Low	Medium	Low	Low
Boothville	Medium High	N/A	High	Medium	High	Low
Venice	Low	N/A	High	Low	Medium High	Low

Coastal Community	Social Vulnerability Indices[a]					Sea-Level Rise Risk Index
	Labor Force	Housing Characteristics	Poverty	Population Composition	Personal Disruption	
Buras	Low	High	Low	Low	Low	Medium
Empire	Medium High	High	High	Medium	Medium High	Medium
Port Sulphur	High	N/A	High	High	High	Medium
St. Bernard Parish						
Chalmette	Low	Medium High	Medium High	Medium High	Medium High	Low
Meraux	Low	Medium	Low	Low	Low	Low
Violet	Medium	Medium	High	Medium High	High	Low
St. Charles Parish						
Des Allemands *(Partially in Lafourche Parish)*	Medium	High	Low	Low	Medium	High
Luling	Low	Medium	Low	Low	Low	High
Paradis	Medium	High	Low	Medium	Medium	High

Source: NOAA Fisheries Office of Science and Technology 2019a. NOAA Fisheries CSVIs. Version 3. https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities.

[a] High index indicates higher vulnerability. Indicators are classified as high, medium high, medium, and low. N/A reflects insufficient data.

2.3. Land Use and Property Values

Current land uses for areas encompassing the Project footprint are described in Section 4.16.2 Land Use and Land Cover of the EIS (Table 4.16-1 and Figure 4.16-1). The largest land use in the proposed Project footprint is cultivated crops (312 acres) followed by deciduous forest (106 acres). The rest of the 1,034 acres of the Project footprint is comprised of a mix of developed and undeveloped parcels.

Assessed Property Values

Assessed values for properties located near the proposed diversion are summarized in Figure 2-3. Values range from under $5,000 for properties categorized as marsh that are used primarily for oil and gas operations and recreational activities, to over $2 million for properties that are slated for industrial development sometime in the future.

Assessed values for areas characterized as residential are summarized in Table 2-6. This includes communities near the diversion that could be impacted by the Project. Data were obtained from the Plaquemines Parish Assessor's Office. In Myrtle Grove, there are 110 developed lots[1] and 212 undeveloped lots. The average assessed value of developed lots is $23,477 and the average assessed value of undeveloped lots is $2,737. In Woodpark, there are 36 developed lots and 3 undeveloped lots. The average assessed value of developed lots is $6,821 and the average assessed value of undeveloped lots is $1,760.

Total assessed values for Jefferson Parish and Plaquemines Parish since 2000 are summarized in Figure 2-4.

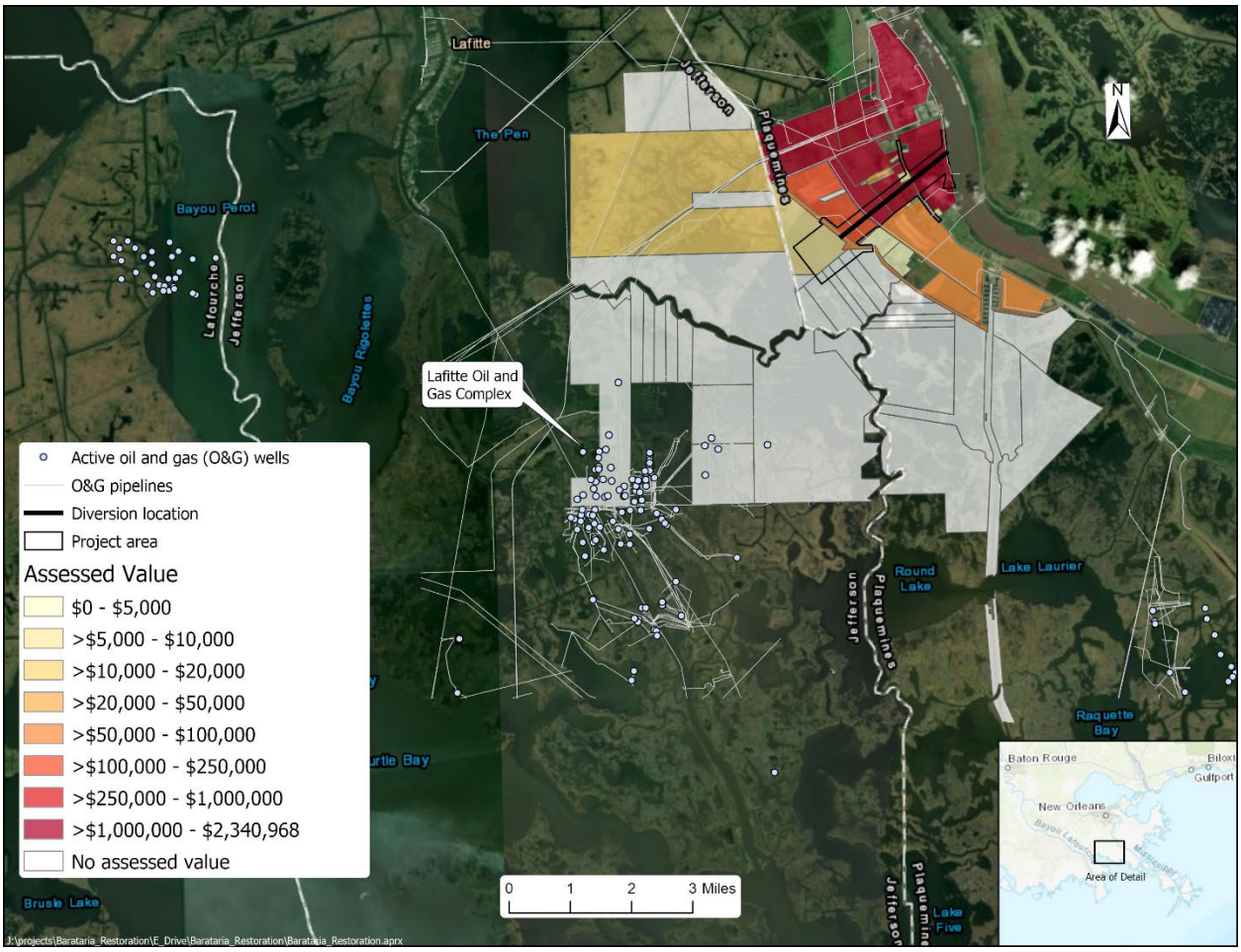
Table 2-6. Assessed Values of Residential Properties Located near the Project Site

Assessed Values	Myrtle Grove	Hermitage	Suzie Bayou North	Suzie Bayou South	Wood Park	Happy Jack	Grand Bayou
Mean	$18,670	$6,487	$5,506	$6,104	$7,817	$11,118	$3,696
Median	$11,305	$5,519	$5,559	$5,506	$7,822	$11,260	$3,567
Max	$68,984	$17,458	$11,382	$18,094	$14,417	$35,956	$9,120
Min	$1,256	$100	$1,414	$1,134	$960	$2,375	$503

Source: Plaquemines Parish Assessor, 2019

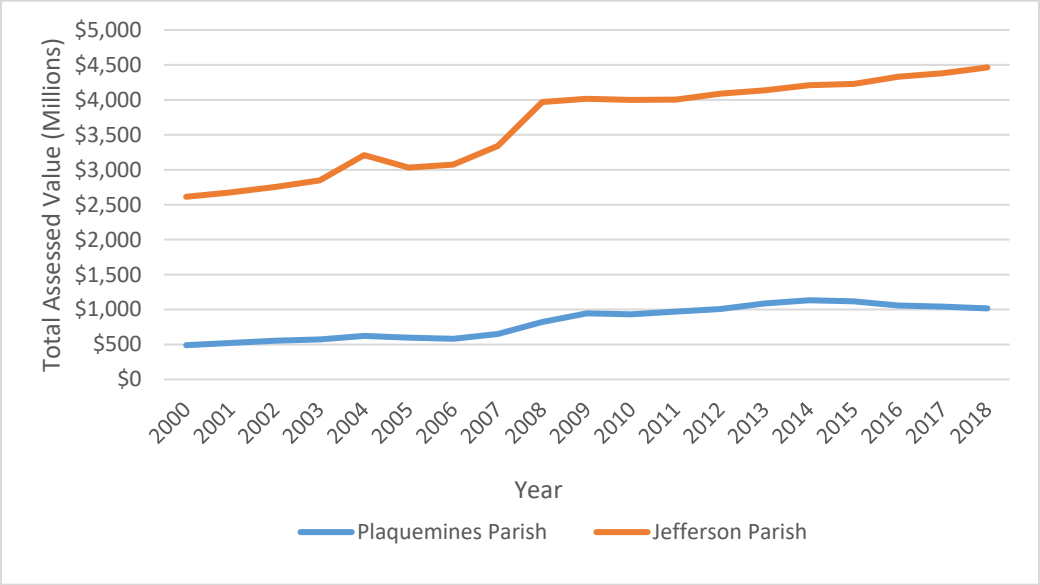
[1] A lot or parcel of land is an area that is meant to be owned by some owners. The size of a designated lot is determined when the area is surveyed and platted.

Figure 2-3. Assessed Property Values near the Proposed Project



Source: Data obtained from the Plaquemines Parish Assessor

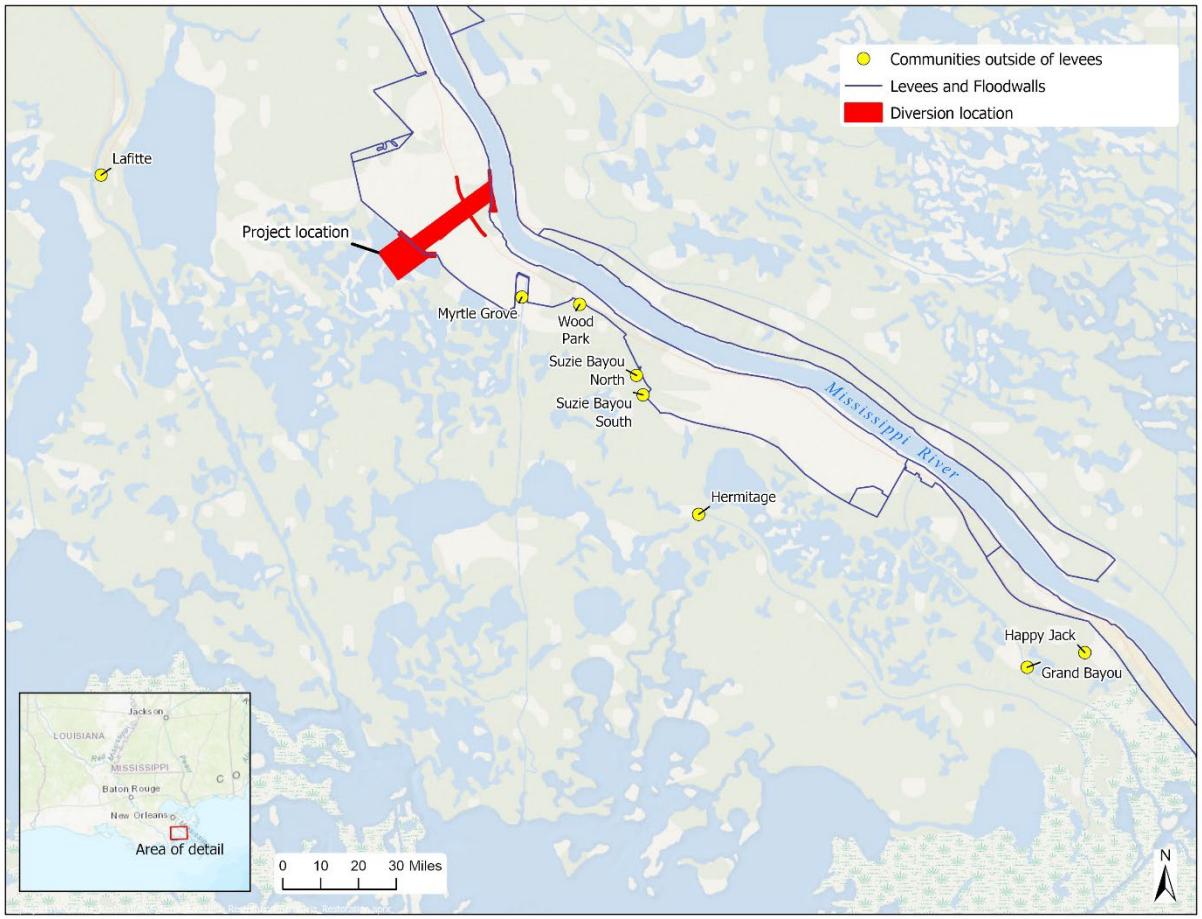
Figure 2-4. Total Assessed Value in Plaquemines and Jefferson Parish over Time



Source: Louisiana Tax Commission, 2019

Through a site visit, additional information was collected on properties in communities located outside of levee protection (Figure 2-5).

Figure 2-5. Location of Communities Outside of Flood Protection near the Project Site



Source: Abt Associates

Table 2-7 provides a screening-level description of the types of properties that are located outside of tidal protection *and* accessible from public roads or supported by public utilities. These data are intended to define the spatial scope for potential land services surveys of unprotected infrastructure that could be affected by the Project. The number of properties per community range from 80 in Happy Jack to ten in Grand Bayou. The vast majority of these properties are residential or recreational in nature. Based on a visual road survey during September 2019, a general majority of active living structures appear elevated enough to accommodate 2019 high tide flooding. Some level of flooding will start to occur in these communities when water surface elevations reach 1.5 to 2.1 feet (Marino, 2019).

Table 2-7. Property Information for Communities Outside of Levee Protection near the Project

Communities	Business Properties Observed	Estimated Number of Developed / Undeveloped Properties[a]	Estimated Total Property Value[b] ($ M)	Water Surface Elevation Producing an Onset of Tidal Flooding in 2019 (ft NAVD88)	Elevation Range of Roads in 2019 (ft NAVD88)
Myrtle Grove Estates and Marina	1 marina	76/231	$52	1.7	0-3
Woodpark	None observed	24/8	$3.1	2.1	2-4
Suzie Bayou: North and South	None observed	66/28	$7.6	1.9	1.5-6
Lake Hermitage	One (1) fishing guide service and lodging observed	55/30	$5.6	1.5	1.5-3
Happy Jack	None observed	80/36	$18.2	1.5	1-2
Grand Bayou	None observed	10/30[c]	$1.4	1.5	1-3

[a] Total parcels were estimated from Plaquemines Parish Tax Assessor's online mapping tool. Developed properties (residences) and undeveloped properties (bare lots) were estimated from road and desktop analysis.
[b] Estimates of property value were based on online value estimates (not appraised) and mean values applied to 'developed' and 'undeveloped'.
[c] Grand Bayou properties include those accessible by both road and boat. Based on a community meeting in 2019, an elder of the Atakapa-Ishak/Chawaska tribe indicated that 4 structures are considered tribe member residences in 2019. These residences were elevated ~ 4 ft or more above land elevation following Hurricane Katrina.
Source: Marino, 2019

Flood Insurance

An important consideration of land use in coastal Louisiana is the availability of affordable flood insurance. This is especially true for areas in the floodplain district that are prone to periodic or occasional inundation and are not within publicly owned hurricane protection levees or pump drainage systems. Recent changes to the National Flood Insurance Program (NFIP) may impact home and business owners' abilities to obtain flood insurance for properties within the Project Area. Two laws driving changes to the NFIP are the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12) and the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA), which are discussed below.

Biggert-Waters Flood Insurance Reform Act of 2012

BW-12 was passed by Congress in 2012 with the primary objective of extending the authority of the NFIP for five years and improving financial security for the program (FEMA, 2013). The NFIP was originally intended to be a self-sustaining program with claims paid with policy premiums. In actuality, the program was unsustainable because low participation and subsidized premiums resulted in the fund being unable to cover the costs of large catastrophic storm events (e.g., Hurricane Katrina). BW-12 allowed for an escalation in premiums of up to 25% per year (upping the cap from a 10% annual increase). In addition, for some properties that were previously subsidized, premiums would be increased 25% per year until the policy was no longer subsidized (the premium would be based on the actual risk of flooding). Finally, legislation phased out the grandfathering of properties that were built under a prior, outdated Flood Insurance Rate Map (FIRM) and have realized an increase in the base flood elevation due to

updates in the FIRM. These properties will also be subject to premiums based on the actual risk of flooding.

Homeowner Flood Insurance Affordability Act of 2014

President Obama signed the HFIAA into law on March 21, 2014 (FEMA, 2014). The law repeals and modifies some of the provisions included in the BW-12. The new law lowers rate increases on some policies, prevents some future rate increases, and implements a surcharge on all policyholders (FEMA, 2014). While the HFIAA provides some relief to policyholders from escalating rates, rates will be allowed to increase in a more gradual manner than prescribed under BW-12. According to HFIAA, the Federal Emergency Management Agency (FEMA) is required to increase premiums 5% per year until the class premium reaches its full-risk rate. Note that 80% of NFIP policyholders paid full-risk rates prior to BW-12 and HFIAA, and are expected to be minimally impacted by either law. HFIAA also repeals the provision of BW-12 that required FEMA to eliminate grandfathering against certain policy increases due to changes in the FIRM. HFIAA implements a surcharge to all policies ($25 per year for a primary residence and $250 per year for other policy types) to help cover the costs of subsidized policies.

2.4. Tax Revenue

Between fiscal years 2013 and 2017, tax revenues in Louisiana have fluctuated between $7 billion and $9 billion (Louisiana Department of Revenue 2018). Sales and income taxes are the largest sources of revenues in the state, each accounting for more one than a third of revenues during this period. Sales taxes in the two-parish analysis area total about $380.2 million, property taxes total $454.2 million, and state income taxes total $293.8 million (Table 2-8)(Louisiana Department of Revenue 2018).[2]

Table 2-8. Tax Receipts for Louisiana, Plaquemines and Jefferson Parishes, 2018

Parish	Gross Sales and Use Tax (FYE 2018)[a]	Sales Tax (Per Capita) (FYE 2018)[a]	Local Property Taxes (2018)	Property Taxes (Per Capita) (2018)[a]	Louisiana Income Tax After Credits (FYE 2018)[a]	Louisiana Income Tax (Per Capita) (FYE 2018)[a]
Louisiana	$2,465,893,313	$526	$4,674,248,814	$998	$2,889,999,990	$617
Plaquemines	$10,286,757	$441	$64,989,262[b]	$2,784	$16,903,248	$724
Plaquemines % of Louisiana	0.4%	83.8%	1.4%	279.0%	0.6%	117.3%
Jefferson	$369,919,561	$843	$389,189,208[b]	$886	$276,944,664	$631
Jefferson % of Louisiana	15.0%	160.3%	8.3%	88.8%	9.6%	102.3%

Sales and use taxes for Louisiana include only tax receipts from the parishes, not from locations outside of the parishes.
Per capita is based on population estimates for 2017 (U.S. Census, American FactFinder release date July 2017); Louisiana population 4,684,333; Plaquemines population 23,348; Jefferson population 439,036

2. The Louisiana Department of Revenue does not capture comprehensive parish-specific sales tax data. This is because firms with establishments in multiple locations may report sales tax as a single entity. As a result, the sales tax data presented at the parish-level represents 67 percent of total sales tax revenues in Louisiana in FYE (fiscal fear end) 2016.

Source: a) Louisiana Department of Revenue 2018 and b) Louisiana State Tax Commission 2018.

2.5. Local Channels and Waterways in the Barataria Basin

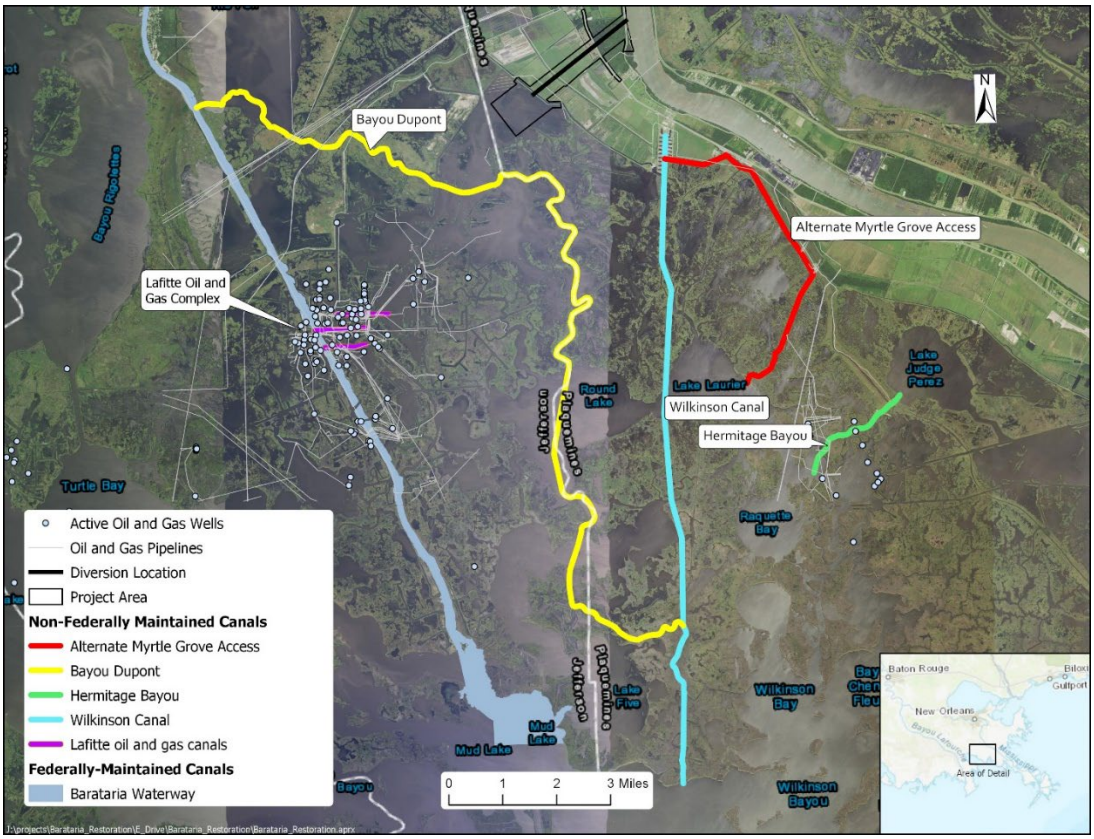
The Barataria Basin includes multiple, shallow-draft waterways that are used for commercial and recreational purposes. The estimated length and depth[3] of primary, non-federally maintained channels that may be impacted by the action alternatives in the Barataria Basin include but are not limited to:

- Wilkinson Canal – 12.2 miles from Myrtle Gove to Wilkinson Bayou, average depth of 8.44 feet
- Alternative Access Channel to Myrtle Grove – 6.2 miles from Myrtle Grove to Wilkinson Canal, average depth 2 feet
- Bayou Dupont – 20.7 miles from Barataria Waterway to Wilkinson Canal, average depth of 2.8 feet
- Hermitage Bayou – 2.3 miles from Lake Judge Perez to Lake Laufner, average depth of 1.9 feet.

In addition, there is an unnamed canal that provides access to Myrtle Grove and a number of oil and gas canals within the Lafitte Oil and Gas Complex that may be impacted by the diversion (Figure 2-6).

3. Channel depths in the Gulf coastal zone refer to water depth below mean low gulf (MLG) datum or mean lower low water (MLLW) datum. Length of channels estimated with data provided by the Water Institute on the land changes scenarios.

Figure 2-6. Canals and Waterways near the Proposed MBSD Project



2.6. Oil and Gas Activities

A description of oil and gas activities is included in Section 3.2.3.2 of the DEIS.

2.7. Socioeconomic Effects of Coastal Land Loss and Tidal Flooding

Louisiana's coast is composed of areas of higher elevation land interspersed with low lying land subject to intermittent flooding and wetlands that are submerged year-round. Natural variations in elevation exist between remnants of natural levees and the delta landscape built by river sedimentation along one of several historic pathways of the Mississippi River to the Gulf of Mexico. As sediment deposits settle over time, soil elevations subside both in submerged and dry areas. This subsidence combines with erosion and sea level rise to cause wetlands to convert to open water and low-lying areas to become submerged, a process referred to collectively as land loss. Approximately 4,833 square kilometers of land has been lost in coastal Louisiana between 1932 and 2016 (Couvillion, 2016). A reduction in coastal land areas causes significant damages to physical assets and infrastructure, disrupts economic activity linked to these areas, and causes flooding and inundation of residences and businesses in these locations that often result in permanent population losses. In addition, these physical processes decrease elevation in areas where land is not considered "lost" but can increase tidal flooding in new areas making them less viable for residential or economic purposes over time. The continued risk associated with land loss in coastal Louisiana has significant economic implications throughout the State of Louisiana and the nation due to the state's importance in shipping, energy production, chemicals, and other industries (Barnes et al., 2015).

2.8. Socioeconomic Effects of Storm Surge and Inundation

Natural coastal hazards, including hurricanes and storms, have resulted in catastrophic economic impacts for coastal Louisiana from property damage, flooding, and business disruptions, which have created permanent economic losses and led to the migration of some of the economic activity northward, out of the coastal region. Because of the extremely low elevation of the Project Area and its proximity to coastal lakes and bays and the open water of the Gulf of Mexico, the area is particularly vulnerable to storm surge and flooding caused by the landfall of tropical storms and hurricanes (see Section 3.4.5 of the EIS). Moreover, storm damage risks in nearby areas may be affected by changes in soil elevation and wetland cover within the project area. An analysis completed by the National Oceanic and Atmospheric Administration estimated the damage costs associated with storms that have occurred in Plaquemines Parish between 1997 and 2017, and indicated that property damage from tropical storms and hurricanes (primarily wind) totaled $3.1 billion, whereas property damage from storm surge flooding associated with tropical storms totaled $4.1 billion (NOAA, 2017). While Hurricane Katrina dwarfs overall damage costs of other storms in the previous decade, other storms and hurricanes that have not made landfall in the Project Area have also resulted in notable storm surge or rainfall flooding impacts in the area.

2.9. Community Cohesion

Coastal residents have dealt with challenges in their environment for decades, both manmade and natural. Natural resource-dependent industries, such as commercial fishing, can restrict residents to their residences along the coast, limiting their ability to leave the region. In addition, Louisiana's coastal residents have demonstrated an array of resilient practices that have enabled many of them to remain in place, including their social networks, the ability to be physically and economically mobile when necessary and ingenuity (Colten, 2017). The ability to work in multiple occupations allows residents to continue their work in a perilous place with a tenuous fishing industry; other work opportunities include oil and gas offshore rigs, building and piloting crew and supply ships, building the rigs that populate the outer continental shelf, and working on the waterfronts and watercraft that operate in the region (Colten, 2017). The oil industry, being a source of employment for many individuals, has allowed those working in the fishing industry to maintain traditional coastal occupations (Gramling and Hagelman, 2005). Many individuals who own a small boat buy a commercial license in order to fish part-time or only during the open season. Because of condensed offshore oil and gas work schedules, many coastal workers continue traditional occupations during their time off from oil and gas employment (Gramling and Hagelman, 2005).

3. Socioeconomic Impact Analysis

This section summarizes the socioeconomic impacts expected to occur under the No Action Alternative (NAA) and some of the action alternatives. Where possible each section addresses the impacts associated with all three of the flow alternatives (50,000 cfs, 75,000 cfs and 150,000 cfs). The exception is commercial fishing and recreation sections which only evaluate the Applicant's Preferred Alternative (PA). The various terrace alternatives have not been evaluated at this time except for the economic impacts of construction (Section 3.13). Each section uses the impact definitions developed for the DEIS and summarized in Table 3-1.

Table 3-1. Impact Intensity Definitions for Socioeconomic Resources

Impact Duration	Impact Intensity Definitions				
	No Impact	Negligible	Minor	Moderate	Major
Temporary – generally occur during construction, with resources returning to pre-construction conditions almost immediately afterward Short-term: Continue for approximately three years following construction Long-term: would continue for more than several years, but would be expected to recover during the life of the Project. Permanent: would modify resources to the extent that they would not return to pre-construction conditions during the life of the proposed Project	No discernible or measurable impact	The impact would be at the lowest level of detection, barely measureable, with no perceptible consequences	The impact would result in a detectable change, but the change would be slight. .	The impact would result in a clearly detectable change with measurable or quantifiable consequences	The impact would be readily apparent, and depending on its context and severity, has the potential to meet the threshold for significance set forth in CEQ regulations (40 CFR 1508.27).

Source: DEIS

3.1. Socioeconomic Effects of Coastal Land Loss and Tidal Flooding

3.1.1 Area of Potential Effects

The area of potential socioeconomic effects associated with coastal land loss impacted by the proposed diversion is within the vicinity of the diversion complex, within the lower Mississippi River, and throughout the Barataria Basin and the birdfoot delta. The area of potential

socioeconomic effects associated with tidal flooding caused by the diversion include areas that are located outside of flood protection near the diversion complex.

For this analysis CPRA evaluated a representative sample of communities (Lafitte, Grand Bayou and Myrtle Grove) outside of flood protection. The communities were chosen as they are generally representative of the other communities in the Basin, representing the reasonable minimum and maximum impacts to communities to the south (Grand Bayou); north (Lafitte); and closet to the outfall (Myrtle Grove). In addition, the selected communities were representative of varying levels of exposure to historic tidal flooding. For example, Grand Bayou has no structural protection and would experience similar tidal flooding as other unprotected communities, such as: Hermitage, Suzie Bayou, and Happy Jack. The Myrtle Grove impacts would also be quite similar to the neighborhood of Woodpark.

3.1.2 Construction Impacts

No Action Alternative

Under the NAA the Project would not be constructed and there would no Project-generated changes in socioeconomic impacts associated with coastal land loss or tidal flooding. Socioeconomic impacts associated with increases in coastal land loss and tidal flooding are expected to continue under the NAA and are discussed further below under Operational Impacts.

Applicant's Preferred Alternative

The construction of the Project under the Applicant's PA is expected to have no impact on coastal land loss or tidal flooding in the short-term construction period. As a result, construction of the Project is not expected to change socioeconomic impacts that may occur as a result of coastal land loss or tidal flooding.

Other Alternatives

Similar to the Applicant's PA, construction of the other alternatives are not expected to impact coastal land loss or tidal flooding in the short-term construction period. As are result, construction under the other alternatives are not expected to change socioeconomic impacts that may occur with coastal land loss or tidal flooding.

3.1.3 Operational Alternatives

No Action Alternative

Under the NAA, the historical processes of subsidence, erosion and sea level rise can be expected to continue, resulting in ongoing land loss and increases in tidal flooding. Based on Delft modeling, land loss is expected to increase in the Barataria Basin under the NAA between 2020 and 2070 with the conversion of nearly 274,000 acres of emergent wetlands and other subaerial landforms into open water (see section 4.2.2.2 of DEIS).

As described in the Chapter 4 Surface Water/Coastal Processes section in the MBSD DEIS, monthly water levels under the NAA at seven locations within Barataria Basin (see Figure 4.4-10 in the EIS) would continue to trend upwards due to sea level rise. Water levels at these locations would increase from one half foot to nearly three feet over the 50-year time period (see Figures

4.4-17, 4.4-18, and 4.4-19 in the DEIS). Bed elevations are expected to decrease in areas near the diversion due to land subsidence, sea level rise and wind and wave action and in the central and western portions of the basin by as much as one foot. Other areas, such as the northern portions of the basin and in and near the birdfoot delta, bed elevations are expected to increase by one quarter of one foot. Increases in bed elevations under the NAA would occur near the communities of Laffite, Jean Lafitte, Barataria, Crown Point, Estelle, Empire and Venice. Most of the remainder of the Barataria Basin (see Figure 4.4-5 in the DEIS) would experience subsidence and decreased bed elevations over the 50-year period of analysis.

In areas near where the diversion would be built, communities throughout coastal Louisiana are expected to continue to experience impacts associated with increases in water surface elevations (WSE). In order to understand the types of impacts that may result from the MBSD, the Water Institute completed a coastal water surface elevation analysis for three communities located near (within 20 miles) the proposed diversion outfall and outside of current flood protection: Lafitte, Myrtle Grove and Grand Bayou (Water Institute, 2019).

The analysis focuses on comparing modeled coastal WSEs and elevation thresholds determined for each community. Thresholds for each community represent an approximate elevation when inundation typically occurs in each community and utilizes Light Detection and Ranging (LiDAR) data, flood maps and direct observations. A historical analysis (Water Institute, 2019) of each community showed that on average Myrtle Grove experienced 9.5 days per year when the WSE exceeded the threshold (2008-2017), Lafitte experienced an average of 1 day per year when the threshold was exceeded (2008-2017), and Grand Bayou exceed the threshold on average 7 days per year (2007-2017).

Over the 50-year study period, relative sea-level rise (RSLR) is variable in time and space and values range from 2.9 to 3.4 feet (relative to 2020) for the three communities evaluated. This is expected to cause an increase in the number of days that WSE thresholds are exceeded on an annual basis under the NAA for these communities (Table 3-2). Under the NAA, Grand Bayou is likely to be susceptible to coastal WSE above the exceedance threshold over 60 days annually in the near-term (2020s), nearly 80% of days in the mid-term (2040s), and nearly daily exceedances in the long-term (2060s). Similarly, Myrtle Grove is predicted to experience more than 60 days of annual exceedance of thresholds in the near-term (2020s), 60-80% of days in the mid-term (2040s) and nearly every day in the long-term (2060s). Threshold exceedances in Lafitte are predicted to be tied to storm events in the near-term (2020s and 2030s), 50 or more days annually in the mid-term (2040s), and nearly daily in the long-term (2060s).

For communities near the diversion, impacts from high water levels under the NAA are expected to continue and likely intensify during the 50-year study period. The number of days when water levels exceed WSE thresholds are predicted to increase over time which can lead to adverse impacts to communities, households and businesses. Towards the end of the study period, when WSEs are expected to be exceeded on nearly a daily basis, residents and businesses would be unable to use the area because increased water surface elevations will limit or prohibit access the affected property.

Land loss and increases in tidal flooding under the NAA would be most acute in the central and southern Barataria Basin, affecting the communities along the west bank of the Mississippi River and southwestern portions of Barataria Basin. Under the NAA, coastal land loss and increases in tidal flooding across coastal regions of Louisiana would continue, contributing to flooding and

Table 3-2. Number of Annual Days of Water Surface Elevation Exceedance for No Action Alternative

Community	Year											
	2020		2030		2040		2050		2060		2070	
	Fixed Threshold[a]	Corrected Threshold[b]	Fixed Threshold[a]	Corrected Threshold[b]	Fixed Threshold[a]	Corrected Threshold[b]	Fixed Threshold[a]	Corrected Threshold[b]	Fixed Threshold[a]	Corrected Threshold[b]	Fixed Threshold[a]	Corrected Threshold[b]
Grand Bayou	68	68	176	228	297	346	343	360	358	362	362	362
Myrtle Grove	62	62	128	174	219	309	322	351	353	357	357	362
Lafitte	1	1	9	18	50	85	122	246	283	345	346	361

[a] Fixed threshold for Grand Bayou, Myrtle Grove and Lafitte are 1.5 ft. 1.75 ft and 2.5 ft., respectively.
[b] Thresholds corrected for subsidence.
Based on Hydrograph year 2011
Source: Water Institute, 2019

inundation of capital stock, such as homes and businesses, causing a decline in value (Barnes and Virgets, 2017). In addition, households will be increasingly strapped economically by increased insurance costs.

Continued land loss under the NAA is expected to have significant economic impacts on the region. Barnes et al. (2015) evaluated the economic implications of coastal land loss to the State of Louisiana. This study was followed up in Barnes and Virgets (2017) which estimated the economic costs of land loss at a regional level and concluded that increases in coastal land loss would result in $1.7 billion physical damages to businesses, residences, and infrastructure in the New Orleans region[4] (which includes Plaquemines and Jefferson parishes) over the next 50 years. These assets and properties support economic activity throughout the nation each year ($1.7 billion in output and 9,000 jobs), which would be at risk from continued land loss (all values in 2017$; Barnes and Virgets, 2017).[5]

Applicant's Preferred Alternative

Operation of the Applicant's PA is expected to result in major, beneficial direct and indirect impacts on land building in the Barataria Basin (Section 4.2.2 DEIS). The Applicant's PA is also expected to cause adverse impacts on land building in the birdfoot delta. The Project would introduce significant volumes of sediment into the Barataria Basin, and much of that sediment is expected to be retained, with an expected net addition of 53 million cy of sediment retained in the outfall area by 2030 and 310 million cy by 2070. These additions are projected to result in the net creation of 4,830 acres (7.5 square miles) of land by 2030, and 13,300 acres (20.8 square miles) by 2050 (see Table 4.2-4 in DEIS). Note that this sediment deposition and land building would occur against a backdrop of subsidence, erosion and sea level rise that contribute to land loss in the basin and across the region, so that even as diversion operations are increasing sediment deposition and land creation, some of this acreage would be lost due to these ongoing processes.

The Applicant's PA is predicted to have immediate, adverse moderate impacts due to increased WSE on some communities located near the diversion. For instance, modeling results show that monthly average water levels will increase by 1.3 feet in the short-term over the NAA in Myrtle Grove the closest community to the diversion outside of flood protection (Table 3-3). In addition, under the Applicant's PA in the short-term (2020), the number of days that the WSE thresholds are exceeded more than doubles in the months of March to June.

The Applicant's PA is also expected to have adverse impacts on the community of Grand Bayou in the short-term, with monthly average WSE increasing by 0.5 feet and an increase in the

[4] The New Orleans region has the largest population base among coastal regions and encompasses the following parishes: Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Tammany (Barnes, et al., 2017).

5. This is based on the "less optimistic" scenario for the future without action scenario described in the 2012 Coastal Master Plan (the 2017 Coastal Master Plan focuses on higher ranges of land loss than the 2012 plan).

Table 3-3. Maximum Monthly Averaged Water Surface Elevation Increases for Applicant's PA

Decade	Feet, Relative to No Action								
	Myrtle Grove			Lafitte			Grand Bayou		
	Applicant's PA (75,000 cfs)	50,000 cfs	150,000 cfs	Applicant's PA (75,000 cfs)	50,000 cfs	150,000 cfs	Applicant's PA (75,000 cfs)	50,000 cfs	150,000 cfs
2020s	1.3	1.0	1.9	0.3	0.2	0.6	0.5	0.4	0.8
2030s	1.1	0.8	1.8[a]	0.3	0.2	0.6	0.3	0.2	0.6
2040s	0.9[a]	0.7	1.7[a]	0.3	0.2	0.6	0.3	0.2	0.4
2050s	0.8[a]	0.4[a]	1.4[a]	0.2	0.2	0.5	0.2	0.1	0.2
2060s	0.6[a]	0.3[a]	1.3[a]	0.2	0.1	0.4	0.1	<0.1	0.1
2070	0.4[a]	0.2[a]	1.6[a]	0.1	0.1	0.3	<0.1	<0.1	0.1

[a] Estimated values for Myrtle Grove are based on monthly averages due to the influences of specific land building patterns on WSEs during some parts of the year.
Source: Water Institute, 2019

number of days of WSE threshold exceedance of 15 days in the months of April through July, when the diversion is operating.

The Applicant's PA is expected to have negligible impacts on Lafitte in the short-run due to a higher WSE thresholds than the other communities and distance from the diversion outfall. Monthly average water levels are expected to increase by 0.3 feet under the Applicant's PA relative to NAA with an increase of five days when WSEs thresholds are exceeded in Lafitte.

In the near term, the Project is expected to increase the potential for periodic, tidal flooding of communities such as Myrtle Grove and Grand Bayou (Water Institute, 2019). These periodic inundation events are not expected to cause damages to existing residential and non-residential structures since most have already been built above grade. However, damages may occur to various infrastructure (e.g. roads). This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences, businesses and recreational properties as described under the NAA. There may also be an increase in damage to those structures that are not already elevated as well as disruption in economic activity as a result of additional periodic, tidal flooding caused by the Project. The Project is not expected to cause socioeconomic impacts on Lafitte in the near-term.

During the medium-term (2040s), the diversion is expected to continue to have moderate, adverse impacts on the community of Myrtle Grove. Model results show that during this decade monthly average water levels will increase by 0.9 feet during diversion operations. The number of days when WSE thresholds are exceeded on a monthly basis increase between 5 to 21 days relative to the NAA during the months that the diversion is operating. In contrast, impacts from the diversion in Lafitte and Grand Bayou in the medium-term are minor and adverse. WSEs in both communities will increase slightly (0.2 feet) while the number of days that the WSE thresholds are exceeded increases by five or less days per month in Lafitte and one to nine days in Grand Bayou. In the medium-term, the Project is expected to increase the potential for periodic flooding and inundation of residential properties. Non-residential structures in Myrtle Grove would likely see an increase in frequency and duration of tidal flooding from operations of the diversion in the medium-term, which could result in further infrastructure improvements to

mitigate impacts and maintain functionality of the residencies, businesses and recreational properties. The Project is not expected to cause socioeconomic impacts on Grand Bayou or Lafitte in the medium-term.

In the long-term, WSEs and thresholds exceedances will be predominately caused by changes in RSLR and subsidence. Relative direct impacts from the diversion in Myrtle Grove will be minor and adverse with WSE increasing by 0.6 feet relative to NAA. During this decade (2060s) Myrtle Grove is expected to experience nearly daily WSE threshold exceedances under both the NAA and the Applicant's PA. The diversion is also predicted to have minor, adverse impacts on the communities of Lafitte and Grand Bayou. The Project is expected to have minor socioeconomic impacts to communities outside of flood protection during later decades of the study period because most of the increases in tidal flooding will be due to RSLR.

Increasing land building in the outfall area under the Applicant's PA is expected to have minor beneficial socioeconomic impacts. Areas were sediment would be deposited and largely maintained would provide protection from erosion to some areas within the New Orleans MSA, which is one of the more densely populated and heavily built areas in coastal Louisiana. Barnes and Virgets (2017), estimated that a future without action could result in economic damages from coastal land loss of $1.7 billion in infrastructure replacement costs and another $1.7 billion in business disruptions for the New Orleans region. While the Project would not be able to completely reduce expected damages likely to occur in the New Orleans region, the benefits provided are likely to be minor and beneficial. However, tidal flooding is expected to increase under the Applicant's PA in areas south of the diversion generating short-term, minor adverse impacts on some communities located near the diversion outfall. This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences and businesses as described under the NAA. Impacts caused by the Project are expected to decrease over time as increased incidents of tidal flooding will be driven by changes in RSLR.

Other Alternatives

The 50,000 cfs and 150,000 cfs alternatives are also expected to result in an increase in land building in the outfall area, with the 50,000 cfs alternative building slightly less than the Applicant's PA and the 150,000 cfs slightly more. As a result, both alternatives will result in beneficial socioeconomic impacts with an increase in land building as result of a reduction in future damages caused by land loss.

Changes in WSE for the 50,000 cfs and 150,000 cfs alternatives are summarized in Table 33. In general, both alternatives would have minor, adverse impacts on Myrtle Grove in the short-term and medium-term and minor adverse impacts in the long-term. The 50,000 cfs alternative would have minor adverse impacts to Lafitte and Grand Bayou throughout the study period while the 150,000 cfs alternative would have moderate adverse impacts in the short-term in both communities and minor adverse impacts in the long-term. These periodic inundation events are not expected to cause damages to existing residential and non-residential structures since most have already been built above grade. However, damages may occur to various infrastructure (e.g. roads). This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences, businesses and recreational properties. Additional investments will be needed under the 150,000 cfs Alternative compared to the 50,000 cfs or Applicant's PA. The

other alternatives will have minor socioeconomic impacts in the long-term because most flooding and inundation will be due to RSLR.

3.2. Socioeconomic Effects of Tidal Flooding

3.2.1 Area of Potential Effects

The area of potential socioeconomic effects associated with tidal flooding caused by the diversion include areas that are located outside of flood protection near the diversion complex and is described in Section 2.3 (See Figure 2.5).

3.2.2 Construction Impacts

No Action Alternative

Under the NAA the Project would not be constructed and there would no Project-generated changes in socioeconomic impacts associated with tidal flooding. Socioeconomic impacts associated with increases in tidal flooding are expected to continue under the NAA and are discussed further below under Operational Impacts.

Applicant's Preferred Alternative

The construction of the Project under the Applicant's PA is expected to have no impact on tidal flooding in the short-term construction period. As a result, construction of the Project is not expected to change socioeconomic impacts that may occur as a result of tidal flooding.

Other Alternatives

Similar to the Applicant's PA, construction of the other alternatives are not expected to impact tidal flooding in the short-term construction period. As are result, construction under the other alternatives are not expected to change socioeconomic impacts that may occur with tidal flooding.

3.2.3 Operational Alternatives

No Action Alternative

In areas near where the diversion would be built, communities throughout coastal Louisiana are expected to continue to experience impacts associated with increases in water surface elevations (WSE). In order to understand the types of impacts that may result from the MBSD, the Water Institute completed a coastal water surface elevation analysis for three communities located near (within 20 miles) the proposed diversion outfall and outside of current flood protection: Lafitte, Myrtle Grove and Grand Bayou (Water Institute, 2019).

The analysis focuses on comparing modeled coastal WSEs and elevation thresholds determined for each community. Thresholds for each community represent an approximate elevation when inundation typically occurs in each community and utilizes Light Detection and Ranging (LiDAR) data, flood maps and direct observations. A historical analysis (Water Institute, 2019) of each community showed that on average Myrtle Grove experienced 9.5 days per year when the WSE exceeded the threshold (2008-2017), Lafitte experienced an average of 1 day per year when the threshold was exceeded (2008-2017), and Grand Bayou exceed the threshold on average 7 days per year (2007-2017).

Over the 50-year study period, relative sea-level rise (RSLR) is variable in time and space and values range from 2.9 to 3.4 feet (relative to 2020) for the three communities evaluated. This is expected to cause an increase in the number of days that WSE thresholds are exceeded on an annual basis under the NAA for these communities (Table 3-2). Under the NAA, Grand Bayou is likely to be susceptible to coastal WSE above the exceedance threshold over 60 days annually in the near-term (2020s), nearly 80% of days in the mid-term (2040s), and nearly daily exceedances in the long-term (2060s). Similarly, Myrtle Grove is predicted to experience more than 60 days of annual exceedance of thresholds in the near-term (2020s), 60-85% of days in the mid-term (2040s) and nearly every day in the long-term (2060s). Threshold exceedances in Lafitte are predicted to be tied to storm events in the near-term (2020s and 2030s), 50 or more days annually in the mid-term (2040s), and nearly daily in the long-term (2060s). For communities near the diversion, impacts from high water levels under the NAA are expected to continue and likely intensify during the 50-year study period. The number of days when water levels exceed WSE thresholds are predicted to increase over time which can lead to adverse impacts to communities, households and businesses. Towards the end of the study period, when WSEs are expected to be exceeded on nearly a daily basis, it is likely that a proportion of residents and businesses would no longer be able to function under the predicted environmental conditions. Increases in tidal flooding, especially in communities outside of flood protection, will call for an increase in investments in infrastructure to maintain the functionality of residences, businesses and recreational properties and may lead to increases in damages to structures and disruptions in economic activity (Barnes and Virgets, 2017).

Applicant's Preferred Alternative

The Applicant's PA is predicted to have immediate, adverse moderate impacts due to increased WSE on some communities located near the diversion. For instance, modeling results show that monthly average water levels will increase by 1.3 feet in the short-term over the NAA in Myrtle Grove the closest community to the diversion outside of flood protection (

Table **3-3**). In addition, under the Applicant's PA in the short-term (2020), the number of days that the WSE thresholds are exceeded more than doubles in the months of March to July.

The Applicant's PA is also expected to have adverse impacts on the community of Grand Bayou in the short-term, with monthly average WSE increasing by 0.5 feet and an increase in the number of days of WSE threshold exceedance of 15 days in the months of April through July, when the diversion is operating.

The Applicant's PA is expected to have negligible impacts on Lafitte in the short-run due to a higher WSE thresholds than the other communities and distance from the diversion outfall. Monthly average water levels are expected to increase by 0.3 feet under the Applicant's PA relative to NAA with an increase of five days when WSEs thresholds are exceeded in Lafitte.

In the near term, the Project is expected to increase the potential for periodic, tidal flooding of communities such as Myrtle Grove and Grand Bayou (Water Institute, 2019). These periodic inundation events are not expected to cause damages to existing residential and non-residential structures since most have already been built above grade. However, damages may occur to various infrastructure (e.g. roads). This may result in a need to accelerate investment in

infrastructure needed to maintain the functionality of residences, businesses and recreational properties as described under the NAA. There may also be an increase in damage to those structures that are not already elevated as well as disruption in economic activity as a result of additional periodic, tidal flooding caused by the Project. The Project is not expected to cause socioeconomic impacts on Lafitte in the near-term.

During the medium-term (2040s), the diversion is expected to continue to have moderate, adverse impacts on the community of Myrtle Grove. Model results show that during this decade monthly average water levels will increase by 0.9 feet during diversion operations. The number of days when WSE thresholds are exceeded on a monthly basis increase between 5 to 21 days relative to the NAA during the months that the diversion is operating. In contrast, impacts from the diversion in Lafitte and Grand Bayou in the medium-term are minor and adverse. WSEs in both communities will increase slightly (0.3 feet) while the number of days that the WSE thresholds are exceeded increases by five or less days per month in Lafitte and one to nine days in Grand Bayou. In the medium-term, the Project is expected to increase the potential for periodic flooding and inundation of residential properties. Non-residential structures in Myrtle Grove would likely see an increase in frequency and duration of tidal flooding from operations of the diversion in the medium-term, which could result in further infrastructure improvements to mitigate impacts and maintain functionality of the residencies, businesses and recreational properties.

In the long-term, WSEs and thresholds exceedances will be predominately caused by changes in RSLR and subsidence. Relative direct impacts from the diversion in Myrtle Grove will be minor and adverse with WSE increasing by 0.6 feet relative to NAA. During this decade (2060s) Myrtle Grove is expected to experience nearly daily WSE threshold exceedances under both the NAA and the Applicant's PA. The diversion is also predicted to have minor, adverse impacts on the communities of Lafitte and Grand Bayou. The Project is expected to have minor socioeconomic impacts to communities outside of flood protection (during later decades of the study period because most of the increases in tidal flooding will be due to RSLR.

The Applicant's PA is expected to have short-term, minor adverse impacts on some communities located near the diversion outfall due to increases in tidal flooding resulting from operation of the Project. This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences, businesses and recreational properties as described under the NAA. Impacts caused by the Project are expected to decrease over time as increased incidents of tidal flooding will be driven by changes in RSLR.

Other Alternatives

Changes in WSE for the 50,000 cfs and 150,000 cfs alternatives are summarized in

Table 3-3. In general, both alternatives would have minor, adverse impacts on Myrtle Grove in the short-term and medium-term and minor adverse impacts in the long-term. The 50,000 cfs alternative would have minor adverse impacts to Lafitte and Grand Bayou throughout the study period while the 150,000 cfs alternative would have moderate adverse impacts in the short-term in both communities and minor adverse impacts in the long-term. These periodic inundation events are not expected to cause damages to existing residential and non-residential structures

since most have already been built above grade. However, damages may occur to various infrastructure (e.g. roads). This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences, businesses and recreational properties. Additional investments will be needed under the 150,000 cfs Alternative compared to the 50,000 cfs or Applicant's PA. The other alternatives will have minor socioeconomic impacts in the long-term because most flooding and inundation will be due to RSLR.

3.3. Socioeconomic Effects of Storm Surge and Inundation

3.3.1 Area of Potential Effects

The area of potential socioeconomic effects associated with coastal land loss impacted by the proposed diversion is within the vicinity of the diversion complex, within the lower Mississippi River, and throughout the Barataria Basin and the birdfoot delta.

3.3.2 Construction Impacts

No Action Alternative

Under the NAA the Project would not be constructed and there would no changes due to the Project in socioeconomic impacts associated with storm surge and inundation.

Applicant's Preferred Alternative

The construction of the Project under the Applicant's PA is expected to have no impact on storm surge and inundation during the short-term construction period. As a result, construction of the Project is not expected to change socioeconomic impacts that may occur as a result of storm surge and inundation.

Other Alternatives

Similar to the Applicant's PA, construction of the other alternatives are not expected to impact storm surge and inundation in the short-term construction period. As are result, construction of the other alternatives is not expected to have socioeconomic impacts associated with storm surge and inundation.

3.3.3 Operational Impacts

No Action Alternative

Water levels and land change projected in the Barataria Basin through the Delft 3D modeling efforts were used to quantify existing tidal flood risk within the Project area, including the NAA (See Section 4.1 in DEIS). In addition, the coupled Advanced CIRCulation (ADCIRC) and Simulating Waves Nearshore (SWAN) high fidelity models were used to quantify existing coastal storm hazards and flooding in the Project area and to project potential impacts due to storm hazards and flooding associated with the Project alternatives, including the NAA. The analysis, which accounts for subsidence and accretion within the basin, shows that under the NAA storm surge is expected to increase and intensify over the next 50 years. Surge levels were modeled to increase between 1.5 and 5-feet across the basin during the time period.

Land loss that is expected to occur under the No Action Alternative will continue to undermine the regions' natural storm defenses in the long-term (see Section 4.4 Surface Water and Coastal

Processes in the DEIS). The increasing reduction of land under the NAA over time would result in larger economic consequences and damages than would occur under existing conditions across the coastal region as well as inland areas. Expected annual damage from storm surge-based flooding events could be over seven times greater in the future with no actions taken to mitigate land loss or provide flood protection (CPRA Coastal Master Plan, 2017).With increasing coastal land loss, Louisiana would face increased and widespread storm damage and storm-related economic disruptions as the coastal buffer disappears. Barnes and Virgets (2017) estimated the potential damage if a storm similar to Hurricane Katrina (size and storm track) were to hit the Louisiana coast in the next 25 or 50-years.

Due to the future expected loss in wetlands that currently serve as a buffer zone to the New Orleans area, damages are estimated to be much higher than they were in 2005. Under these two scenarios (storms in 25 and 50 years), total replacement costs[6] range from $5.5 to $129.6 billion.[7] Most of this impact would occur in the New Orleans region (includes Plaquemines and Jefferson parishes), with up to $26 billion in lost economic output from business disruptions (2015$; Barnes and Virgets, 2017).[8] Households will be increasingly strapped economically by increased insurance costs.

Applicant's Preferred Alternative

Evaluation of potential storm surge under the Applicant's PA generally shows an increase in peak water levels on the seaward side of the diversion and a decrease in water levels on the inland side (Arcadis, 2019). The magnitude of the changes is similar for the 1% and 4% storm event in 2040 and 2070. The Applicant's PA, through additional land building, will result in an increase in protection from storm surge in areas north of the diversion site. Areas were sediment would be deposited and largely maintained would provide protection to some areas within the New Orleans MSA, which is one of the more densely populated and heavily built areas in coastal Louisiana and includes the highest concentration of productive assets in the state of Louisiana (Barnes and Virgets, 2017). Reducing storm surge with the operation of the diversion will generate significant benefits in terms of avoided damages and fewer and less severe storm-related economic disruptions. While the Project would not be able to completely reduce expected damages likely to occur in the New Orleans region with a major storm event as described under NAA, the benefits provided are likely to be major and beneficial.

However, the Applicant's PA will also increase storm surge impacts to areas south of the diversion (by up to 0.7 feet in 2040 and 1.7 feet in 2070) (Arcadis, 2019). While this effect is likely to lead to an increase in damages and loss in economic activity, these impacts are likely to

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[6] Total replacement costs represent the cost to replace physical assets (residential and business properties) expected to be damaged in a storm event.

7. The large increase in damages between the 25- and 50-year scenarios is due to the modeled failure of levees in the City of New Orleans (Barnes and Virgets, 2017).

8. The study measured the increase in storm damage in a future without action for three storm scenarios to characterize the potential economic risks facing coastal Louisiana. The storms include an eastern-track storm with a path similar to Hurricane Katrina; a western-track storm with a path similar to Hurricane Rita; and a 100-year storm, which indicates the level of flooding across the coast that would be expected only once every 100 years. The figures reported represent the worst-case impacts of the three types of events.

be minor, adverse and long-term because these areas have a much smaller population and far less concentration of economic activity than areas north of the diversion.

Other Alternatives

Evaluation of the 50,000 cfs and 150,000 cfs alternatives shows a similar pattern of impacts over the study period to the Applicant's PA with storm surge levels and wave heights reduced on the inland side of the diversion and increasing in storm surge levels and wave height on the seaward side Arcadis, 2019). The difference in water levels and wave heights is 0.5 feet or less across the alternatives. The larger capacity alternatives will result in more land building and in general provide greater benefits in terms of avoided damages and lost economic activity. However the larger capacity alternatives will have moderate, long-term, adverse impacts associated with more intense storm surge and wave action for areas to the south of the diversion.

3.4. Commercial Fishing

***** The text of the Commercial Fishing section of this report was prepared based on the initial draft of the aquatic species impact assessment prepared as part of the LA TIG's MBSD Draft Restoration Plan. Thereafter, the aquatic species section of the DEIS was completed, which includes different impact conclusions for some aquatic species than the assessment prepared as part of the Draft Restoration Plan. This Report has not been revised to address those different DEIS impact conclusions; however, the impacts of those DEIS conclusions on commercial fishing are addressed in the text of the commercial fishing impact sections of the DEIS.***

The commercial fishing industry in Louisiana is a dynamic, resource-dependent set of economic activities heavily influenced by both environmental and economic changes. To succeed in this competitive industry, participants must balance operating expenses with market prices, which are heavily influenced by imports and consumer preferences. Major drivers of operating expenses include capital investments in vessels and gear, labor costs, fuel, and other supplies such as ice and bait. Over a period of many decades, the commercial fishing industry has developed local supply chains and a range of seafood processors that support additional economic activity in the region. The level of participation has changed notably over time and the specific individuals engaged in these activities exhibit a high degree of turnover when compared to the economy as a whole. Yet, the commercial fishing industry continues to be a highly-visible and important economic driver in coastal Louisiana landing an average of $284 million statewide from 2014 to 2017. While an overview of existing conditions is provided in Chapter 3 of the EIS, additional historical data are provided below to illustrate the dynamic nature of the industry. These data are organized by major category of activities to provide additional insights about how the industry could be expected to change in the future. Commercial fishing activities in Louisiana are often segmented into five major categories: shrimp, oysters, crab, saltwater finfish, and freshwater finfish. The report follows this general grouping of activities and also includes commercial activity related to alligator hunting and farming as well as aquaculture.

3.4.1 Approach for Evaluating Impacts to Commercial Fishing

To investigate changes in commercial fishing, it is important to consider both economic and environmental factors. However, the longtime scales involved in this analysis extend beyond commonly used horizons for formal statistical economic forecasts. Similarly, uncertainty inherent in environmental and ecological modeling limits the degree of specificity available from assessments of changes in the future environment. Therefore, a qualitative approach is taken to

evaluate likely changes under the NAA as well as potential impacts to commercial fishing under the Applicant's PA including a review of historical trends and consideration of both economic and environmental factors.

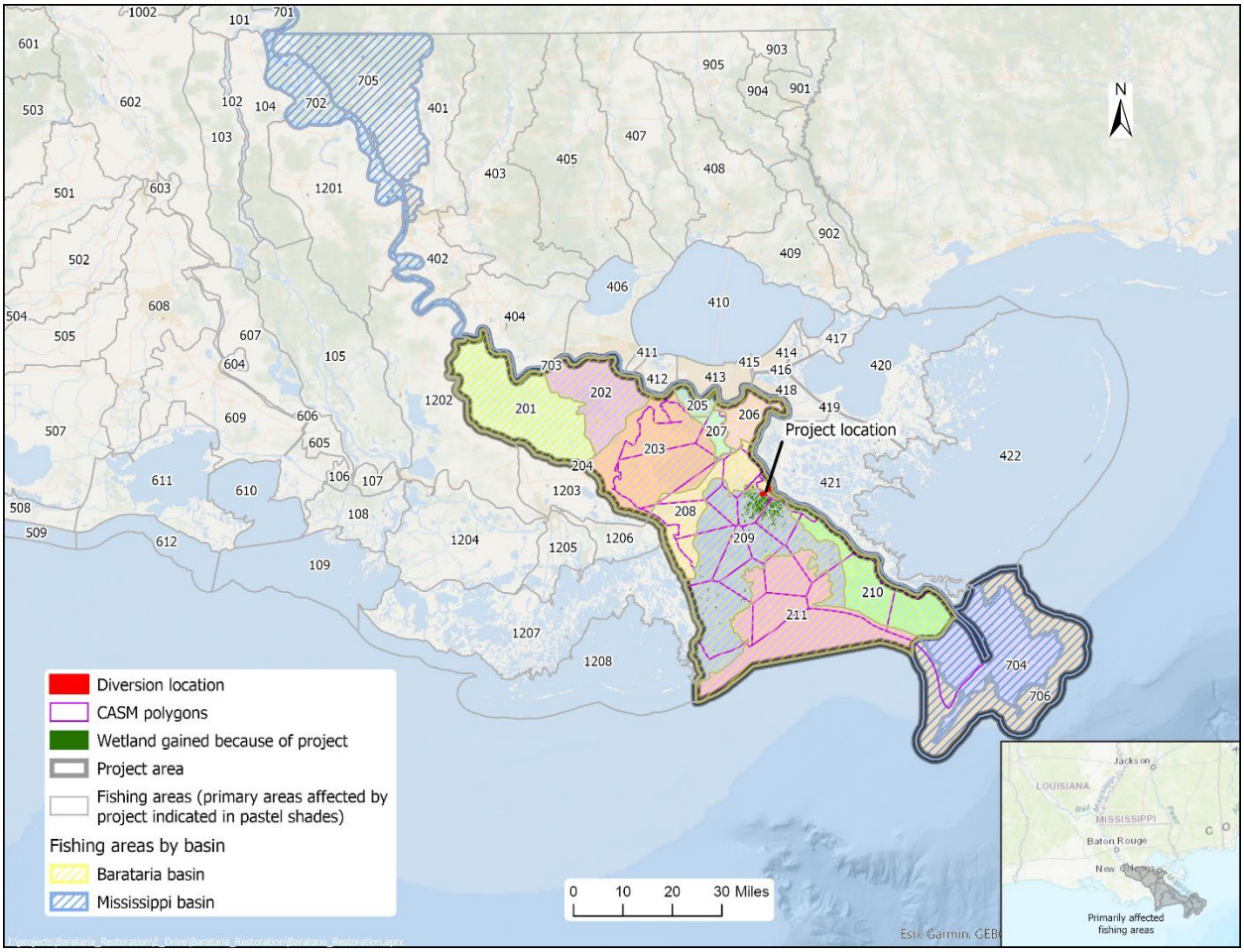
Because economic markets adjust over time in response to changing economic conditions, the ultimate influence of specific economic factors is particularly difficult to anticipate over very long time horizons. For example, increasing fuel costs over time could be expected to reduce profitability in the commercial fishing industry. However, higher fuel costs also affect producers of many other consumer goods and market mechanisms may allow producers to pass along much of this increase to consumers in the form of higher prices. The most important long-run economic consideration for the overall health of the commercial fishing industry is the preference for seafood harvested from the region relative to imports and other consumer products. For purposes of this analysis, future consumer preferences are assumed to be similar to current consumer preferences. However, additional economic factors are discussed when comparing the Applicant's PA to the NAA to better illustrate how different environmental conditions can influence the industry given a general expectation about future consumer preferences.

While there is uncertainty in long term projections of environmental changes, changes that are expected to influence abundance, biomass, or access to commercial fisheries will impact commercial landings and the broader commercial fishing industry. Assessments of the impact of environmental changes to commercially relevant species have been completed elsewhere in the EIS as well as in the Draft Phase II Restoration Plan: MBSD (in preparation). These two analyses are referred to collectively throughout this document as "Aquatics Analysis". Those results are summarized here to provide a basis for assessing the impact of those changes to commercial fishing.

3.4.2 Area of Potential Impacts

The area of potential impact includes the 13 sub-basins identified as the Project Area in Chapter 3 of the EIS; these sub-basins are located in Barataria Basin and the lower portion of the Mississippi River Basin. According to trip ticket data summarized in Chapter 3 of the EIS, annual landings from the Project Area averaged a total value of $87 million from 2014 to 2017, representing just over 30% of the statewide value. These sub-basins are depicted below in Figure 3-1 along with Comprehensive Aquatic Systems Model (CASM) polygons used in calculating habitat suitability indices, which inform the aquatic species impacts assessments. Some commercial fishing data are available at the sub-basin level while other data may be available only basin-wide or statewide.

Figure 3-1. Trip Ticket Sub-Basins in and near the Project Area and CASM Polygons Used to Inform Impact Analysis



3.4.3 Description of Fisheries Existing Conditions

Shrimp Fishery

Shrimping is the most economically valuable commercial fishery in Louisiana. The shrimping sector has consolidated (and employment has decreased) in the last two decades as imported shrimp have driven down shrimp prices, while fuel costs have increased, putting downward pressure on profitability to those in the shrimp industry (Barnes et al., 2016). Shrimpers can trawl in open Gulf of Mexico waters regulated by state and federal authorities most of the year, while inshore marshes and bays under state regulation experience shorter open seasons that are intended to protect juvenile shrimp. The otter trawl is the most common fishing gear used to harvest shrimp, although skimmer nets are also used working in the inshore waters (Austin et al., 2014b). In general, smaller boats mostly fish in estuaries and bayous of state waters, while larger boats fish offshore in federal waters (Ingles and McIlvaine-Newsad, 2007).

As summarized in Chapter 3 of the EIS, shrimp landings in the Project Area make up approximately one-third of statewide shrimp landings and are a major component of total commercial fishing activity in the Project Area. Other major sources of shrimp landings are Terrebonne Basin and federal offshore fishing areas, which from 2000 to 2013 averaged 24% and 33% of total statewide landings, respectively (Barnes et al. 2016). Shrimp make up a majority of all commercial fishing landings from the Project Area when measured by weight; when measured by value, shrimp have constituted the highest source of value in the Project Area for any species group since trip ticket data collection began in 2000, aside from 2017 when the value of oyster landings was higher. Historically, areas fished located closest to the Gulf of Mexico were the predominant source of commercially-landed shrimp, with subbasin areas fished 211 and 210 in the southern Barataria Basin providing the highest quantity of landings.

While shrimp continue to be a major contributor to commercial fishing in the Project Area, the level of activity is down from close to 40 million pounds and $74 million in value in 2000 to approximately 26 million pounds and under $30 million in value in 2017 (all values converted to 2017 dollars). The long-run trend since 2000 has exhibited considerable ups and downs, influenced by major events including hurricanes and the Deepwater Horizon oil spill as well as the influence of imports and associated downward pressure on prices (Keithly and Poudel 2008, Barnes et al. 2016). This long-term trend has been accompanied by a marked decline in the number of commercial fishing license holders landing shrimp: in 2000, there were 3,408 license holders actively landing shrimp in the Project Area, and by 2017 this number had decreased to 1,235 license holders, as shown in Chapter 3 of the EIS.

In addition to the overall historical decline in the number of commercial license holders landing shrimp, a more detailed review of the trip ticket and licensing data illustrates a considerable amount of change in the specific individuals participating over time with a continuing pattern of new entrants and exiters, though some of those exiting may continue to be engaged in the industry as crew members not holding licenses. Trip ticket data show that since 2000, a steady and significant percentage of those license holders active in any given year do not land shrimp in the subsequent year both statewide and within Barataria Basin (Issacs 2018a, Isaacs 2019a). While these patterns have changed over time, roughly 35% of those landing shrimp from the Barataria Basin in any year do not land shrimp from the Barataria Basin the following year from 2000 to 2016. After five years, significantly fewer license holders are still landing shrimp from the Barataria Basin with an average of just under 40% still active five years later over the period

2000 and 2012. Of the commercial license holders landing shrimp from Barataria Basin in 2012, the most recent year for which activity can be tracked over a five-year period, only 52.8% were active in 2017. There is also a steady flow of new entrants with more than 20% of those landing shrimp from the Barataria Basin in 2017 having no landings in the previous year. Those 2017 data also suggest that more than 40% of those harvesting shrimp from the Barataria Basin in 2017 had not been active in the shrimp fishery in that area five years before. Statewide data on entry and exit show that average landings among those leaving the industry tends to be lower, averaging $16,155 in 2013 among those who exit compared to $59,361 among those who do not exit (Isaacs 2018a). The fact that exits have outpaced entrants over time explains the overall decline in the total number of license holders landing shrimp.

The characteristics of active commercial fishing license holders can provide important context for understanding potential impacts to the industry. Shrimp and crab are commonly sought species in coastal Louisiana because large investments are not necessary for their harvest (Gramling and Hagelman, 2005). There are many individuals who own a small boat and buy a commercial license in order to shrimp part time or only during the inland season (Gramling and Hagelman, 2005). The nature of the Louisiana shrimp industry includes over 90% of shrimpers as owner-operators, supplying most of the labor power and much of the capital needed for their vessels out of their own household and funds (Marks, 2012).

Beyond the fishing license holder, there are often additional crew members actively engaged in the industry, but more readily available data on license holders can be used to assess the age distribution and how age has changed over time. Table 3-4 shows the average and median age of commercial fishermen who landed shrimp from Barataria Basin between 2000 and 2017 (Isaacs, 2019a). Over time, the average age among those landing shrimp has been increasing, with the median increasing at a faster pace, suggesting a higher proportion of relatively older fishermen relative to the average. By 2017, the average age among those landing shrimp from Barataria Basin was 50.9 and the median was 52. This compares to a 2018 median age of 41 across all workers in Louisiana (U.S. Census Bureau 2019).

Overall, shrimping in Project Area has been declining for the past couple of decades, likely from a combination of environmental and market factors that have impacted both supply and demand. The specific individuals engaged in the industry has been changing over time with a sizeable amount of entry and exit. However, the net effect of these changes has been a decline in the number of license holders engaged in shrimping and a population of shrimpers that is growing older faster than other occupations in Louisiana.

Table 3-4. Average and Median Age of commercial Fishing License Holders Landing Shrimp from Barataria Basin

Year	Average	Median
2000	43.0	41.0
2001	43.0	42.0
2002	43.7	42.0
2003	44.6	43.0
2004	45.1	44.0
2005	46.1	45.0
2006	45.8	46.0
2007	46.2	46.0
2008	47.3	47.0
2009	47.8	48.0
2010	47.6	48.0
2011	47.6	48.0
2012	48.8	49.0
2013	48.8	50.0
2014	49.5	50.0
2015	49.6	51.0
2016	50.2	51.0
2017	50.9	52.0

Source: LDWF Commercial Fishing Trip Tickets (Isaacs 2019a)

Oyster Fishery

As summarized in Chapter 3 of the EIS, the oyster fishery in the Project Area makes up slightly more than one-third of statewide oyster landings and is a major component of total commercial fishing activity in the Project Area. Other major sources of oyster landings are the Pontchartrain and Terrebonne Basins, which from 2000 to 2013 averaged 48% and 22% of total statewide landings, respectively (Barnes et al. 2016). However, analysis of data through 2013 shows that landings in the Pontchartrain Basin dropped precipitously following the DWH oil spill in 2010 and that the level of activity in the Terrebonne and Barataria Basins increased significantly (Barnes et al. 2016). Between 2014 and 2017, oysters made up approximately 10% of landings when measured by weight;[9] when measured by value, oysters have constituted 35% of value in the Project Area. Within the Project area, the vast majority of landings came from subbasin area fished 210 in the southern Barataria Basin along the Mississippi River, which represented $36.6 million out of the $38.0 million total landings from Barataria Basin.[10]

The level of commercial activity among oyster harvesters has been far more stable than seen among those harvesting other species and the activity within the Barataria Basin has actually increased in recent years. The number of license holders landing oysters from the Barataria Basin was above 300 in 2017 compared to an average of 214 before 2010. In 2017, 53 million pounds and $40 million in value of oysters were landed from the Barataria Basin compared to 28 million pounds and $9 million (in 2017$) in 2000. Along with the overall increase in activity, these data

9. Based on trip ticket data excluding menhaden.

10. Landings for the Mississippi River Basin generally cannot be published due to confidentiality restrictions.

also show a marked increase in the price per unit for oysters offered in the market. The historical data have exhibited considerable ups and downs; however, the recent trend has shown a higher level of activity in the Project Area than in earlier years of data.

As in the shrimp fishery, trip ticket and licensing data illustrates a considerable amount of change in the specific individuals participating over time with a continuing pattern of new entrants and exiters, though some of those exiting may continue to be engaged in the industry as crew members not holding licenses. Trip ticket data show that since 2000, a steady and significant percentage of those active in any given year do not land oysters in the subsequent year both statewide and within the Barataria Basin (Issacs 2018b, Isaacs 2019b). While these patterns have changed over time, roughly 40% of those landing oysters from the Barataria Basin in any year do not land oysters from the Barataria Basin the following year from 2000 to 2016. After five years, significantly fewer are still landing oysters from the Barataria Basin with an average of just over 40% still active five years later over the period 2000 and 2012. Of the commercial license holders landing oysters from the Barataria Basin in 2012, the most recent year for which activity can be tracked over a five-year period, only 48.6% were active in 2017. There is also a steady flow of new entrants with more than 40% of those landing oysters in 2017 having no landings in in the previous year. Those 2017 data also suggest that more than 60% of those harvesting oysters from the Barataria Basin in 2017 had not been active in the oyster fishery in that area five years before. Statewide data on entry and exit show that average landings among those leaving the industry tends to be lower, averaging $25,195 in 2013 among those who exit compared to $56,341 among those who do not exit (Isaacs 2018b).[11]

The characteristics of active commercial fishing license holders can provide important context for understanding potential impacts to the industry. Beyond the fishing license holder, there are often additional crew members actively engaged in the industry, but more readily available data on license holders can be used to assess the age distribution and how age has changed over time. Table 3-5 shows the average and median age of commercial fishermen who landed oysters from the Barataria Basin between 2000 and 2017 (Isaacs, 2019b). Over time, the average age among those landing oysters had followed gradually increasing pattern, but dropped notably in 2017, the final year of data currently available. In 2017, the average age among those landing oysters from the Barataria Basin was 41.2 while the median was 40.5. This is quite similar to the 2018 median age of 41 across all workers in Louisiana (U.S. Census Bureau 2019).

Overall, oyster harvests from the Project Area have increased somewhat over the past couple of decades, likely from a combination of environmental and market factors that have impacted both supply and demand. The specific individuals engaged in the industry has been changing over time with a sizeable amount of entry and exit. However, the net effect of these changes has been an increase in the number of license holders harvesting oysters.

11. Data are based on the definition of exit that identifies commercial license holders landing oysters and then not landing oysters again for at least the next four years. Values are presented in 2009 dollars.

Table 3-5. Average and Median Age of Commercial Fishing License Holders Landing Oysters from Barataria Basin

Year	Average	Median
2000	41.2	40.5
2001	43.0	42.0
2002	42.6	42.0
2003	42.4	42.0
2004	42.7	42.0
2005	43.0	43.0
2006	43.9	45.0
2007	42.2	42.0
2008	42.3	42.0
2009	43.5	44.0
2010	45.4	47.0
2011	44.3	45.0
2012	45.2	46.0
2013	44.2	44.0
2014	44.7	45.0
2015	45.5	46.0
2016	45.0	46.0
2017	41.2	40.5

Source: LDWF Commercial Fishing Trip Tickets (Isaacs 2019b)

Crab Fishery

Commercial crab landings are dominated by blue crab, with a small amount of stone crab also landed in some areas. As summarized in Chapter 3 of the DEIS, the crab fishery in the Project Area makes up just over 20% of statewide crab landings. Within the Project Area, crab represents almost 20% of landings across all species groups from the area. Other major sources of crab landings are the Pontchartrain and Terrebonne Basins, which in 2018 represented 40% and 20% of total statewide landings in terms of value, respectively (LDWF Trip Ticket Summary 2019). Landings of crab from the Project Area are dominated by blue crab with 10.8 million pounds valued at just over $14 million in 2018. A small amount of stone crab was also landed from the Barataria Basin, but monthly trip ticket summaries include fewer than three dealers in all months and cannot be released due to confidentiality restrictions. Historically, areas fished with the highest concentration of crab landings have been located in the middle and lower portions of the Barataria Basin and the lower Mississippi River Basin surrounding the mouth of the river. According to trip ticket data from 2000 to 2013, subbasin area fished 209 has had the highest crab landings averaging 2.2 million pounds and $1.8 million in value.

Landings of crabs, as measured in pounds, has been fairly stable over time as shown in Figure 3.14-9 in Chapter 3 in the DEIS. Despite a number of low and high years, the long-run trend has averaged approximately 9 million pounds per year. However, rising prices in recent years has pushed values above the long-run average. While landings have remained stable, this long-term trend has been accompanied by a notable decline in the number of commercial fishing license holders landing crab: in 2000, there were 820 license holders actively landing crab in the

Project Area by 2017 this number had dropped by more than half to just 345 license holders, as shown in Chapter 3 of the DEIS.[12]

As in the shrimp and oyster fisheries, trip ticket and licensing data illustrates a considerable amount of change in the specific individuals participating over time with a continuing pattern of new entrants and exiters, though some of those exiting may continue to be engaged in the industry as crew members not holding licenses. Trip ticket data for blue crab landings show that since 2000, a steady and significant percentage of those active in any given year do not land blue crab in the subsequent year both statewide and within the Barataria Basin (Issacs 2018c, Isaacs 2019c). While these patterns have changed over time, roughly 40% of those landing blue crab from the Barataria Basin in any year do not land blue crab from the Barataria Basin the following year from 2000 to 2016. After five years, significantly fewer are still landing blue crab from the Barataria Basin with an average of less than 40% still active five years later over the period 2000 and 2012. Of the commercial license holders landing blue crab from the Barataria Basin in 2012, the most recent year for which activity can be tracked over a five-year period, only 41.8% were active in 2017. There is also a steady flow of new entrants with more than 20% of those landing blue crab from the Barataria Basin in 2017 having no blue crab landings in in the previous year. Those 2017 data also suggest that more than 45% of those landing blue crab from the Barataria Basin in 2017 had not been active in the blue crab fishery in that area five years before. Statewide data on entry and exit show that average landings among those leaving the industry tends to be lower, averaging $6,657 in 2012 among those who exit compared to $30,308 among those who do not exit (Isaacs, 2018c).[13]

The characteristics of active commercial fishing license holders can provide important context for understanding potential impacts to the industry. Beyond the fishing license holder, there are often additional crew members actively engaged in the industry, but more readily-available data on license holders can be used to assess the age distribution and how age has changed over time. Table 3-6 shows the average and median age of commercial fishermen who landed blue crab from the Barataria Basin between 2000 and 2016 (Isaacs, 2019c). Over time, the average and median age among those landing blue crab from the Barataria Basin have been increasing, reaching 46.7 and 47, respectively. This compares to a 2018 median age of 41 across all workers in Louisiana (U.S. Census Bureau, 2019).

Overall, crabbing in Project Area has been relatively stable over the past couple of decades, though increasing prices in recent years have pushed the value of those landings up in recent years. The specific individuals engaged in the industry has been changing over time with a sizeable amount of entry and exit. However, the net effect of these changes has been a decline in the number of license holders engaged in crabbing and a population of crabbers that is growing older faster than other occupations in Louisiana.

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12. Numbers for license holders across the project area calculated as the sum of unique license holders landing crab from Barataria Basin and unique license holders landing crab from the Mississippi River Basin. Some license holders may have landed crab from both areas causing this sum to overstate the number of unique license holders across the two basins within a year.

13. Data based on definition of exit that identifies commercial license holders landing blue crab and then not landing blue crab again for at least the next four years. Values are presented in 2009 dollars.

Table 3-6. Average and Median Age of Commercial Fishing License Holders Landing Blue Crab from the Barataria Basin

Year	Average	Median
2000	40.2	39.0
2001	40.7	39.0
2002	40.4	39.0
2003	40.8	39.0
2004	41.6	41.0
2005	43.9	43.0
2006	43.4	43.0
2007	43.2	43.0
2008	43.8	43.0
2009	45.1	46.0
2010	44.3	44.0
2011	44.4	44.0
2012	46.2	47.0
2013	45.8	47.0
2014	46.0	46.0
2015	46.3	47.5
2016	46.7	47.0

Source: LDWF Commercial Fishing Trip Tickets (Isaacs 2019c)

Saltwater Finfish Fishery

As noted in Chapter 3 of the EIS, saltwater finfish landings are primarily made up of menhaden, which comprise 97% of total finfish landings. Menhaden are primarily harvested in offshore waters with a small number of license holders producing the majority of the menhaden catch. Additional species included in the commercial saltwater finfish fishery are sheepshead, black drum, mullet-red roe, mullet-white roe, cobia, Vermilion snapper, flounder, Florida pompano, and a range of other species caught in small quantities (LDWF 2019). Because of this concentration of finfish landings, many summaries of saltwater finfish exclude menhaden, thereby providing a clearer picture of how nearshore activity varies by area and species. Saltwater finfish data summarized in Chapter 3 of the EIS show that landings from the Project Area (excluding menhaden) make up approximately one-third of statewide saltwater finfish landings in pounds and 18% of the value of statewide saltwater finfish landings on average from 2014 to 2017. With a 2017 value of $1.2 million, saltwater finfish make up approximately 1.5% of total landings from the Project Area. Historically, areas fished located closest to the Gulf of Mexico had the highest quantity of saltwater finfish landings.

Landings of saltwater finfish from the Project Area have declined over time. Saltwater finfish landings from the Project Area were over five million pounds and $3 million in value (in 2017$) in 2000 but had fallen to under two million pounds and approximately $1.2 million in value by 2017. The long-run trend since 2000 has exhibited considerable ups and downs, influenced by major events including hurricanes and the DWH oil spill (Barnes et al. 2016). Alongside this long-run trend has been a dramatic decline in the number of commercial fishing license holders

landing saltwater finfish: in 2000, there were 1,017 license holders active in the Project Area, compared to just 262 in 2017.[14]

As in other commercial fisheries, trip ticket and licensing data illustrates a considerable amount of change in the specific individuals harvesting saltwater finfish over time, with a continuing pattern of new entrants and exiters, though some of those exiting may continue to be engaged in the industry as crew members not holding licenses. Trip ticket data show that since 2000, a steady and significant percentage of those active in any given year do not land saltwater finfish in the subsequent year within the Barataria Basin (Issacs, 2019d). While these patterns have changed over time, an average of 45% of commercial license holders landing saltwater finfish in any given year return the following year from 2000 to 2016. While some of those individuals become active in future years, this effect is smaller than the dominant trend of continued attrition over time, with the percent of license holders returning in any future year tending to decline further in future years, even after accounting for reentry. After five years, the average percent of license holders still landing saltwater finfish within the basin is less than 25% across all years for which data can be tracked over a five-year period suggesting a significant number moving away from this fishery over time. There is also a steady flow of new entrants, with over half of those landing saltwater finfish in 2017 having no landings in the previous year. Those 2017 data also show that only 35% of those harvesting saltwater finfish were active five years before.

Overall, commercial landings of saltwater finfish in Project Area are dominated by menhaden. However, confidentiality concerns related to the small number of businesses landing menhaden limit the availability of data on this important commercial species. Landings of other saltwater finfish have been variable over time, though relatively low when compared to other major commercial species. The specific individuals engaged in the industry has been changing over time with a sizeable amount of entry and exit. However, the net effect of these changes has been a decline in the number of license holders landing saltwater finfish.

Freshwater Finfish Fishery

As shown in Chapter 3 of the EIS, the freshwater finfish fishery constitutes a much smaller portion of commercial fishing activity than the species groups discussed previously. Between 2014 and 2017, landings from the Project Area averaged 1.3 million pounds and $824,000 in value, representing 14% and 19% of statewide landings of freshwater finfish, respectively based on data summarized in Chapter 3 of the DEIS. Since 2000, freshwater finfish landings from the Barataria Basin have shown a period of general decline from 2000 to 2008, dropping from 1.1 million to 620,000 pounds, followed by a period of increasing activity from 2009 to 2017, during which time landings returned to a level above 1 million pounds by 2017 (Isaacs, 2019e). The number of license holders landing freshwater finfish from the Barataria Basin followed a similar trend dropping from 210 in 2000 to 98 in 2008, before rebounding to 122 in 2017 (Isaacs, 2019e). Data summarizing entry and exit among those landing freshwater finfish shows a pattern similar to that seen among fishers landing other species, with a high degree of turnover. As with commercial license holders targeting shrimp, the group targeting freshwater finfish has exhibited

14. Numbers for license holders across the Project area calculated as the sum of unique license holders landing saltwater finfish from the Barataria Basin and unique license holders landing saltwater finfish from the Mississippi River Basin. Some license holders may have landed saltwater finfish from both areas causing this sum to overstate the number of unique license holders across the two basins within a year.

a pattern of increasing average age over time, with the average age increasing from 44.7 in 2000 to 53.4 by 2016.

Aquaculture and Alligator Harvesting and Hunting

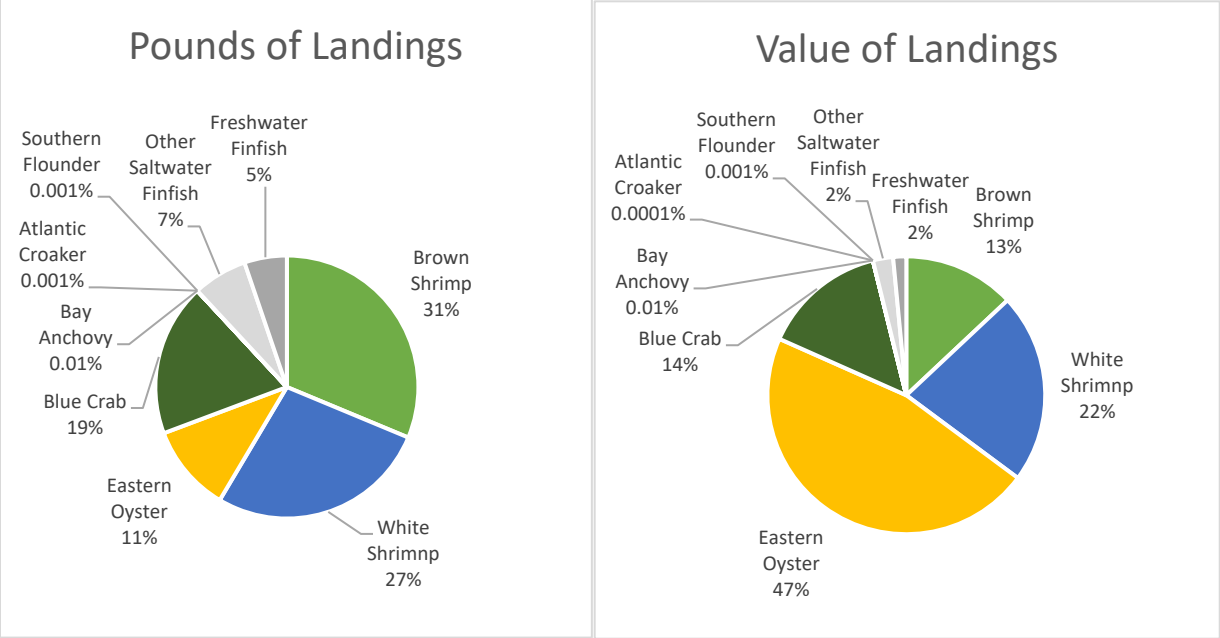
Aquaculture in Louisiana can include a wide variety of activities, but major contributors to aquaculture include farm-raised crawfish and alligator (LSU AgCenter 2018). Commercial harvesting of oysters and soft-shell crabs are sometimes categorized as aquaculture, but are captured through trip ticket data and discussed separately elsewhere in this report. A summary of aquaculture activity in parishes located partially or entirely in the Project Area is provided in Chapter 3 of the EIS. Aside from oyster and soft-shell crab harvesting, aquaculture present in the Project Area includes alligator farming, crawfish farming, fish bait, and turtles, with 2017 total values of $19.2 million, $6.9 million, $1.4 million and $770,000, respectively.

In addition to alligator farming, the harvesting of wild alligators is also an important source of commercial resource-based activity in Louisiana. Since the inception of the management of alligator by the Louisiana Department of Wildlife and Fisheries, the number of commercial hunters and wild-caught alligators taken has grown over time, with 3,281 hunters active and 33,613 alligators taken in Louisiana in 2016, valued at $9.7 million, including skin and meat (LDWF 2017). The management of alligators includes assessment of nest density and population in order to set quotas, which is coupled with a wild-egg harvest program that allows alligator ranchers to harvest eggs from the wild, but requires ranchers to return a quantity of juvenile alligators equal to 10% of the eggs hatched to the wild within two-years. This program has helped sustain the wild population, while also cultivating a robust alligator farming/ranching program. However, this connection also demonstrates how both segments of this industry can be impacted by environmental changes.

Summary of Existing Conditions

While aquatic resource assessments are not available for all commercially relevant species, the discussion below puts each of the species considered in the context of the broader species group as a whole and the conclusion summarizes what the patterns identified below imply for the industry more broadly. To illustrate the importance of each species discussed below to commercial fishing as a whole, Figure 3-2 shows each species landings as a percent of all landings in terms of both pounds and value based on 2018 LDWF trip ticket data. As individual species, brown shrimp, white shrimp, eastern oyster and blue crab are by far the most important. Data for menhaden are not published by LDWF, but as discussed below they are also a major contributor to commercial fishing activity though landed primarily from offshore waters beyond the Project Area. Individual finfish species make up a very small percentage of finfish landings, which as a group make up a relatively small portion of commercial fishing activity. The contribution of each species is discussed in further detail below.

Figure 3-2. Share of Commercial Fishing from Project Area by Individual Species, 2018



Note: Calculations based on non-confidential monthly LDWF trip ticket summaries by species and area fished.

3.4.4 Construction Impacts

No Action Alternative

Under the NAA the Project would not be constructed and there would no changes due to the Project in socioeconomic impacts associated with commercial fishing.

Applicant's Preferred Alternative

Construction activities under the Applicant's PA are not expected to close or impair road access for those engaged in commercial fishing. There may be occasional highway or waterway traffic congestion from the mobilization of crews and equipment, which may contribute to short-term delays in accessing areas used for commercial fishing. However, due to the temporary and localized nature of these effects, the construction of the Project is likely to have no significant impact on commercial fishing.

Other Alternatives

The construction impacts from the other alternatives would be no different than those for the Applicant's PA.

3.4.5 Operational Impacts

No Action Alternative

Brown Shrimp

Brown shrimp are one of two major species of shrimp harvested from the Project Area. Commercial landings data from 2018 indicate that brown shrimp made up 44% of all shrimp

landings from the Project Area in terms of weight and 30% in terms of value.[15] Total landings of brown shrimp in the Project Area were just over 15 million pounds and nearly $11 million in value in 2018. As shown in Table 3-7 below, brown shrimp landings are heavily concentrated in subbasin areas fished 211 and 210 in the lower portion of the Barataria Basin (Figure 3-3), which together accounted for approximately 70 percent of brown shrimp landings from the Project Area in 2018.

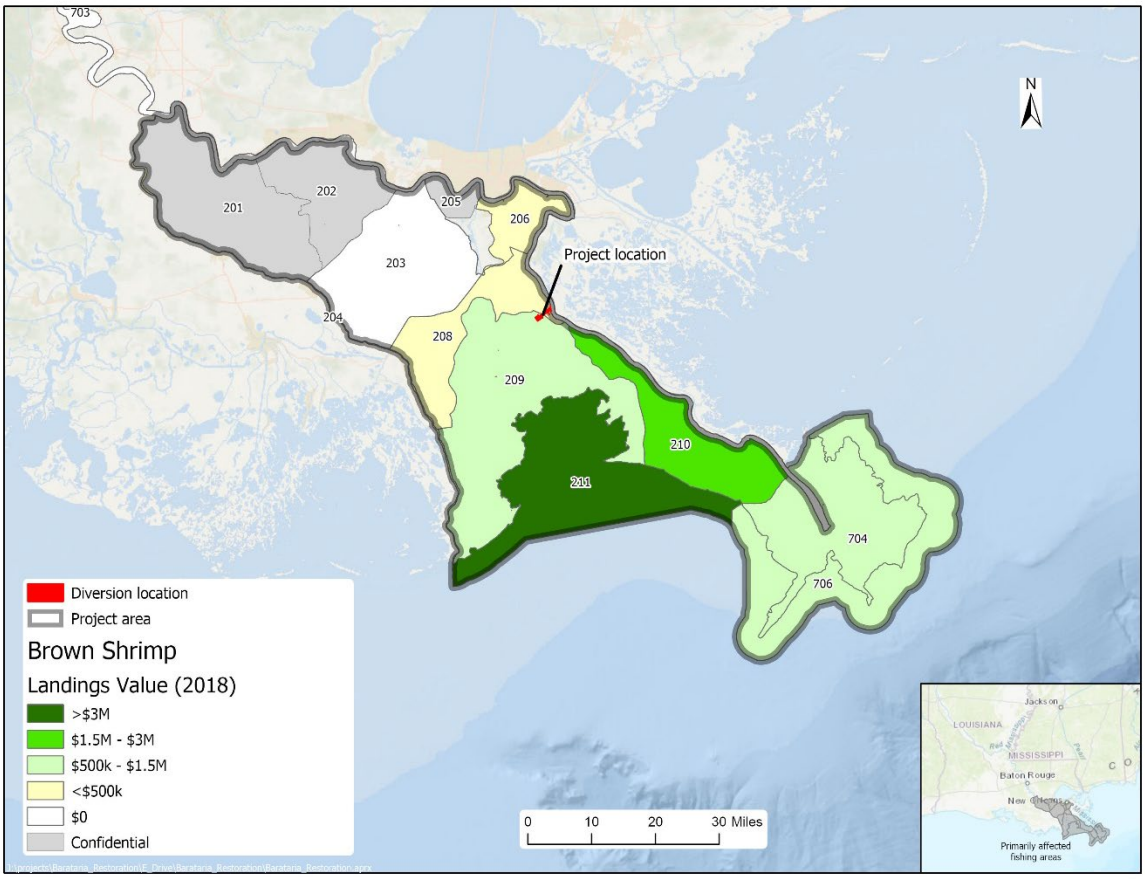
Table 3-7. Brown Shrimp Landings in Pounds and Value by Area Fished, 2018

Basin	Area Fished	Landings	Value
Barataria	201	CONFIDENTIAL	CONFIDENTIAL
Barataria	202	CONFIDENTIAL	CONFIDENTIAL
Barataria	203	0	$0
Barataria	204	168,638	$120,836
Barataria	205	CONFIDENTIAL	CONFIDENTIAL
Barataria	206	19,281	$14,573
Barataria	208	8,533	$11,876
Barataria	209	1,966,987	$1,402,492
Barataria	210	3,890,100	$2,659,193
Barataria	211	7,136,951	$4,671,927
Barataria	213	CONFIDENTIAL	CONFIDENTIAL
Mississippi River	703	30,435	$23,147
Mississippi River	704	881,051	$846,336
Mississippi River	706	867,330	$789,973
Project Area Total		**15,145,313**	**$10,655,595**

Notes: CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed. Project Area Total includes values suppressed as CONFIDENTIAL.

15. Calculations based on non-confidential monthly trip ticket summaries by species and basin. Due to confidentiality restrictions, some monthly values are suppressed and assumed to be zero in these calculations.

Figure 3-3. Brown Shrimp Landings by Value in the Project Area, 2018



Note: Calculations based on non-confidential monthly trip ticket summaries by species and area fished.

Under the NAA, decreases in marsh habitat over time are expected to reduce habitat suitability for brown shrimp resulting in lower population abundance in the Barataria Basin. Research by Turner (1977) reported the production of Penaeid shrimp (which includes brown shrimp and white shrimp) to be directly correlated to the amount of wetlands in the estuary.

By the end of the modeled 50-year period, Delft3D modeling results project that almost 80% of the marsh present at the initiation of the project will have been lost to relative sea level rise and erosion. This reduction in marsh implies a significant reduction in brown shrimp abundance, which likely will lead to significant declines in commercial landings of brown shrimp from the Project Area. If the price of native brown shrimp increases as they become scarcer (particularly if consumers are willing to pay a premium for native shrimp versus imported or farmed shrimp), then the reduction in the weight of landings may decrease faster than the reduction in value (with fishers potentially able to obtain a higher price per pound). However, a decline in shrimp prices because of imports (as has been observed recently) would result in a faster reduction in value compared to the reduction in the weight of landings. This projected decrease in brown shrimp landings is not likely to be evenly spread over the 50-year operational period for the project, but concentrated after 2050 when relative sea level rise and marsh loss accelerates.

White Shrimp

White shrimp are one of two major species of shrimp harvested from the Project Area. Commercial landings data from 2018 indicate that white shrimp made up 56% of all shrimp landings from the Project Area in terms of weight and more than 70% in terms of value.[16] Total landings of white shrimp in the Project Area were just over 13 million pounds and $18 million in value in 2018. As shown in Table 3-8 below, white shrimp landings are most heavily concentrated in areas fished 211 and 210 in the lower portion of Barataria Basin (Figure 3-4), which together accounted for approximately 50% of white shrimp landings from the Project Area in 2018. However, commercial fishing of white shrimp was also sizeable from subbasin areas fished 209, 704 and 706.

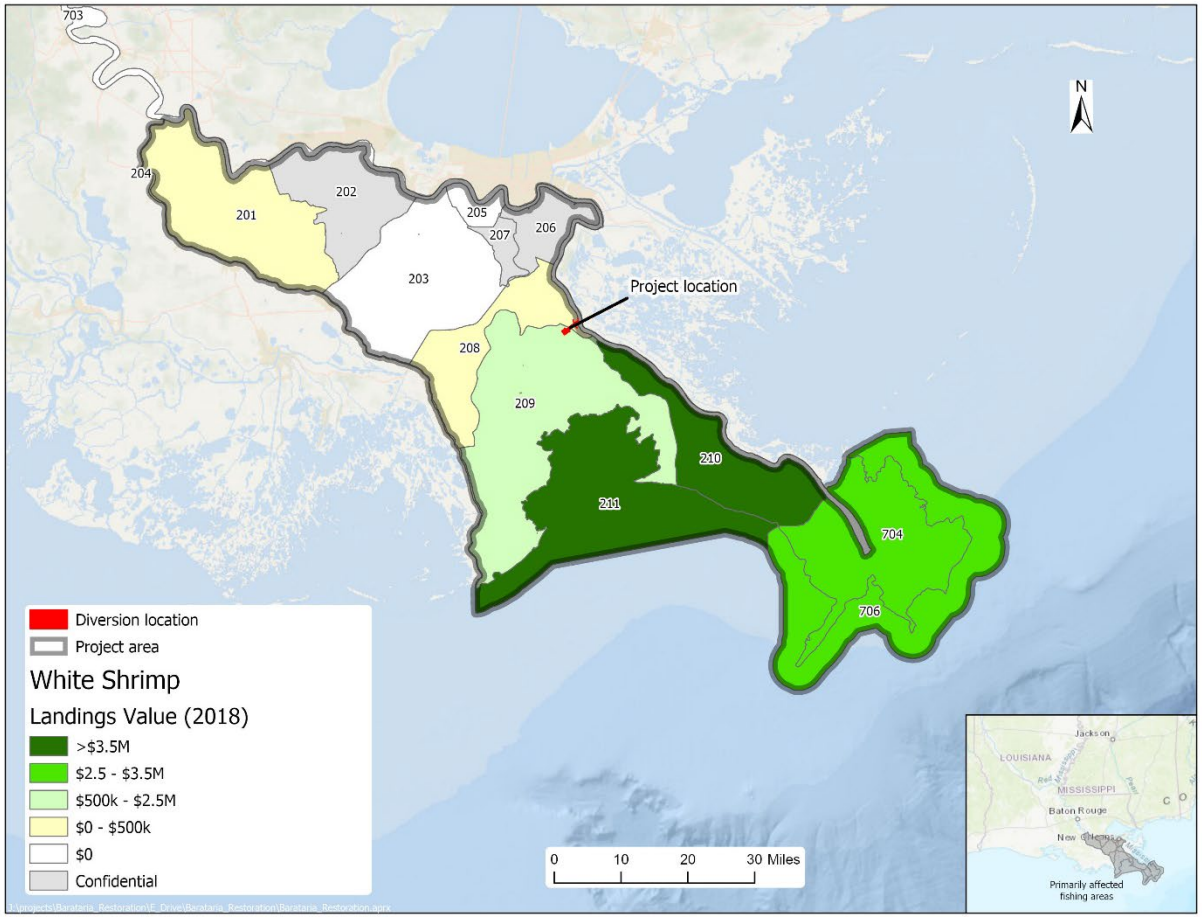
Table 3-8. White Shrimp Landings in Pounds and Value by Area Fished, 2018

Basin	Area Fished	Landings	Value
Barataria	201	116,224	$133,856
Barataria	202	CONFIDENTIAL	CONFIDENTIAL
Barataria	203	0	$0
Barataria	204	29,170	$36,196
Barataria	205	0	$0
Barataria	206	CONFIDENTIAL	CONFIDENTIAL
Barataria	207	CONFIDENTIAL	CONFIDENTIAL
Barataria	208	6,172	$7,592
Barataria	209	1,794,596	$2,138,239
Barataria	210	3,488,694	$4,567,392
Barataria	211	3,472,504	$4,608,422
Barataria	213	CONFIDENTIAL	CONFIDENTIAL
Mississippi River	703	295,134	$448,674
Mississippi River	704	1,929,880	$3,214,588
Mississippi River	706	2,314,805	$3,389,514
Project Area Total		**13,468,219**	**$18,566,717**

Notes: CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed. Project Area Total includes values suppressed as CONFIDENTIAL.

16. Calculations were based on non-confidential monthly trip ticket summaries by species and basin. Due to confidentiality restrictions, some monthly values are suppressed and assumed to be zero in these calculations.

Figure 3-4. White Shrimp Landings by Value in the Barataria Basin, 2018



Note: Calculations based on non-confidential monthly trip ticket summaries by species and basin.

Under the NAA, decreases in marsh habitat are expected to reduce habitat suitability for white shrimp resulting in lower population abundance of white shrimp in the Barataria Basin. As noted for brown shrimp, research by Turner (1977) reported the production of Penaeid shrimp (which includes brown shrimp and white shrimp) to be directly correlated to the amount of wetlands in the estuary.

As with brown shrimp, the projected reduction in marsh over the modeled 50-year period implies a significant reduction in white shrimp abundance, which likely will lead to significant declines in commercial landings of white shrimp from the Project Area. If the price of native white shrimp increases as they become scarcer (particularly if consumers are willing to pay a premium for native shrimp versus imported or farmed shrimp), then the reduction in the weight of landings may decrease faster than the reduction in value (with fishers potentially able to obtain a higher price per pound). This projected decrease in white shrimp landings is not likely to be evenly spread over the 50-year operational period for the project, but concentrated after 2050 when relative sea level rise and marsh loss accelerates.

Eastern Oyster

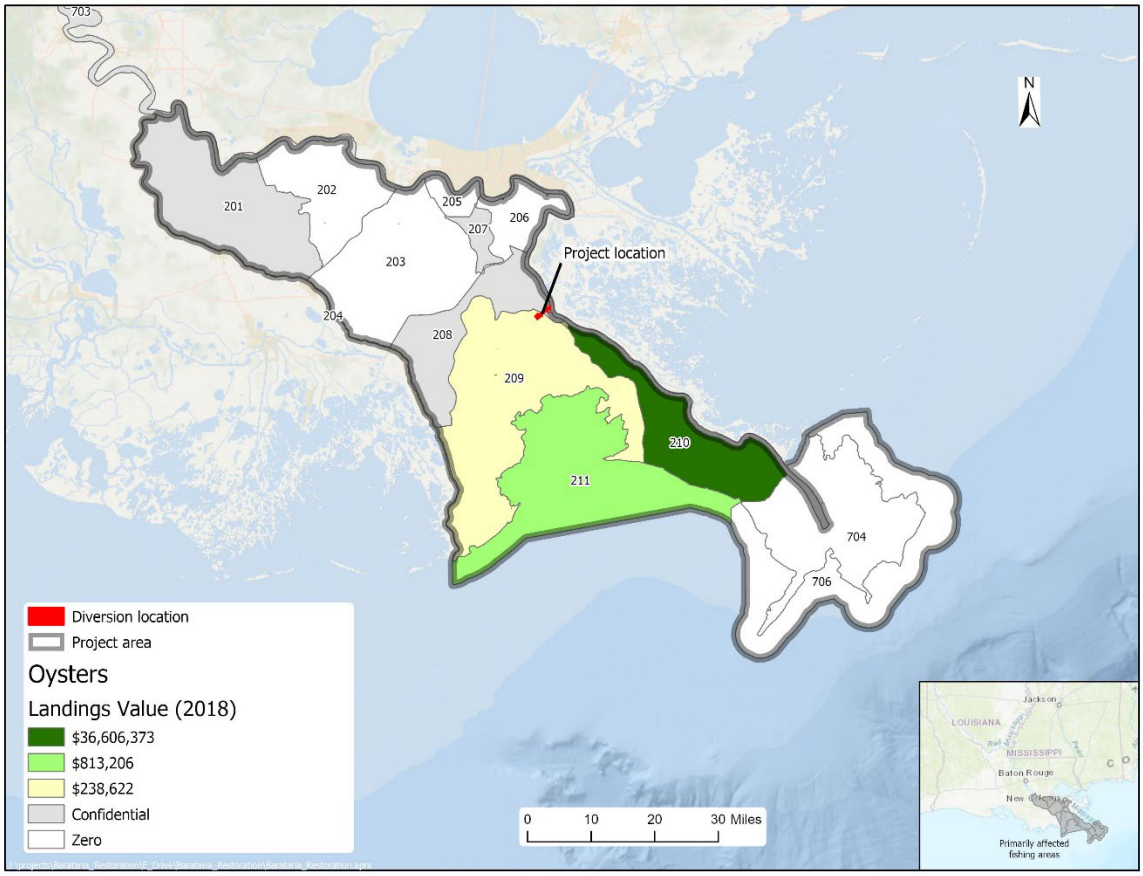
Total landings of oysters from the Barataria Basin were just over 5 million pounds and $38 million in value in 2018 (LDWF, 2019). As shown in Table 3-9 below, oyster landings are most heavily concentrated in subbasin area fished 210 in the southeastern portion of the Barataria Basin along the Mississippi River, which accounted for 97% of oyster landings from the Project Area in 2018. While oyster harvested from area 210 (Figure 3-5) provide virtually all commercial landings, other portions of the basin include public oyster grounds and private leases, which are also used to seed oysters for transplant at later life stages to other areas.

Table 3-9. Oyster Landings in Pounds and Value by Area Fished, 2018

Basin	Area Fished	Landings	Value
Barataria	201	CONFIDENTIAL	CONFIDENTIAL
Barataria	202	0	$0
Barataria	203	0	$0
Barataria	204	CONFIDENTIAL	CONFIDENTIAL
Barataria	205	0	$0
Barataria	206	0	$0
Barataria	207	CONFIDENTIAL	CONFIDENTIAL
Barataria	208	CONFIDENTIAL	CONFIDENTIAL
Barataria	209	38,165	$238,622
Barataria	210	4,933,765	$36,606,373
Barataria	211	137,585	$813,206
Mississippi River	703	CONFIDENTIAL	CONFIDENTIAL
Mississippi River	704	0	$0
Mississippi River	706	0	$0
Project Area Total		**5,197,924**	**$38,019,028**

Notes: CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed. Project Area Total represents only Barataria totals including values suppressed as CONFIDENTIAL, but excludes Mississippi River since the area total is also confidential and cannot be disclosed.

Figure 3-5. Oyster Landings by Value in the Project Area, 2018



Calculations based on non-confidential monthly trip ticket summaries by species and area fished.

Under the NAA, suitable locations for oysters may decline or move, if currently productive commercial areas, which are concentrated in the southeastern portion of the project area along the Mississippi River, become too salty with the potential for additional sea-level rise and saltwater intrusion. If the future locations suitable for oyster production do not overlap with the location of currently suitable habitat (e.g., waterbottoms with "cultch material" suitable for oyster growth), the commercial fishery may incur additional costs associated with the placement of cultch in new areas. Also, if newly suitable locations do not overlap with current commercial leases, then individual fishers may incur costs associated with establishing new leases. Furthermore, the value of current leases may decline. These changes in the fishery would likely be minor to moderate (depending on the locations where conditions change) over the long-term.

Blue Crab

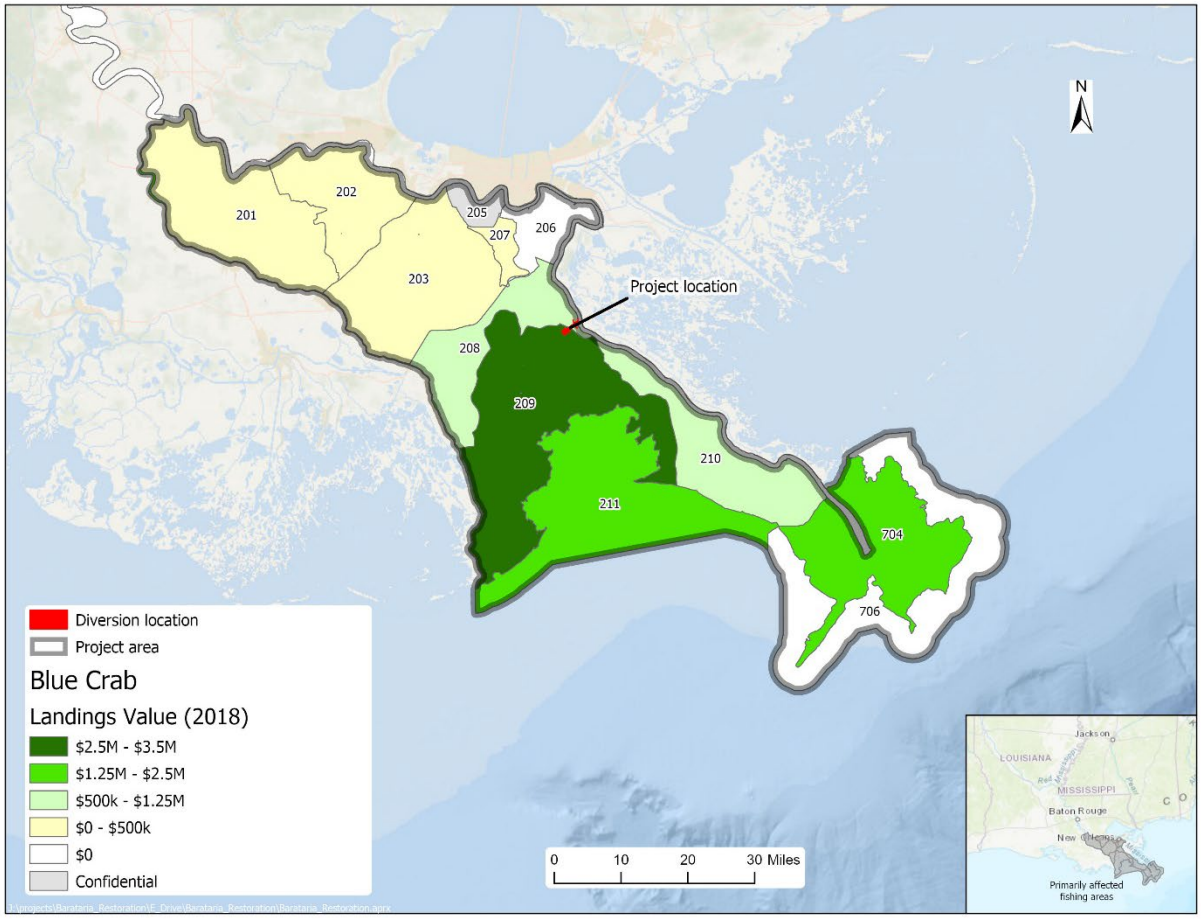
Total landings of blue crab from the Project Area were just over 9 million pounds and nearly $12 million in value in 2018 (LDWF 2019). As shown in Table 3-10 and Figure 3-6 below, blue crab landings are most heavily concentrated in areas fished 209, 211 and 704, which together made up roughly 70% of blue crab landings from the Project Area in 2018.

Table 3-10. Blue Crab Landings in Pounds and Value by Area Fished, 2018

Basin	Area Fished	Landings	Value
Barataria	201	10,268	$18,192
Barataria	202	14,216	$18,222
Barataria	203	243,861	$316,024
Barataria	204	820,143	$1,257,909
Barataria	205	CONFIDENTIAL	CONFIDENTIAL
Barataria	206	0	$0
Barataria	207	445,118	$494,044
Barataria	208	443,674	$632,975
Barataria	209	2,458,912	$3,497,194
Barataria	210	520,506	$603,116
Barataria	211	2,169,394	$2,831,223
Mississippi River	703	1,745,003	$2,196,281
Mississippi River	704	1,949,484	$2,161,348
Mississippi River	706	0	$0
Project Area Total		**26,525,606**	**$33,793,057**

Notes: CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed. Project Area Total does not include Area Fished 205 due to confidentiality concerns. However, for reference area 205 data from 2016 showed 80,503 pounds in landings and $107,218 in value, which is the most recent year that can be disclosed. Boundaries for Area 204 align with Bayou Lafourche.

Figure 3-6. Blue Crab Landings by Value in the Project Area, 2018



Calculations based on non-confidential monthly trip ticket summaries by species and area fished.

Under the NAA, decreases in marsh habitat are expected to reduce habitat suitability for blue crab. Reduced marsh habitat increases predation, however juvenile crabs are able to bury themselves in mud, which will partially offset this change in habitat. Overall, blue crab abundance is expected to exhibit a minor decrease, which will lead to minor declines in commercial landings of blue crab from the Project Area under the No Action Alternative.

Finfish

Aquatic impacts analyses are available only for select finfish. While impacts across the entire commercial fishing industry are of concern, the discussion below focuses on the specific species for which impacts assessments are available and assumes they provide a general indication of likely trends across other commercially-relevant species within the group of finfish.

In 2017, total statewide landings of gulf menhaden were 716 million pounds valued at $61 million.[17] This statewide catch is supported by estuaries across the coast including the Project Area where fish recruit in early life stages. Commercial landings data for menhaden are not available by area fished, but menhaden are typically targeted in state waters outside of the

17. Species-specific data for gulf menhaden are not published by LDWF, but are available from NOAA National Marine Fisheries Service (2019).

barrier islands near-shore or offshore areas outside of the Project Area where more gulf menhaden migrate after maturing.

Habitat suitability for gulf menhaden exhibits very little change under the NAA. However, gulf menhaden are found in open water areas associated with marsh so the reduction in marsh habitat is expected to produce very minor decreases in abundance, which can be expected to translate in to declines in commercial landings similar in order of magnitude.

In 2017, total statewide landings of spotted seatrout were less than 4,000 pounds valued at approximately $14,000 of value.[18] Habitat suitability is expected to decrease for spotted seatrout across the Project Area. In particular, marsh cover provides nursery habitat and supports prey. The 80% reduction in marsh acreage over the 50-year horizon of the analysis implies that spotted seatrout will experience minor decreases in abundance over time, which will translate into minor decreases in commercial landings of spotted seatrout from the Project Area under the NAA.

Commercial landings data capture bay anchovy as part of the reporting group for all minnows. In 2018, landings of minnows from the Barataria Basin were under 7,000 pounds and valued at slightly more than $7,000 (LDWF, 2019). Due to confidentiality restrictions, data by area fished cannot be reported. Habitat suitability does not change much under the NAA. However, decreases in marsh acreage are expected to increase predation and can be expected to lead to minor decreases in abundance resulting in minor decreases in commercial fishing for bay anchovy in the Project Area under the NAA.

Total landings of Atlantic croaker from the Project Area were just over 600 pounds valued at $100 in 2018 (LDWF, 2019). In 2018, all landings within the Project Area were reported from area fished 211 in the southernmost part of the Barataria Basin. Habitat suitability is expected to decrease under the NAA due to increasing salinities and water depth from relative sea level rise changes in water temperature and decreases in marsh acreage. However, abundance is not expected to change appreciably under the NAA. Similarly, commercial fishing of Atlantic croaker is expected to exhibit no significant change in the Project Area under the NAA.

Historically, southern flounder made up a sizeable amount of saltwater finfish landings. However, commercial gear restrictions enacted in the 1990s led to a significant decline in landings (Davis et al., 2015). Since 2000, statewide landings have averaged approximately 60,000 pounds and $92,000 in nominal value per year. Statewide landings dropped to just over 25,000 pounds and $57,000 in value in 2017, making southern flounder a very small contributor to overall commercial fishing activity. Commercial landings data capture southern flounder as part of the broader group of all flounder. In 2018, landings of flounder from the Barataria Basin were under 700 pounds and valued at slightly more than $800 (LDWF, 2019).

Habitat suitability for southern flounder will benefit from increased salinity in the basin but loss of marsh acreage will reduce and prey availability. Given the significant declines in marsh acreage under the NAA, southern flounder can be expected to experience minor decreases in abundance, which will lead to minor decreases in commercial fishing in the Project Area under the NAA.

18. Species-specific data for spotted seatrout are not published by LDWF, but are available from NOAA National Marine Fisheries Service.

Largemouth bass are classified as a Game Fish by LDWF making their sale or use for commercial purposes illegal. However, this is the only freshwater species that has been studied for potential impacts and is discussed briefly here to provide some insight about potential impacts to freshwater commercial fishing. Under the NAA, increases in salinity and reductions in marsh cover are expected to lead to minor decreases in abundance. To the extent that general patterns for largemouth bass are representative of patterns for freshwater fish more broadly, this suggests minor decreases in commercial fishing of freshwater finfish more broadly under the NAA.

Applicant's Preferred Alternative

Operations under the Applicant's PA will affect salinity conditions, habitat availability, and prey availability for commercially important species (and in turn, their abundance) in the Basin, as described in the Aquatics Analysis. While impacts across the entire commercial industry are of concern, aquatic impacts analyses are not available for all species. Therefore, individual species for which aquatic impacts are available are included here and assumed to be representative of species within a major category more broadly (e.g. saltwater finfish). Below, each of the species analyzed for this commercial fishing impact assessment is categorized into a group based on their expected change in abundance. The expected change to each target species is measured as the general difference between the expected change under the Applicant's PA and expected change under the NAA (Table 3-11).

- **Group 1: Expected Increase in Abundance Due to Decrease in Salinity Relative to the NAA**
  - **White Shrimp** – Over time, the Applicant's PA is expected to create and maintain more than 10,000 acres of marsh, benefiting white shrimp by providing additional cover and food resources. In general, shrimp productivity correlates with area of marsh. Because white shrimp are more tolerant of fresh conditions than brown shrimp, white shrimp are expected to increase in abundance relative to the NAA.
  - **Southern Flounder** – The Applicant's PA is expected to improve submerged aquatic vegitation (SAV) habitat and increase marsh nursery habitat, both of which affect southern flounder abundance. Although southern flounder does not directly rely on marsh as nursery habitat, the added marsh coverage from the diversion will increase prey availability. The increase in marsh coverage, SAV habitat, and prey availability for southern flounder is expected, in turn, to increase the abundance of southern flounder under the Applicant's PA in comparison to the NAA.
  - **Bay Anchovy** – Over time, the Applicant's Preferred Alternative is expected to create and maintain more than 10,000 acres of marsh, as well as supply nutrients which increase planktonic prey and benefit bay anchovy by providing additional food resources. This benefit is more likely to be important in the later decades of the project, when the overall marsh loss in the basin may have limited food resources.
  - **Gulf Menhaden** – Over time, the Applicant's PA is expected to create and maintain more than 10,000 acres of marsh, benefiting gulf menhaden by providing additional cover and providing nutrients which increase planktonic prey and benefit Gulf menhaden by providing food resources. This benefit is more likely to be important in the later decades of the project, when the overall marsh loss in the basin may have limited food resources.

Because menhaden spawning occurs in the northern Gulf of Mexico, spawning activities are not likely to be impacted by the diversion.

- **Atlantic Croaker** – The Applicant's PA is expected to deposit sediment in open water areas, thus decreasing water depths and increasing the amount of shallow-water habitat for Atlantic croaker. Additional marsh created from the Applicant's Preferred Alternative will also increase prey abundance. Freshwater from the diversion is anticipated to lower water temperatures, which will also benefit Atlantic croaker. Increases in marsh and prey abundance, as well as lower water temperatures, are expected to increase the abundance of Atlantic croaker under the Applicant's PA in comparison to the NAA.
- **Blue Crab** – The Applicant's PA is expected to create additional marsh acreage in the Barataria Basin, providing blue crabs with more protection from predators. Because of an increase in marsh acreage, the abundance of blue crab is expected to increase under the Applicant's PA compared to the NAA.
- **Freshwater Commercial Species (represented by largemouth bass as a proxy species)** – With the Applicant's Preferred Alternative, freshwater from the Mississippi River will flow into the Barataria Basin leading to lower salinity levels and in-turn, benefit largemouth bass, particularly in the mid-basin. Additionally, the Applicant's PA will create and maintain marsh and SAV, which are utilized by both juvenile and adult largemouth bass. Lower salinity and increases in marsh and SAV habitat are expected, in turn, to increase the abundance of freshwater species under the Applicant's PA in compared to the NAA.

    - **Alligator** – Terrestrial impact reports have not yet been completed for alligator. However, alligator are anticipated to fall into Group 1.

- **Group 2: Expected Decrease in Abundance Relative to the NAA**

    - **Brown Shrimp –** Under the Applicant's PA, the project will divert freshwater into the basin, decreasing brown shrimp abundance compared to the NAA, although, the severity of impacts to brown shrimp from the Applicant's PA will vary depending on water flow rates.
    - **Spotted Seatrout** – The Applicant's PA will divert freshwater into the Basin, decreasing spotted seatrout abundance, because spotted seatrout prefer high salinity environments. Spotted seatrout may relocate away from areas where freshwater discharges into the mid-Basin. In the near-term, mid-term, and long-term, spotted seatrout under the Applicant's PA will decrease in abundance compared to the current conditions in the Basin. The decrease in abundance of spotted seatrout is greater under the Applicant's PA than the decrease of spotted seatrout under the NAA. Therefore, the addition of lower salinity freshwater is expected to decrease the abundance of spotted seatrout under the Applicant's PA in comparison to the NAA in the near-term, mid-term, and long-term.
    - **Eastern Oyster** – Under the Applicant's PA, the project will divert freshwater into the basin, decreasing eastern oyster abundance relative to the NAA, especially in the mid-basin area where salinity changes are greatest. There may be areas in the lower-basin where the Applicant's PA generates beneficial reductions in salinity from unsuitably high levels in the NAA, however, the overall effect is expected to be a major, permanent decrease in abundance within the Project Area.

Table 3-11. Expected Trends in Barataria Basin Abundance from the Applicant's Preferred Alternative

Aquatic Species	Applicant's PA Compared to NAA
Brown Shrimp	Decrease
White Shrimp	Increase
Eastern Oyster	Decrease
Blue Crab	Increase
Gulf Menhaden	Increase
Spotted Seatrout	Decrease
Bay Anchovy	Increase
Atlantic Croaker	Increase
Southern Flounder	Increase
Largemouth Bass	Increase

Source: Interpretation of Abt/Confluence (2019). Aquatics Analysis.

Brown Shrimp

As summarized above, under the Applicant's PA, brown shrimp abundance is expected to decline due to reductions in salinity relative to the NAA. This decline in abundance may lead to major, adverse, short-term and long-term impacts to the brown shrimp fishery, up to and including the complete loss of a commercial fishery for brown shrimp in the Barataria Basin. In the Vermilion Basin, affected by freshwater inflows from the Atchafalaya River, juvenile brown shrimp are found in LDWF sampling nets (Lindquist, 2019), but the Vermilion Basin does not support a commercial fishery for brown shrimp because they do not grow to commercial sizes in sufficient quantities (B. Carter, LDWF, personal communication. 2019). In 2018, approximately $40,000 of brown shrimp were landed from the Vermilion Basin according to LDWF trip ticket data.

Even if brown shrimp are not entirely absent from the Project Area, major declines in abundance could undermine the viability of a commercial fishery for brown shrimp in the Project Area as is the case in the Vermilion Basin. The level of commercial fishing activity for brown shrimp has followed a long-run downward trend and environmental conditions in the NAA are expected to decrease brown shrimp abundance putting further downward pressure on the industry. Therefore, the most recent year of landings of 2018, which indicate that the brown shrimp fishery in the project area produced just over 15 million pounds and $10.6 million in landings, can be thought of as providing an upper bound estimate of the potential impacts to brown shrimp in the Applicant's PA compared to the NAA. It should be noted that the largest concentration of historical landings is in area 211, which includes a significant area beyond the barrier islands and outside of the analysis area for assessing aquatic resource impacts.

The planning horizon for the Applicant's PA includes a three to five year period for construction. During this time, some adjustment among participants and potential participants is likely to occur. Because of the ongoing trends of entry and exit for commercial fishers, a small portion of current, lower-level and part-time participants can be expected to have left the industry before any impacts from the project would have occurred. Based on historical trends, nearly half of commercial fishing license holders currently harvesting shrimp would be expected to have stopped landing shrimp within 5 years, which could be prior to any operational impacts occurring. Exits from the industry may also increase due to some participants deciding to retire

given the uncertainty of fishery impacts from the diversion and the average age of fishers currently active in the Barataria Basin. These exits may be accelerated by fishers who are anticipating future impacts. Similarly, there may be a reduction in new entrants in the Barataria Basin during this time, because of increased uncertainty about future profitability. The net effect of increasing exits and slowing entry is likely to be an acceleration in the long-run decline in the number of commercial license holders landing brown shrimp. Prior analysis of LDWF trip ticket data shows that those entering or exiting tend to have lower average landings than those who remain in the fishery year over year. Those entering or exiting average $16,155 pounds annually compared to $59,361 among those who continued to be active (Isaacs 2018a).[19] If the brown shrimp fishery is not entirely lost, decreases in participation associated with declining activity may continue to be concentrated among smaller operators.

Expectations about long-run changes created by the diversion may also cause current and future entrants to focus efforts in different areas that are less likely to be affected by the diversion, which may include higher fuel costs or investing in different boats and gear to maintain access to brown shrimp in other areas along Louisiana's coast. Because new entrants have greater flexibility in determining the vessels and gear to acquire, the costs of adjusting to these future environmental changes will be smaller than for those currently engaged in the industry. Similarly, current and future entrants may be able to offset a portion of this impact by substituting effort toward other species (such as white shrimp), which is discussed below following the impacts assessments for each species.

White Shrimp

As summarized above, under the Applicant's PA, white shrimp abundance is expected to increase relative to the NAA over the long-term because of the relative increase in marsh area in the basin. The Vermilion Basin, which is affected by freshwater inflows from the Atchafalaya River, provides a useful historical example where a significant commercial fishery exists for white shrimp (with 2018 landings of more than 600,000 pounds and $1 million in value) but no significant fishery exists for brown shrimp. While substitution across species is discussed further below, a number of commercial fishers target both brown shrimp and white shrimp so it should be noted that impacts to the brown shrimp fishery may lead to some fishers increasing fishing pressure in the white shrimp fishery, while others may stop shrimping altogether. The potentially major adverse impacts to brown shrimp could generate indirect adverse impacts on those targeting white shrimp due to increased fishing pressure if effort is shifted toward white shrimp. These trends may lead to minor to moderate, direct, long-term benefits to the white shrimp fishery together with minor to moderate indirect, adverse short to long-term impacts to the white shrimp fishery.

Should historical patterns of those exiting the industry continue, a sizeable portion of current participants can be expected to have left the industry before any impacts or benefits from the project would have occurred. These exits may be accelerated if commercial fishers leave the shrimp industry altogether if the brown shrimp fishery is lost from the Barataria Basin, even if

19. Data based on definition of exit that identifies commercial license holders landing shrimp and then not landing shrimp again for at least the next four years. Values are for calendar year 2013, which is the most recent year for which a subsequent 4-year period of inactivity has been examined, and are presented in 2009 dollars.

white shrimp remain. Exits from the industry may also increase due to some participants deciding to retire given the uncertainty of fishery impacts from the diversion and the average age of fishers in the Barataria Basin. Similarly, there may be a reduction in new entrants in the Barataria Basin during this time, because new entrants may be less likely to invest in capital and target locations that are soon to be impacted by the diversion, out of a sense of uncertainty about the future (even if the data suggest that white shrimp may benefit over time). However, the potential benefits to white shrimp abundance could generate higher rates of entry (and higher participation) than expected in the NAA.

Eastern Oyster

Because oysters are highly sensitive to salinity changes as well as to low salinity, there is the potential for major, adverse, short-term to long-term impacts to the commercial fishery for oysters, up to and including the complete loss of a commercial fishery for oysters in the Barataria Basin. The degree and location of these changes in salinity is uncertain, but in the extreme case of a complete loss of the fishery, recent landings provide a helpful benchmark for understanding the order of magnitude of impacts to commercial fishing and the broader regional effects of changes in oyster landings. In 2018, a total of just over 5 million pounds valued at $37.8 million in oysters were landed from the Project Area with 96% of those landings coming from area 210 in the southeastern portion of Barataria Basin. Oyster landings in the Project Area have exhibited a historical trend of increasing landings and value, with prices increasing substantially in recent years even after accounting for inflation. Given that landings have increased over the same period of time that prices have risen, decreases in supply from other areas or increases in consumer demand can be seen as the dominant driver of recent price increases. However, changing environmental conditions in the NAA can be expected to put downward pressure on landings over time, but potentially further increase prices if demand for Louisiana oysters remains strong while supply is limited. Therefore, further reductions in the supply of oysters with the Applicant's PA should be compared to expectations about future landings under the NAA, which can be expected to drop below the 5 million pounds reported in 2018. However, even if the impact to oysters is smaller in future years when measured in pounds, the 2018 value of nearly $40 million provides a reasonable upper bound order of magnitude estimate for the value of impacts to oysters under the Applicant's PA when compared to the NAA given that increasing prices may bolster the total value of catch under the NAA even with declines in landings.

While uncertainty surrounding impacts to oysters makes a complete loss of the fishery a scenario worth exploring, it should be noted that recent oyster landings within the Project Area come primarily from fishing area 210 in the southeastern portion of Barataria Basin along the Mississippi River. Significant changes in habitat suitability between the Applicant's PA and NAA occur in CASM polygons that overlap with only a portion of area 210. Therefore, the extent of impacts to oysters will be sensitive to the exact location of oyster beds, which are most heavily concentrated in the southeastern portion of the Project Area along the Mississippi River, and extent of environmental changes in particular areas. The location of oyster beds can also change over time so net effects to the industry will depend on the location and size of areas with suitable conditions over time relative to area 210 today.

As noted in the discussion of impacts to brown shrimp, ongoing trends of entry and exit for commercial fishers implies that some of those currently engaged in landing oysters can be expected to leave the industry before any impacts from the Project would have occurred. Based

on historical trends, more than half of commercial fishing license holders currently harvesting oysters would be expected to have stopped landing oysters within 5 years, which could be prior to any operational impacts occurring. Exits from the industry may also increase due to some participants deciding to retire given the uncertainty of fishery impacts from the diversion and the average age of fishers currently active in the Barataria Basin. These exits may be accelerated by fishers who are anticipating future impacts. While there is a steady stream of individuals exiting the industry, there is also a steady stream of new entrants, which has outpaced exits in recent years leading to a modest increase in the number of license holders landing oysters. However, expectations about future environmental changes may slow the rate of entry with the Applicant's PA leading to further declines. The net effect of increasing exits and slowing entry is likely to be a long-run decline in the number of commercial license holders landing oysters. Prior analysis of LDWF trip ticket data shows that those entering or exiting tend to have lower average landings than those continuing year over year in the industry, with those exiting averaging $25,195 in annual landings and those remaining active averaging $56,341 in average landings (Isaacs 2018b). [20] If the oyster fishery is not entirely lost, future decreases in participation associated may continue to be concentrated among smaller operators.

Expectations about long-run changes created by the diversion may also cause current and future entrants to focus efforts in different areas that are less likely to be affected by the diversion, which may include facing higher fuel costs or making different capital investments to maintain access to oysters in other areas along Louisiana's coast. Because new entrants have greater flexibility in determining where to locate and the vessels and gear to acquire, the costs of adjusting to these future environmental changes will be smaller than for those currently engaged in the industry. Similarly, current and future entrants may be able to offset a portion of this impact by substituting effort toward other species, which is discussed below following the impacts assessments for each species.

Blue Crab

As summarized above, under the Applicant's PA, blue crab abundance is expected to increase relative to the NAA over the long-term because of the relative increase in marsh area in the Basin. In the Vermilion Basin, affected by freshwater inflows from the Atchafalaya River, a robust commercial fishery exists for blue crab with 3.9 million pounds of landings valued at $6.2 million in 2018 (LDWF 2019). However, because commercial fishers may feel a high degree of uncertainty about the impacts of the diversion, there may be an indirect adverse impact on the blue crab commercial fishery. These fears may be heightened for blue crab because fishing area 209, which is the area closest to the diversion outfall, had the highest landings of blue crab in 2018 at 2.5 million pounds and $3.5 million in value (LDWF 2019).

During the planning and construction of the project, some adjustment among participants and potential participants is likely to occur. Because of the ongoing trends of entry and exit for commercial fishers, a small portion of current, lower-level and part-time participants can be expected to have left the industry before any impacts from the project would have occurred.

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20. Data based on definition of exit that identifies commercial license holders landing oysters and then not landing oysters again for at least the next four years. Values are for calendar year 2013, which is the most recent year for which a subsequent 4-year period of inactivity has been examined, and are presented in 2009 dollars.

Exits from the industry may also increase due to some participants deciding to retire given the uncertainty of fishery impacts from the diversion and the average age of fishers in the Barataria Basin. These exits may be accelerated by blue crab fishers who are anticipating future impacts. Similarly, there may be a reduction in new entrants in the Barataria Basin during this time, because new entrants may be less likely to invest in capital and target locations that are soon to be impacted by the diversion. Across Louisiana, however, new entrants or potential new entrants to the blue crab fishery may invest in different areas that are less likely to be affected by the diversion. However, the potential benefits to blue crab abundance can be expected to generate higher rates of entry (and higher participation) and support increases in activity relative to the NAA.

Finfish

As summarized above, under the Applicant's PA, abundance of gulf menhaden is expected to increase relative to the NAA over the long-term. Menhaden are primarily harvested offshore and the fishery is dominated by just a few large, commercial enterprises that may have a greater tolerance to risk and the ability to move to different target locations, if necessary.

As summarized above, under the Applicant's PA, abundance of saltwater finfish is expected to increase relative to the NAA over the long-term for all species analyzed except spotted seatrout, which are projected to decline because of the impacts of decreased salinity. Because of the small contribution of a single saltwater finfish species to commercial landings, even a total loss of spotted seatrout will generate only minor effects. For reference, 2018 landings of spotted seatrout were valued at $14,000. However, because commercial fishers may feel a high degree of uncertainty about the impacts of the diversion, there may be indirect negative impacts on the saltwater finfish commercial fishery.

As noted previously, largemouth bass are classified as a Game Fish by LDWF, making their sale or use for commercial purposes illegal. However, as an indicator of potential impacts to other freshwater species targeted for commercial purposes, impacts to the population of largemouth bass are summarized briefly here. Under the Applicant's PA, habitat suitability increases compared to the NAA in the near-term in the central portion of the Barataria Basin as freshwater flows through the diversion decrease salinity.

The expected benefit to freshwater finfish may encourage new entrants to target freshwater finfish in these areas and potentially offer a new source of revenue to those facing or anticipating reduced revenues from other species.

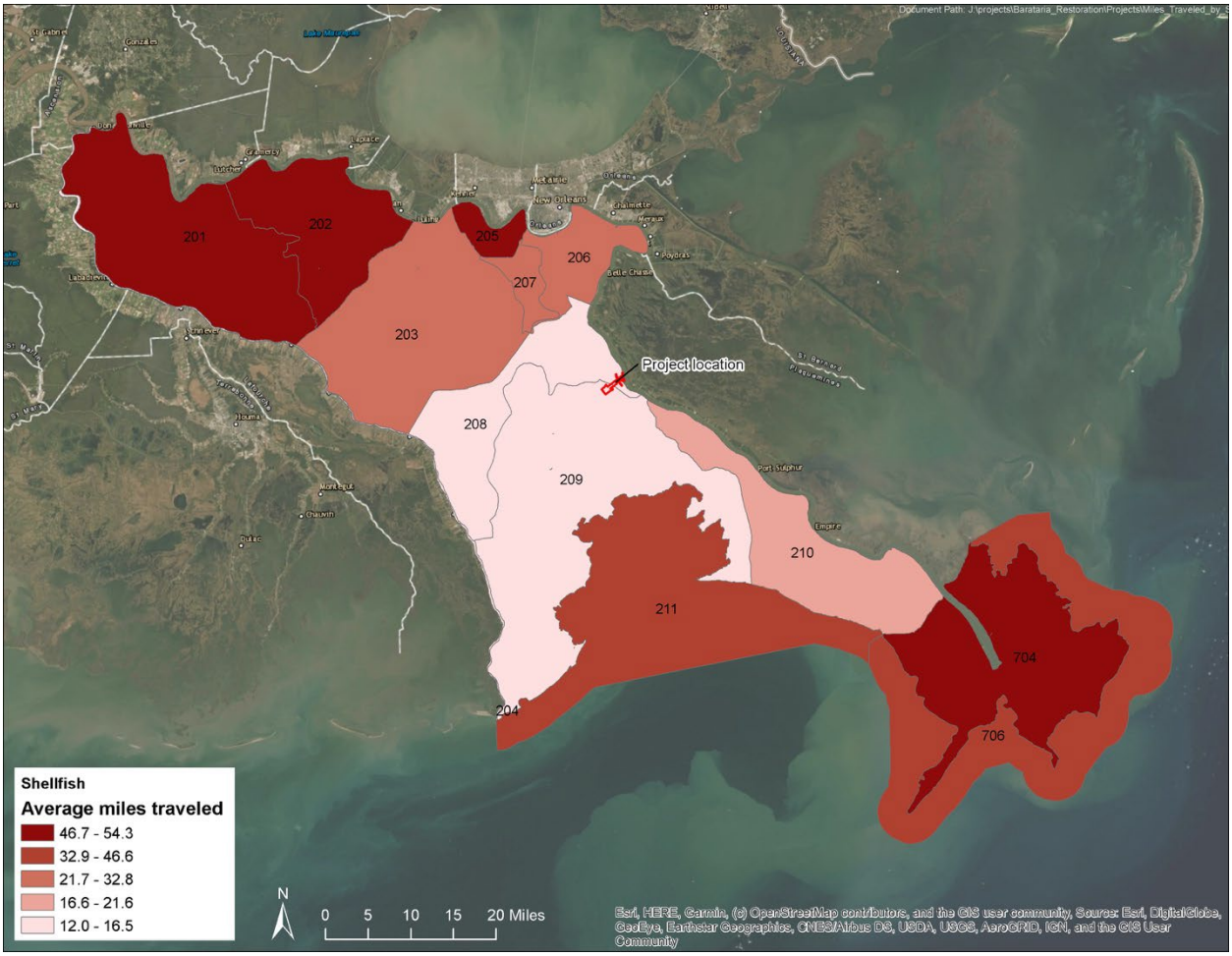
Substitution

The impacts discussed above include adverse impacts to brown shrimp and oysters, two of the most valuable species for commercial fishing, and moderate benefits to white shrimp as well as minor to moderate benefits to blue crab, saltwater finfish (with the exception of spotted seatrout) and freshwater finfish. Economic theory implies that a natural response among commercial fishers will be to substitute from adversely impacted species toward those that are unaffected or beneficially impacted species as well as substitution to other fishing areas along the coast. This type of substitution was also identified as a potential response to coastal change in the Louisiana's Seafood Future survey of commercial fishers (Twilley, Banks and Lezina 2019).

As noted previously, brown shrimp and oysters are two of the most valuable species making up more than half of the total value of landings from the Project Area in 2018. With the potential for large decreases in landings for these two species, including potential for a total loss of commercial harvest for these species, and only minor to moderate increases for other species, the relative size of brown shrimp and oyster landings from the Project Area suggests that substitution across species will offset only a small portion of lost activity even considering the high value of white shrimp, which is expected to benefit from the APA. By contrast, the small amount of landings for spotted seatrout can easily be offset by landings of other saltwater finfish species given the expectation of potential benefits to many other species. It should also be noted that substituting to different species, such as shifting from brown shrimp or oysters to white shrimp, blue crab and finfish may require investing in different gear and in some cases different vessels. Because of similarities across areas fished and gear, shifting from brown shrimp to white shrimp can be done fairly easily while other types of substitutions are more likely to require capital investments. These added costs will further limit the effect of substitutions across species in mitigating potential impacts, but may be more feasible for new entrants.

Another type of substitution that is likely to occur is shifting to other areas. Currently, some commercial fishing participants operate in a relatively small geographic area while others travel across multiple basins. To better understand the ability of commercial fishers to substitute to other areas, Figure 3-7Figure 3-7 shows the average distance traveled among those landing shellfish, which includes brown and white shrimp, as well as a small portion of other shellfish species (Barnes et al. 2016). While estimates of distances traveled specifically among those landing brown shrimp are not available, the distances shown suggest that those landing shrimp from the middle portion of the Project Area may face significantly longer distances traveled if substituting to other basins but the distances will depend on where those license holders are based and to which basins they may be able to substitute. For example, a shrimper in Terrebonne Parish may be able to shift effort into the Terrebonne Basin without significantly increasing distance traveled. Longer distances traveled among those landing shellfish from the lower portion of the Project Area suggest that access to adjacent basins may be feasible with only modest changes in travel costs, at least for some commercial fishers targeting brown shrimp. In addition to travel costs for commercial fishing license holders, shifts in commercial fishing activity across basins also may affect local businesses that support the commercial fishing industry as will be discussed below.

Figure 3-7. Average Distance Traveled by Commercial Fishing License Holders Landing Shellfish, 2014



Source: Average distances from Barnes et al., 2016.

Table 3-12 summarizes landings for brown shrimp by basin for commercial fishing license holders located in Project Area parishes. Brown shrimp landed from the Project Area (including Barataria and Mississippi River basins) make up a large portion of catch for those in nearby parishes. However, landings from nearby basins indicate that a sizeable amount of activity also occurs in Terrebonne, Lake Pontchartrain and offshore areas and some substitution to those areas may occur as brown shrimp harvesters respond to negative impacts of the APA. Again, the large contribution of landings from the Project Area to catch among this group of commercial fishing license holders suggests that increased effort in nearby areas is likely to offer only a limited offset to a potentially large decline. Moreover, this type of substitution generally requires additional travel-related costs and in some cases may require larger vessels, or changes in the type of gear used.

Table 3-12. Brown Shrimp Landings by Basin among Commercial Fishing License Holders in Project Area, 2018

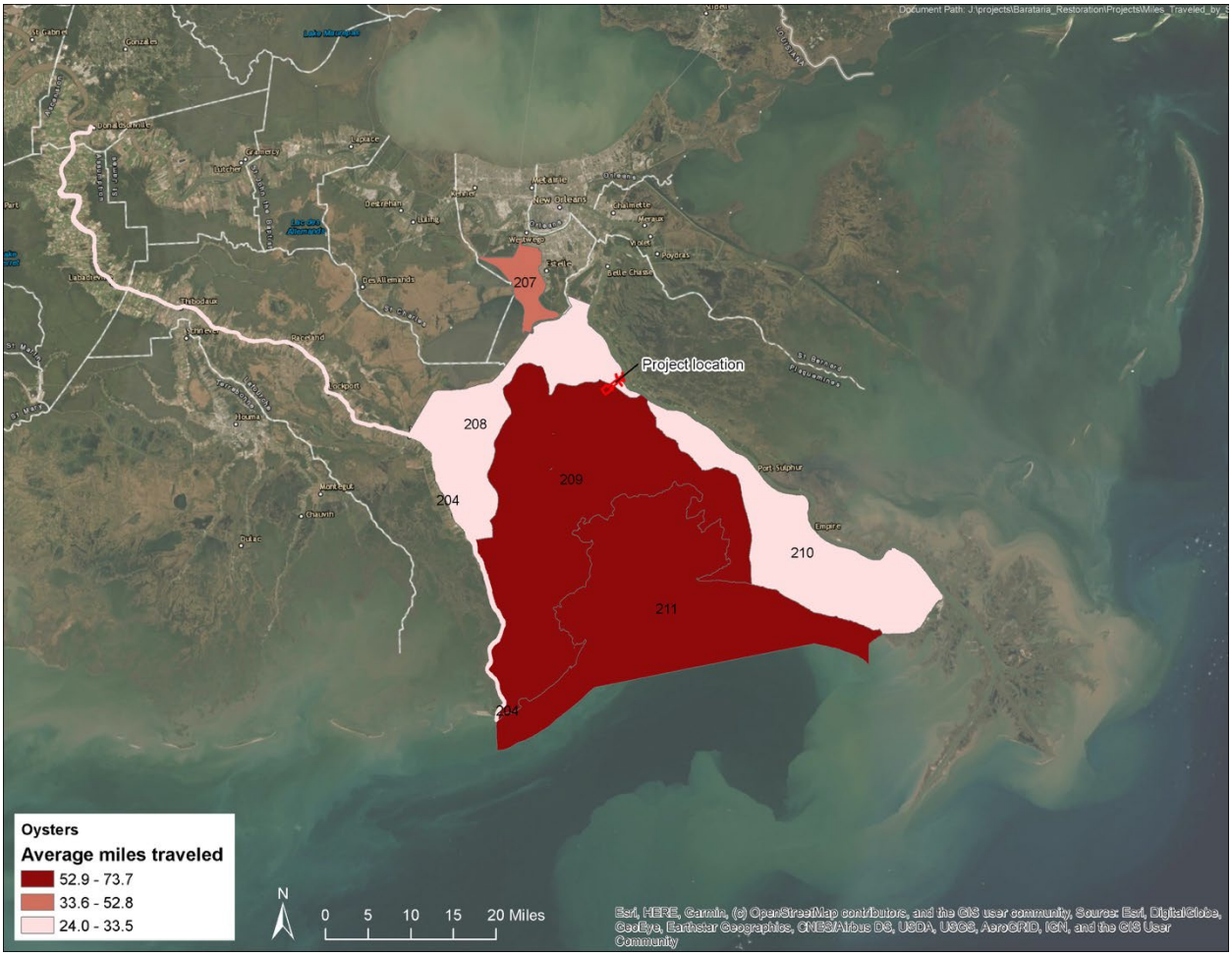
Parish	Basin				
	Terrebonne	Barataria	Mississippi River	Lake Pontchartrain	Offshore (Federal Waters)
Lafourche	$1,868,961	$904,386	$0	$13,544	$1,939,999*
Jefferson	$1,592,039	$4,014,161	$481,477	$387,312	$1,268,899*
Plaquemines	$207,086	$3,269,037	$787,723	$1,113,311	$330,898*
St. Bernard	$186,218	$97,798	$75,760	$1,113,311	CONFIDENTIAL
Total	**$3,854,303**	**$8,285,381**	**$1,344,960**	**$2,627,479**	**$3,539,797***

Note: Offshore totals are calculated from data reported by individual Federal Grid. * identifies values where data were not available from one or more federal grids so reported total may be lower than actual. CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed.

Distances traveled among those landing oysters from the project area are displayed in Figure 3-8. While long average distances traveled among those landing oysters (including private leases and public grounds) from areas 209 and 211 imply a wide range of options for substitute locations without increases in travel costs, the vast majority of landings come from area 210, which has relatively short distances traveled. However, the average distance traveled to area 210 still suggests that some substitution to adjacent basins may be feasible without significant increases in distances traveled; however, the availability of viable oyster grounds in other basins also remains very uncertain.

To further explore potential for substitution of oyster harvest to other basins, Table 3-13 summarizes landings for oysters by basin for commercial fishing license holders located in Project Area parishes. Oysters landed from the Project Area make up a large portion of catch for those in nearby parishes. However, landings from nearby basins indicate that a sizeable amount of activity also occurs in Lake Pontchartrain with a much smaller amount of activity in Terrebonne Basin. Some substitution to Lake Pontchartrain (and to a lesser extent Terrebonne) may occur as oyster harvesters respond to negative impacts of the Applicant's PA. However, the dominant role that Barataria Basin plays in oyster activity among this group of commercial fishing license holders suggests that increased effort in nearby basins is likely to offer only a limited offset. Moreover, this type of substitution generally requires additional travel-related costs and may also require near-term investments to establish oyster beds in new areas.

Figure 3-8. Average Distance Traveled by Commercial Fishing License Holders Landing Oysters, 2014



Source: Average distances from Barnes et al., 2016.

Table 3-13. Oyster Landings by Basin among Commercial Fishing License Holders in Project Area. 2018

Parish	Basin			
	Terrebonne	Barataria	Mississippi River	Lake Pontchartrain
Lafourche	$496,464	$368,029	$0	CONFIDENTIAL
Jefferson	CONFIDENTIAL	$3,211,271	CONFIDENTIAL	CONFIDENTIAL
Plaquemines	$185,706	$26,824,081	CONFIDENTIAL	$3,064,662
St. Bernard	$108,739	$1,146,802	$0	$12,192,633
Total	**$790,909**	**$31,550,183**	**$0**	**$15,257,295**

Note: CONFIDENTIAL denotes observations with fewer than three dealers and cannot be disclosed. Totals do not account for suppressed values.

Substitution away from brown shrimp, oysters, and spotted seatrout in the Project Area to other species and areas can be expected as the commercial fishing industry responds to changing environmental conditions. However, these types of substitution are expected to offer only limited reductions to potential impacts given the potentially large reduction in landings for brown shrimp

and oysters and resource constraints that will limit increases in catch in other areas, especially considering additional costs that accompany many substitution opportunities. Moreover, substitution could also increase fishing pressure on other species and those active in other areas generating indirect adverse impacts of the Applicant's PA, partially reducing the benefit of substitution as a way for the commercial fishing industry to offset adverse impacts.

Considering the potential for substitution, as well as the backdrop of considerable entry and exit over time, which can also be thought of as substitution between commercial fishing and other activities, it is important to distinguish between the impacts to individuals and impacts to the industry as a whole. While impacts to specific fishermen, or businesses cannot be predicted, the general nature of impacts to currently active commercial fishers should be considered. Among those currently active in the industry, substitution will often generate more acute short-term costs if currently usable vessels and equipment must be replaced. The need to make these sorts of capital investments was acknowledged as a potential response to coastal changes in the Louisiana Seafood Future survey (Twilley, Banks and Lezina, 2019). For longer-term changes, individuals have more flexibility to time those purchases to occur at the end of the useful life of current vessels or equipment. However, major investments are unlikely to occur at a point in time when all current capital has met the end of useful life. The timing of these decisions is further complicated with an aging workforce because short term impacts may be more difficult to offset as older workers are less likely to invest in new skills and have less time to recoup the costs of acquiring or purchasing new equipment.

At an industry level, substitutions over time will also be driven by new entrants who will naturally invest in capital to target species and areas that are expected to be more attractive under the Applicant's PA. Many fishers may be expected to decrease the level of participation across the industry; this dynamic shifting over time illustrates how substitution can occur at lower cost than would be expected if the source of all substitution was from those currently active in the industry. Finally, it is worth acknowledging that the increasing trend of exits from the industry may have broader implications for communities along the coast. Some commercial fishers rely on these activities for supplemental income, or hold other part-time jobs to supplement commercial fishing income (Marks 2012). These additional sources of employment can include activities ranging from work in the oil and gas industry to working as a part-time firefighter. Individuals who can no longer rely on commercial fishing as a source of income may have difficulty finding alternate sources of income that can accommodate part-time, temporary, or seasonal schedules.

Regional Economic and Community Effects

The core set of commercial fishing activities discussed above are based on trip ticket data that provide estimates of the number of commercial fishing license holders and dockside value of commercial landings. In addition to the commercial license holders, there are several groups of individuals directly engaged in commercial fishing and dependent on the landings of commercial license holders. These groups include crew, dealers, suppliers, and seafood processors. Some of these individuals may be considered directly engaged in commercial fishing while others such as suppliers of commercial fishing operations are dependent on this industry and represent the broader regional economic effects tied to the core set of commercial fishing activities discussed in the earlier sections of this report.

A 2009 survey of commercial fishing license holders by LDWF gathered data on the average crew size on commercial fishing trips, which have been summarized by species group in a series of reports. Those estimates of average crew size (including the captain) were 2.1 among shrimp-harvesting license holders (Isaacs 2015a); 2.6 for trips landing oysters (Banks et al. 2016); 1.4 for trips landing crab (Isaacs 2015b); 2.9 for trips landing saltwater finfish (Isaacs, 2015c); and 1.4 for trips landing freshwater finfish (Isaacs 2015d). These estimates of crew size likely include some operations led by one license holder as well as some operations with multiple individuals holding a license on the same vessel. The business models of commercial fishing operators vary with some license holders hiring crew and paying wages and some license holders dividing catch with crew or deckhands and each individual landing catch under a separate commercial fishing license. Therefore, multiplying estimates of the number of commercial license holders landing each species by the average crew size may overstate the total number of individuals engaged in the industry. However, these data illustrate that direct impacts to the commercial fishing industry extends beyond the commercial fishing license holder and potentially includes roughly twice as many individuals in the case of brown shrimp and 2.6 times as many individuals in the case of oysters. While the general implication of these data is that a broader group of individuals are directly affected by changes in commercial fishing activity, it is also true that some of the entry discussed previously may reflect decisions by unlicensed crew members to purchase a license and begin reporting landings independently.

Another group of individuals dependent on commercial fishing in the project area is seafood dealers. Each commercial fishing trip ticket captures the sale of landings from a commercial fishing license holder to a seafood dealer. Statewide, there were a total of 1,765 licensed dealers including 1,540 resident dealer licenses in 2017, the most recent year with comprehensive license statistics available.[21] These dealers represent another group of individuals directly engaged in the commercial fishing industry. More recent analysis of statewide 2018 trip ticket-license linked data by Jack Isaacs shows an estimated 180 dealers handled shrimp landings and 70 handled oysters.[22] Some dealers handle multiple types of landings so negative impacts to brown shrimp and oysters may not translate directly into proportional impacts to dealers. However, significant declines in brown shrimp or oysters within the Project Area can also be expected to impact dealers as well.

Beyond the commercial fishing license holders, crew and dealers, a broader group of economic activities closely connected to commercial fishing includes local supply chains and a range of seafood processors that support additional economic activity in the region. The Louisiana Department of Health is responsible for permitting and inspecting the roughly 350 wholesale seafood processors and distributors (Commercial Seafood Program, 2019).[23] However, some of those businesses secure permits to support a small portion of their business such as some restaurants or retail establishments and a recent study identified 57 seafood processors in

21. LDWF commercial license sales by parish, available at http://www.wlf.louisiana.gov/licenses/statistics. In addition to wholesale/retail dealer licenses, there were 1,622 commercial fishing license holders with a fresh products dealer license, which allows them to sell landings directly to consumers.

22. Figures include only wholesale/retail seafood dealer-business or wholesale/retail seafood dealer-vehicle licenses.

23. Commercial Seafood Program, http://ldh.la.gov/index.cfm/page/444/n/207

Louisiana based on a National Marine Fisheries Service survey, suggesting that the number of businesses heavily engaged in these activities is considerably smaller (Miller et al. 2014). Comprehensive data on seafood processers and suppliers in the Project Area is not available, but prior assessments of the economic impact of commercial fishing can provide additional insight into the broader implications of operational impacts to the regional economy. Statewide 2017 data show that 10,728 individuals hold resident commercial fishing licenses and 941 hold non-resident commercial fishing licenses, but many more jobs are created across Louisiana by the commercial fishing industry (LDWF 2019). As summarized in Chapter 3 of the EIS, annual dockside value of landings of roughly $300 million supports a broader set of economic activities valued at $600 million in income and roughly 30,600 jobs. Considering the potential loss of brown shrimp and oysters in the Project Area, the broader implications to the regional economy would potentially be twice as large as direct economic effects in terms of total income in the region and roughly three times as large as direct economic effects in terms of jobs as the numbers of commercial fishing license holders and dockside value discussed in earlier sections of this report.

Another source of data on the importance of commercial fishing to communities located in coastal Louisiana are the Social Indicators of Fishing Community Vulnerability and Resiliency developed by NOAA (Jepson and Colburn, 2013). Table 3-14 and

Table 3-15 shows the commercial fishing engagement and reliance indices for select communities in Plaquemines and Jefferson parishes, respectively. The commercial fishing engagement index is comprised of the number of permits, pounds and value of landings and the number of dealers for commercial fishing. The commercial fishing reliance index is a relative measure comprised of value of landings per capita; number of commercial permits per capita; number of dealers per capita and percentage employed in agriculture, forestry and fishing (Jepson and Colburn,2013). The relative index provides a score that is higher among communities with larger values across the various inputs relative to other communities in the analysis. For communities in Plaquemines Parish, Empire, Port Sulfur, Venice and Buras have a high engagement index as well as a high reliance on commercial fishing. Alternatively, only two communities (Grand Isle and Lafitte) in Jefferson Parish show both a high engagement and high reliance on commercial fishing.

Table 3-14. Measures of Commercial Fishing Engagement and Reliance for Communities in Plaquemines Parish, Louisiana - 2017

Community	Commercial Engagement Index	Commercial Reliance Index
EMPIRE	3.97	8.29
BELLE CHASSE	1.90	0.01
PORT SULPHUR	1.60	1.67
VENICE	1.46	17.45
BURAS	1.32	3.23
BOOTHVILLE	0.39	1.32
TRIUMPH	-0.38	-0.24

Source: NOAA, 2019; Notes: Larger values are emphasized in bold.

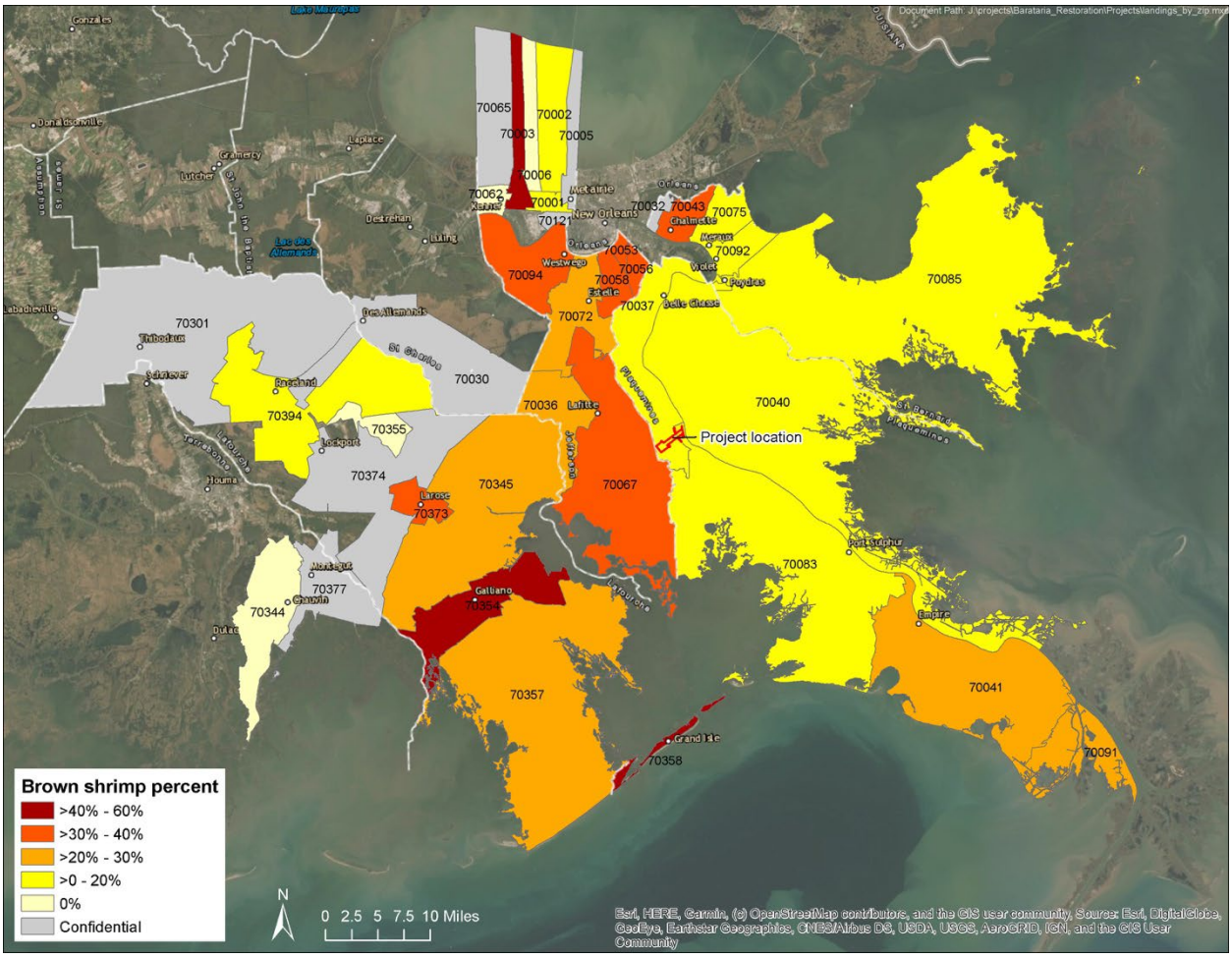
Table 3-15. Measures of Commercial Fishing Engagement and Reliance for Communities in Jefferson Parish, Louisiana - 2017

Community	Commercial Engagement Index	Commercial Reliance Index
GRAND ISLE	2.45	9.09
LAFITTE	1.43	2.14
MARRERO	0.75	-0.18
BARATARIA	0.43	1.97
WESTWEGO	0.35	-0.08
GRETNA	0.35	-0.15
METAIRIE	0.18	-0.24
HARVEY	0.15	-0.19
KENNER	0.00	-0.23
RIVER RIDGE	-0.24	-0.22
JEFFERSON	-0.25	-0.22
CROWN POINT	-0.27	0.05
BRIDGE CITY	-0.32	-0.23
AVONDALE	-0.38	-0.24
ESTELLE	-0.38	-0.24
HARAHAN	-0.38	-0.24
JEAN LAFITTE	-0.38	-0.24
TERRYTOWN	-0.38	-0.24
WOODMERE	-0.38	-0.24

Source: NOAA, 2019; Notes: Larger values are emphasized in bold.

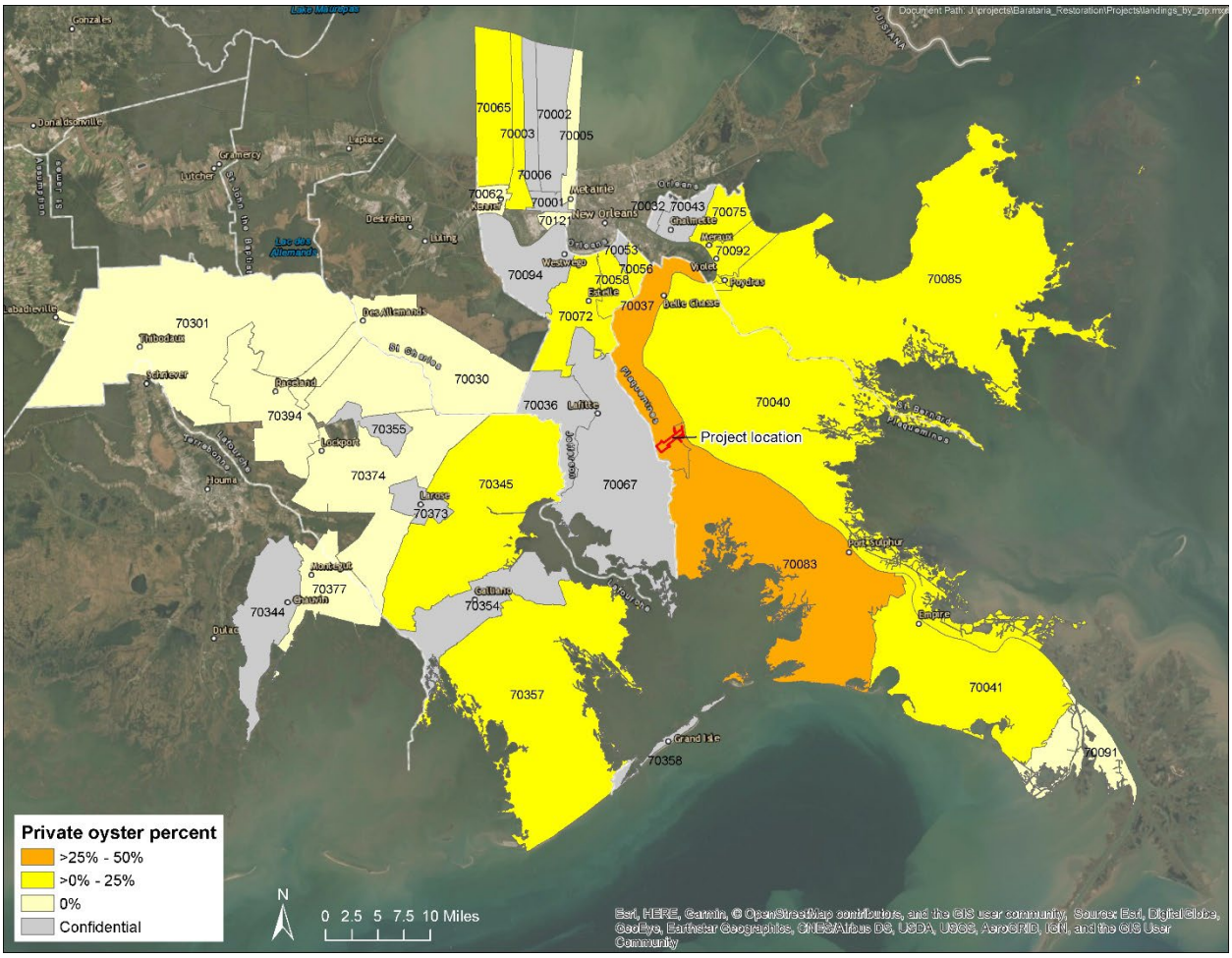
Figure 3-9 and Figure 3-10 display the percent of all commercial landings made up by brown shrimp and oysters, respectively. Areas with a higher concentration of landings from a particular species will experience relatively larger indirect effects from reductions in landings from that species. In the case of brown shrimp, zip codes 70358 (Grand Isle) and 70354 (Galliano), stand out as most reliant on brown shrimp with more than 40% of commercial landings coming from that species. However, all three of these zip codes are relatively close to Terrebonne Basin, which may offer an alternate source of brown shrimp in years when abundance is low in Barataria Basin. Zip code 70003 also demonstrates a high concentration of brown shrimp landings within the commercial fishing industry, but is located in a more highly developed portion of Jefferson Parish with a larger, more diversified economy suggesting that the community impacts will be less pronounced from declines in commercial fishing activity. In the case of oysters, zip codes 70037 (Belle Chasse, Live Oak), 70082 (Port Sulphur, Pointe à la Hache, and Bohemia) and 70083 (Port Sulphur, Empire, Ironton, Myrtle Grove, and Grand Bayou) are most heavily dependent on oysters with more than 25% of all landings coming from that species.

Figure 3-9. Brown Shrimp as a Percent of Commercial Landings Value by Zip Code, 2018



Source: LDWF, 2019.

Figure 3-10. Oysters as a Percent of Commercial Landings Value by Zip Code, 2018



Source: LDWF, 2019.

Other Alternatives

TBD: Discussion of alternatives will consider different flow rates (50,000 CFS or 150,000 CFS rather than the 75,000 CFS of the Applicant's PA) as well as terracing options. Discussion will depend on aquatic resource impacts, but expect to focus on how each alternative increases or decreases the probability of total loss in brown shrimp and oysters.

3.4.6 Summary of Potential Impacts to Commercial Fishing

Under the Applicant's PA, brown shrimp abundance is expected to decline due to reductions in salinity relative to the NAA. This decline in abundance may lead to major, adverse, short-term and long-term impacts to the brown shrimp fishery, up to and including the complete loss of a commercial fishery for brown shrimp in the Barataria Basin. White shrimp abundance is expected to increase relative to the NAA over the long-term because of the relative increase in marsh area in the Basin. Because oysters are highly sensitive to changes in salinity and low salinity, there is the potential for major, adverse, short to long-term impacts to the commercial fishery for oysters, up to and including the complete loss of a commercial fishery for oysters in

the Barataria Basin. Under the Applicant's PA, the abundance of blue crab, gulf menhaden, and saltwater finfish (expect for spotted seatrout) and freshwater finfish are expected to increase relative to the NAA over the long-term.

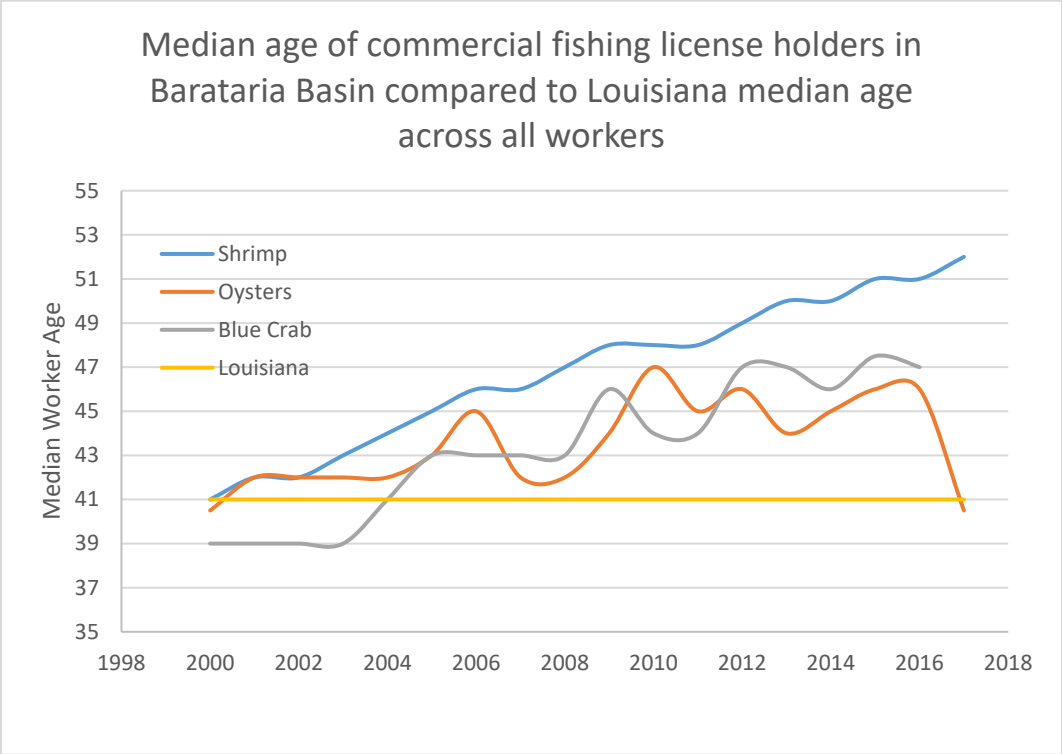
For major commercial species expected to decline under the Applicant's PA (brown shrimp and, oysters), commercial fishing dependent on these species is expected to experience moderate near and long-term adverse impacts. Spotted seatrout is also expected to decline, but is expected to experience only minor near and long-term adverse impacts. Other commercial operations may experience minor short and long-term beneficial impacts as species they are dependent on will increase in abundance under the Applicant's PA.

As noted in several places, increased uncertainty about future changes to the industry may lead to larger adverse impacts across the industry. There are additional uncertainties that could not be fully explored given data limitations related to water access and water-based movements of commercial fishers. Potential changes in access generated by increased flooding or inundation, which are discussed elsewhere, could also impact commercial fishing including potential for increasing travel distances to avoid areas with increased siltation, or even closure of certain water access points or storm refuge areas.

As commercial fishers respond to these environmental changes, it is likely that participants will shift their efforts away from declining species such as brown shrimp, oysters and perhaps spotted seatrout toward species that are relatively more available such as blue crab and white shrimp. Smaller boats that are often used in estuaries and bays in coastal Louisiana are often rigged for multiple purposes (Gramling and Hagelman, 2005). For example, it is not uncommon to see a boat with a skimmer or butterfly rigging that can also be set up to trawl or transport crab traps. Having this flexibility in boats and equipment will allow some fishers to adjust to environmental conditions in the short-term, such as a decline in the brown shrimp fishery. Small boat owners also tend to buy a commercial license in order to shrimp part-time or only during the inland season (Gramling and Hagelman, 2005). This phenomenon may give fishers the flexibility to move in and out of the industry when environmental conditions change and not have to rely on the activity for full-time employment or income. Commercial fishers may also be able to substitute to areas outside of the Project Area to help offset adverse impacts within the Project Area. However, these types of substitution are not likely to fully offset the adverse impacts.

The implementation of the Applicant's PA has the potential to introduce further uncertainty into the highly uncertain commercial activity. This heightened uncertainty may result in a further acceleration of exits from the industry regardless of whether impacts analysis predicts changes in habitat suitability and abundance of certain species of commercial importance. The exits may also be influenced by an aging commercial fishing workforce, which is notably older than the general workforce in Louisiana (Figure 3-11).

Figure 3-11. Average Age of Workforce for Commercial Fishing and Louisiana



With an aging workforce, short-term impacts may be more difficult to offset as older workers are less likely to invest in new skills, and have less time to recoup the costs of purchasing new equipment. However, this age distribution also implies smaller, long-term effects as many of these workers would have retired, or otherwise left the fishery in a No Action or Action Alternative.

Aside from the role that entry and exit can play in influencing the overall number of participants over time, the relatively high rate of turnover within the industry also suggests that specific individuals who may need to adjust to environmental changes years in the future will include a sizeable share of individuals not currently engaged in these activities. In addition, if environmental changes can be anticipated and publicized, it is possible for future entrants to invest in capital and locations better suited to those future conditions, thereby reducing any costs facing current participants who may consider substituting to other areas or species. As seen with data on shrimp harvesters, the natural attrition of participants with lower average landings implies that changes expected to occur at least several years in the future will impact current participants who are less likely to have exited by that time, which tend to be larger producers on average.

3.5. Recreation and Tourism

The northern Gulf of Mexico, where the Barataria Basin is located, contains diverse and productive natural resources, attracting recreators locally, nationally, and internationally. In 2017, Louisiana issued over 1.7 million recreational licenses, including licenses for a variety of

hunting, fishing, and boating purposes.[24] In 2011, the U.S. Fish & Wildlife Service's National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (NSFHWAR) estimated that all recreational fishing-related expenditures in Louisiana totaled $938 million,[25] all hunting-related expenditures in Louisiana totaled $655 million, and all wildlife watching-related expenditures in Louisiana totaled $630 million.[26,27] In 2006, the LDWF estimated that the total economic impact of activities associated with Louisiana's fisheries, wildlife, and boating resources totaled $8.7 billion.[28,29] This larger value includes the total impact of all direct spending, indirect supply-chain effects, and induced spending associated with Louisiana's outdoor recreation economy.

Coastal Louisiana's local tourism and recreation economy depends heavily on the natural resources in the northern Gulf of Mexico, including the Barataria Basin. This dependency means that an impact on one part of the regional ecosystem can have rippling impacts throughout the greater northern Gulf economy. The Deepwater Horizon oil spill is an example of how a decrease in the quality of a natural resource can affect recreation and tourism. The National Oceanic and Atmospheric Administration estimated the value of recreational losses to the public from the oil spill to be approximately $693.2 million, not including losses to private businesses/individuals or tax revenues.[30]

Coastal Louisiana supports many types of outdoor recreation, including fishing, hunting, boating, wildlife viewing, and general shoreline use, among others. Extensive estuarine and freshwater wetlands provide habitat for many kinds of fish, birds, reptiles, and mammals that are an integral component of recreation in the region.[31] Many recreators travel to observe, fish, and hunt these species. Recreational use in the region is motivated by the health and availability of these animals and their supporting habitats. In addition to fishing, recreational birdwatchers travel to

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24. Louisiana Department of Wildlife & Fisheries. (2017). Recreational License Sales by Parish-License Year 2017. Available at http://www.wlf.louisiana.gov/licenses/statistics

25. All dollar values in this report have been update to 2019 using the Bureau of Labor Statistics' Consumer Price Index.

26. Louisiana 2011 NSFHWAR. U.S. Fish and Wildlife Service. Available at https://www2.census.gov/programs-surveys/fhwar/publications/2011/fhw11-la.pdf

27. All dollar estimates are adjusted for inflation as of May 2019.

28. Includes impacts from commercial fishing.

29. Southwick Associates, Inc. (2008). The Economic Benefits of Fisheries, Wildlife and Boating Resources in the State of Louisiana. Available at http://www.wlf.louisiana.gov/sites/default/files/pdf/publication/32728-economic-benefits-fisheries-wildlife-and-boating-resources-state-louisiana-2006/southwick_2006_final_final_report_5-27-08_0.pdf

30. National Oceanic and Atmospheric Administration. (2016). Deepwater Horizon Oil Spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement: Chapter 4: Injury to Natural Resources. Retrieved from https://www.gulfspillrestoration.noaa.gov/sites/default/files/wp-content/uploads/Chapter-4_Injury_to_Natural_Resources_508.pdf

31. For a more in-depth description of existing recreational resources, see Chapter 3.17 of the Mid-Barataria Sediment Diversion Project DEIS.

observe a wide range of type of birds and habitats and drives general shoreline use. In 2006 there were 517,471 recreators that spent 1,516,635 days observing wildlife in Louisiana.[32]

Alligator hunting is another type of non-fishing recreation that occurs in the region. Louisiana manages both wild and farm-raised alligator populations for hunting and issues specific tag allotments for each parish and marsh type, based on the quality of habitat and number of acres of suitable habitat. Statewide in 2016, DLWF reported that 33,613 wild alligators were harvested by 3,281 hunters[33]. Brackish marshes have the highest ratio of tags to marsh habitat, and therefore see the most recreation.

This section evaluates the scale of potential impacts the MBSD project is expected to have on recreation and tourism in the region. The impacts from the MBSD are evaluated by comparing the Applicant's PA to the NAA. This analysis uses existing data to identify the types of recreational use in the region, regional participation in recreation, and the environmental attributes that motivate recreational site choice. Impacts on recreational use are predicted by combining an understanding of the influence of ecological conditions on recreational use along with the Project's expected impact on the environment. This analysis addresses the following four topics:

1) The quantity and type of recreation occurring in the region under existing conditions,
2) How environmental conditions influence recreational use in the region,
3) How recreational use participation is expected to change through 2070 (NAA), and
4) How recreational use patterns might change in the Applicant's PA scenario.

This analysis evaluates the marginal effects of the Applicant's PA relative to the NAA. In many instances, a lack of available data restricts the ability to generate direct quantitative estimates. In cases where data is unavailable, impacts are described using a combination of quantitative and qualitative approaches. These results reflect analysis based on the best available data and a set of reasonable assumptions, described throughout.

3.5.1 Methodology for Analysis of Impacts on Recreation

A mixed quantitative and qualitative approach is used to evaluate operation impacts due to limitations in environmental and recreational behavior data. Specifically, empirical data on boating recreational use patterns are available, but information on the effects of the Project on recreationally important ecological resources is more general. Projected long-term environmental changes in the NAA and Applicant's PA scenarios are used as general inputs into quantitative recreational demand models; however, the outcomes projected by the model are only interpreted qualitatively. The interpretation of the results projected by the model helps to understand the potential scope and scale of effects on recreation without improperly conveying precision in the estimates. The key outcome produced by this mixed approach is an indication of the number of recreational users potentially affected, as well as the direction of that effect (positive, negative, no change) in the NAA and Applicant's PA scenarios. All major recreational activities are incorporated into the mix of analytical approaches, as described in Table 3-16 below.

[32] LDWF The Economic Benefits of Fisheries, Wildlife, and Boating Resources, 2006, pp.29.

[33] LDWF Louisiana's Alligator Management Program 2016-2017 Annual Report, pg 4.

Table 3-16. Analysis Approach by Activity

Access Mode:	Boat			Shoreline			
Activity:	Fishing	Hunting	Other	Fishing	Hunting	Wildlife Viewing	Other
Approach for evaluating substitution patterns	DWH Boating Model			DWH Shoreline Use Model			
Approach for evaluating potential changes	Quantitative/ Qualitative	Qualitative	Qualitative	Derived from Boat-Fishing Results	Qualitative	Qualitative	Qualitative

Source: ECONorthwest

The following section describes the methods for evaluating recreational impacts in both the NAA and Applicant's PA scenarios.

Environmental Quality and Recreational Demand

A number of peer-reviewed economic studies have measured the influence that environmental quality has on recreational demand. These studies use modeling approaches that evaluate an individual's recreational site choice among alternatives. This type of site choice model is regularly used by economists to measure the demand for private market goods and is largely unmodified when used to estimate recreation demand associated with environmental resources. In this site-choice model, a set of potential recreation sites make up a recreator's choice set, and the cost to travel to and from each recreation site serves as the price.

The travel cost represents the cost a recreator faces to travel to any site in the choice set and includes out-of-pocket expenses (e.g., gas, vehicle maintenance, and vehicle depreciation), as well as the opportunity cost of time (calculated as one-third of hourly household income). The inclusion of this dollar-denominated attribute shows the tradeoffs individuals make between money and environmental quality. Travel cost tends to have a negative relationship with site choice, meaning that with all else being equal, sites that are further away (and more costly to access) are less likely to be visited. Alternatively, if a set of sites are equidistant from a recreator, but one has a preferred set of ecological attributes (i.e. species abundance), then the recreator is more likely to visit that site.

This is the case for both recreators and subsistence users of the natural resources in the basin. Subsistence harvesters are distinguished though from other recreators by that fact that they rely upon their yield to feed themselves and their social network. They may be commercial fisherman living off a portion of their catch, a low-income family supplementing their meals with wild resources, or individuals participating in a cultural practice of fishing and hunting[34]. Subsistence fisherman are likely to experience similar impacts as other recreational fisherman, but due to the strong connection to place and potential budget constraints, they are less likely to substitute to sites that are farther away. Subsistence use in the basin in captured in existing data sources, however those users may exhibit stronger site fidelity when faced with changing conditions.

This type of modeling approach can explicitly measure the changes in site choice that result from specific changes in recreational site quality. However, given the limited precision regarding the exact scope and nature of long-term changes projected under both the NAA and Applicant's PA

[34] Regis, H., Walton, S. (2015) "Subsistence in Coastal Louisiana Volume 1: An Exploratory Study," BOEM, pp 64-67.

scenarios, a qualitatively-supported modeling approach is used here. Changes in site quality are inferred from expected environmental changes, and the model is then re-estimated under a series of potential scenarios where sites are relatively more or less attractive to recreators. These modeling results are interpreted qualitatively and provide an overall indication of how recreators may respond in the NAA and Applicant's PA scenarios.

In addition to the site choice model, a projection of future annual recreational participation is generated to help understand the scale of potential impacts as a result of the NAA and Applicant's PA scenarios. Each element of this approach is described in the following sections.

Site Choice Model

During the Natural Resource Damage Assessment for the DWH oil spill numerous local and national studies were conducted to measure the recreational use impacts from the spill.[35] Some of the data collected can also be used in a site choice model to estimate the potential change in trips that may occur as a result of the Project, conditional on the assumption that the underlying preferences of recreators have not changed.

The type of site choice model used in this analysis uses site-specific constants[36] to capture the differences in quality between sites. In a second-stage analysis, these site-specific constants are decomposed by a set of site attributes that help identify how variations in site quality motivate recreational use decisions, which helps isolate the choice behavior of different types of users. For boating and general shoreline use activities, two different datasets and models are used to evaluate site-choice decisions under the NAA and Applicant's PA.

Boating Analysis Methodology

The DWH boating valuation survey[37] was administered from April 2012 through June 2013 to residents of Louisiana, Mississippi, Alabama, and Florida, plus portions of Georgia. This sample was supplemented with addresses of registered boaters. Interviews were completed with 2,585 individuals. The respondents identified locations where they participated in boat-based coastal recreation along the Gulf of Mexico. The survey captured all types of boating trips whose main purpose was fishing, hunting, wildlife viewing, or general recreation. Of all respondents, 675 indicated they spent a total of 3,655 boating days in Louisiana and Mississippi between April 2012 and June 2013, representing a total of 7.7 million days when weighted up to the population. Demographic summary statistics of interviewees are listed in Table 3-17 below. Recreational boaters who visit the Barataria Basin, on average, have higher incomes than the average

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35. Including: 1) English, E., R. von Haefen, J. Herriges, C. Leggett, Christopher, F. Lupi, K. McConnell, M. Welsh, A. Domanski, & N. Meade (2018). "Estimating the value of lost recreation days from the Deepwater Horizon oil spill," Journal of Environmental Economics and Management, Elsevier, 91 pp 26-45, 2) Tourangeau, R., E. English, K. McConnell, D. Chapman, I. Flores Cervantes, E. Horsch, N. Meade, A. Domanski, M. Welsh. (2017). "The Gulf Recreation Study: Assessing Lost Recreational Trips from the 2010 Gulf Oil Spill." Journal of Survey Statistics and Methodology, 5 (3) pp. 281-309, and 3) a full set of technical memos describing the assessment available in the DWH Administrative Record (https://www.doi.gov/deepwaterhorizon/adminrecord).

36. Also known in the economics literature as "alternative specific constants" (ASCs).

37. Additional information on this survey is available in the DWH Administrative Record: https://www.doi.gov/deepwaterhorizon/adminrecord.

Louisiana resident. Out-of-state Barataria Basin visitors tend to be older, are mostly male, and a greater share are retired in comparison to out-of-state visitors in other parts of Louisiana.

Table 3-17. Demographic Summary Statistics from the DWH Boating Survey

Destination	Boating Days	Average Income	Average Age	% Male	Working Full Time	Working Part Time	Retired	Other (student, etc.)
Louisiana Residents								
Barataria Basin	369,779	112,399	46	75%	67%	1%	14%	18%
Rest of Louisiana	2,323,987	84,304	45	75%	69%	5%	16%	10%
Sites in Mississippi	41,768	78,054	47	78%	18%	10%	31%	40%
Non-Louisiana Residents								
Barataria Basin	8,195	96,563	63	99%	46%	~%	54%	~%
Rest of Louisiana	89,900	67,011	40	91%	87%	~%	11%	2%
Sites in Mississippi	761,745	75,297	49	60%	50%	6%	17%	27%

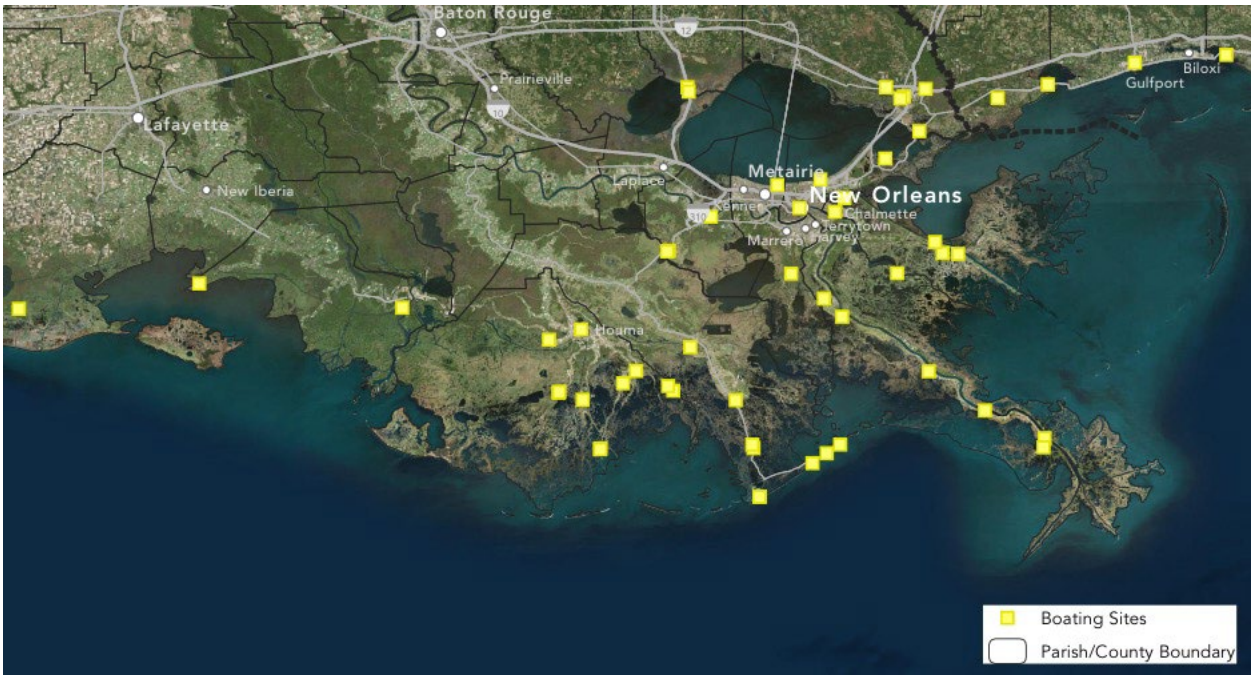
Note: Restricted to visitors traveling to destinations in Louisiana and Mississippi from origins in Louisiana, Mississippi, Alabama, Florida, and parts of Texas and Georgia. Demographic variables are displayed here for context but are not a component of the modeling analysis used herein. Results are population-weighted.
Source: ECONorthwest analysis of DWH Boating Valuation Survey data.

Survey respondents visited 222 individual recreation sites in Louisiana, many of which are adjacent to each other.[38] To include a full range of possible sites that recreational boaters may consider substitutes to sites in the basin, trips to Mississippi are also included in this analysis. A partial site aggregation approach is used to group similar sites[39] and reduce the number of destinations in the model to 57; 11 of which provide direct access to the Barataria Basin. Sites in and near the Barataria Basin are kept at a slightly disaggregate level, while locations farther east and west are grouped at the watershed or parish level. A limited partial site aggregation approach is applied to sites in and near Barataria Basin in which trips to low-visitation sites are assigned to their nearest neighbor. The resulting set of aggregate boating sites are mapped in Figure 3-12 below.

38. Although respondents indicated the boat ramp they visited, the survey did not collect information on the location on the water to which they traveled.

39. Sites are aggregated to reduce computation burden. Sites in and near the Basin were sorted by use, with the 50 sites with highest visitation retained as aggregate sites. Trips to the remaining sites were allocated to their nearest neighbor.

Figure 3-12. Aggregate Boating Sites



Source: ECONorthwest

These sites serve as departure points for recreational boating trips. Physical attributes of each site are derived from NOAA's Marine Recreational Information Program (MRIP). On-site intercept interviews were conducted as part of MRIP in 2013, which allows the model to match conditions observed during administration of the DWH boating valuation survey. A summary of the physical characteristics for the 11 direct access destinations in the Barataria Basin (sorted north to south), is provided in Table 3-18 below. Sites in the basin have between 14 and 125 trailer parking spots, between one and three boat ramps, and see between 11 thousand to 90 thousand trips per year.

Table 3-18. Boating Site Attributes in Barataria Basin

Aggregate Site Name	Parish	Trailer Parking	Boat Ramps	Average Miles Traveled	Total Trips
Jean Lafitte Launch	Jefferson	29	2	35	47,670
Jean Lafitte Harbor	Jefferson	22	2	13	11,283
Myrtle Grove Marina	Plaquemines	18	2	36	20,733
Port Sulphur Launch	Plaquemines	25	2	77	29,563
Oak Ridge Launch	Lafourche	50	3	20	90,067
Top Water Marina	Lafourche	25	2	59	25,418
Leeville Boat Launch	Lafourche	25	2	68	13,870
Buras Boat Harbor	Plaquemines	14	1	56	25,521
Sand Dollar Marina	Jefferson	25	1	135	19,766
Grand Isle, Mid-Island	Jefferson	125	1	140	37,165
Grand Isle, Bridge Side	Jefferson	42	1	146	56,919

Note: Results are population-weighted.
Source: Trailer Parking, Boat Ramps – NOAA MRIP[40]; Average Miles Traveled, Total Trips – DWH Boating Valuation Survey.

MRIP on-site intercept interviews also collected information on the primary and secondary species of fish targeted by anglers. MRIP interviewees self-identified five of the eight recreationally-important species evaluated in Aquatics Analysis targeted species when angling in Barataria Basin. Table 3-19 below lists the weighted average share of intercepted anglers that identified either spotted seatrout, southern flounder, Atlantic croaker, largemouth bass, or red drum as their primary or secondary targeted species for that trip. Spotted seatrout and red drum are widely targeted at almost all boat ramps, while a much smaller share of anglers target southern flounder, Atlantic croaker, or largemouth bass at far fewer sites.

Table 3-19. Percent of Angler Trips Targeting Impacted Recreational Fish in Barataria Basin

Aggregate Site Name	Spotted Seatrout	Southern Flounder	Atlantic Croaker	Largemouth Bass	Red Drum
Jean Lafitte Launch	38%	0%	0%	5%	63%
Jean Lafitte Harbor	61%	0%	0%	0%	51%
Myrtle Grove Marina	48%	0%	0%	0%	47%
Port Sulphur Launch	72%	0%	0%	0%	67%
Oak Ridge Launch	64%	0%	0%	0%	57%
Top Water Marina	66%	0%	0%	0%	54%
Leeville Boat Launch	22%	9%	0%	0%	59%
Buras Boat Harbor	64%	1%	0%	0%	60%
Sand Dollar Marina	56%	0%	0%	0%	52%
Grand Isle, Mid-Island	72%	0%	0%	0%	0%
Grand Isle, Bridge Side Marina	50%	1%	1%	0%	23%

Note: Values represent the percent of intercepted anglers who designate the relevant fish as their primary or secondary target.
Source: ECONorthwest analysis of 2013 MRIP data.

LDWF launched the LACreel program in 2014 to replace MRIP. This effort also includes on-site intercept surveys that record information on species caught and targeted by anglers, but also

40. NOAA. 2013. Access Point Angler Intercept Survey. Available from: http://www.st.nmfs.noaa.gov/st1/recreational/Intercept_survey.htm.

includes information on crab and shrimp species. The table below compares the number of dockside intercepted trips in the basin where each of the recreationally important species evaluated in this analysis was caught or targeted in 2014. The shares of recreators targeting or catching crab or shrimp is relatively small compared to some of the finfish species (Table 3-20).

Table 3-20. Percent of Intercepted Trips in Barataria Basin

Species	Caught	Primary Target	Secondary Target
Fish			
Atlantic Croaker	1%	0%	0.2%
Largemouth Bass	1.3%	0.3%	1.6%
Red Drum	36%	40%	53%
Southern Flounder	3%	0.3%	1%
Spotted Seatrout	37%	47%	40%
Other			
Blue Crab	0.5%	0.01%	0%
Brown Shrimp	0.02%	0%	0%
White Shrimp	0.01%	0%	0%
Total Trips Intercepted	14,514	10,898	3,310

Source: LACreel Survey, 2014.

In order to estimate the change in site visitation as a result of the NAA and Applicant's PA scenario, a two-stage modeling approach is followed, as outlined in Murdock (2006)[41] and Melstrom and Jayasekera (2017).[42] In the first stage, a conditional logit model is used to estimate the probability of site selection for each respondent and each of the 57 aggregate boating sites. Travel cost is estimated for each origin-destination pair and alternative specific constants are used to account for all observed and unobserved site characteristics. The second stage uses an Ordinary Least Squares (OLS) regression to predict the coefficients for each of the alternative specific constants using known site characteristics including the number of trailer parking spots, the number of boat ramps, the set of targeted species at each site[43], and average catch rates for all species[44]. Together, the first stage (site choice model) captures all observable and unobservable attributes, while the second stage (OLS regression) controls for unobservables by allowing for a variety of estimators (including an intercept term). This two-step approach can evaluate the implications of future changes in the Basin as a result of the NAA and Applicant's PA. These are evaluated by applying anticipated changes to site characteristics in the specified second-stage OLS regression. The second stage then predicts new alternative specific constants, which are in turn used to predict new site-choice probabilities in the first stage. These new site-choice probabilities are summed across geographies to predict the distribution of trips under each policy scenario.

41. Murdock, J., "Handling unobserved site characteristics in random utility models of recreation demand," Journal of Environmental Economics and Management, 51 (2006): 1-25.

42. Melstrom, R. T. & Jayasekera, D. H. W. (2017). Two-Stage Estimation to Control for Unobservables in a Recreation Demand Model with Unvisited Sites. Land Economics 93(2), 328-341.

43. Described in Table 3-18.

44. Calculated using 2013 MRIP on-site intercept data.

Shoreline Use Methodology

Many other non-boat based recreational activities occur in the Project Area, including shore-based fishing, wildlife viewing, hunting, and other types of general shoreline use. These activities are all jointly evaluated in the DWH Shoreline Valuation Survey.[45] During 2012 and 2013, 41,716 telephone interviews were conducted with a sample of households in the contiguous 48 United States, with 1,159 respondents indicating that they took 1,306 trips to coastal areas of Louisiana, Mississippi, and Alabama to participate in general shoreline recreation. Weighted up to the population, these represent 7.4 million visits, approximately 645,000 of which occurred in areas potentially affected by the Project. Demographic summary statistics for those completing the survey are listed in Table 3-21 below. Visitors to sites potentially affected by the Project have slightly higher incomes, are somewhat older, and a larger share is male.

Table 3-21. Demographic Summary Statistics for the DWH Shoreline Survey (April 2012 – June 2013)

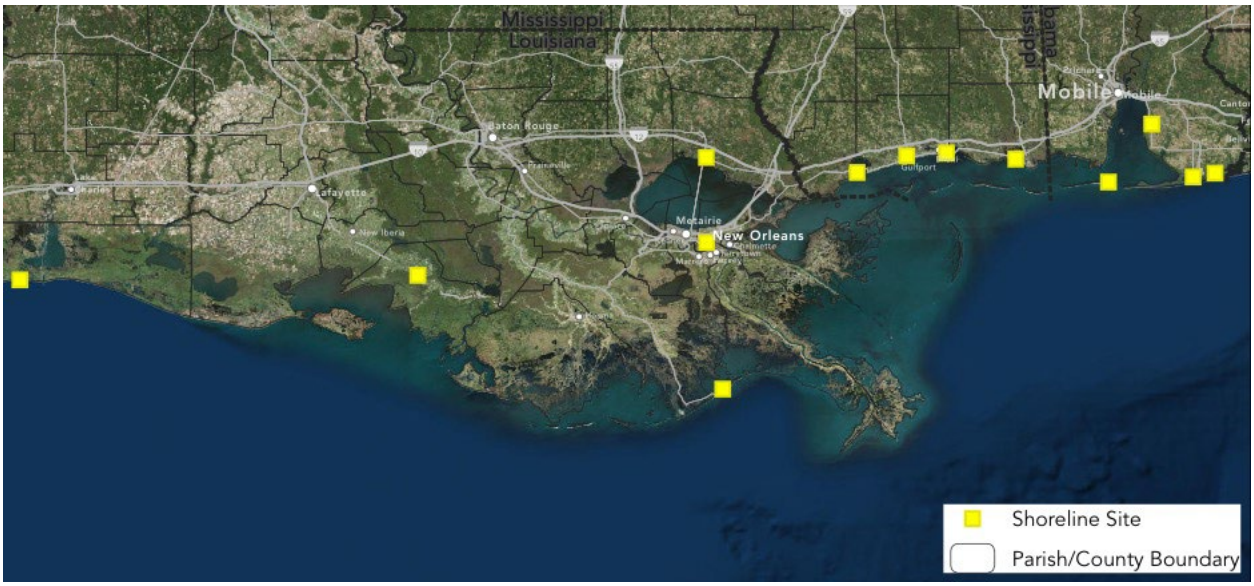
Destination	Trips	Average Income	Average Age	% Male	Working Full Time	Working Part Time	Retired	Other (student, etc.)
Affected Sites	644,596	65,431	49	61%	52%	3%	36%	9%
Remaining Sites	6,723,861	60,466	45	40%	48%	8%	20%	24%

Note: Restricted to destinations in Louisiana, Mississippi, and Alabama. Demographic variables are displayed here for context but are not a component of the modeling analysis used herein. Results are population-weighted.
Source: ECONorthwest analysis of DWH Shoreline Survey data.

A set of 13 aggregate sites are used to capture all types of trips to all locations, identified in Figure 3-13 below. For modeling tractability, all trips to shoreline sites along the southern portion of the basin are aggregated to a single site on Grand Isle, while all trips to shoreline sites along the northern portion of the basin are aggregated to a single site in New Orleans. This is because these two aggregate sites are most representative of the behavior occurring in different portions of the basin, and therefore more easily summarize the potential changes.

45. Additional information on this survey is available in the DWH Administrative Record: https://www.doi.gov/deepwaterhorizon/adminrecord.

Figure 3-13. Aggregate Shoreline Sites



Note: Aggregate site locations are representative of all shoreline destination sites in that area, as reported by survey respondents.
Source: ECONorthwest

A summary of each of these sites from west to east is listed in Table 3-22 below. There is a notable difference in the average travel cost and the number of trips for each site. Sites most likely affected by the Project within the basin are in Lafourche, Jefferson, Plaquemines, and Orleans parishes, while the remaining destinations serve as possible substitutes for both local and out-of-state recreators.

Table 3-22. Shoreline Site Attributes

Aggregate Shoreline Site	Average Travel Cost ($)	Trips
Cameron Parish, LA	158.17	349,092
Vermillion, Iberia, and St. Mary Parishes, LA	20.90	97,597
Southern Barataria Basin	68.57	213,581
Northern Barataria Basin	362.19	431,015
St. Tammany Parish, LA	16.28	131,067
Hancock County, MS	32.67	461,230
Gulfport, MS	36.11	1,068,667
Biloxi, MS	87.41	1,691,397
Pascagoula, MS	13.06	132,609
Dauphin Island, AL	63.00	576,422
Fairhope, AL	187.07	464,404
Gulf Shores, AL	233.06	1,190,714
Orange Beach, AL	262.55	560,663

Note: Sites most likely directly affected by the Project are outlined. Includes all shoreline recreational activities.
Source: ECONorthwest analysis of DWH Shoreline Valuation Survey data.

Impacts from the NAA and Applicant's PA may vary by type of recreational activity, and while the DWH Shoreline Valuation Survey includes all types of recreation, it does not separate out fishing from non-fishing. To approximate the share of trips attributable to shore fishing and other

types of general shoreline use, the ratio of the total estimated shore fishing to boat fishing trips from the 2013 MRIP[46] onsite intercepts are applied to the number of boating trips estimated from the DWH Boating Survey such that:

$$Total\ General\ Shoreline\ Trips_{Parish} = Fishing\ Shore\ Trips_{Parish} + NonFishing\ Shore\ Trips_{Parish}$$

Where:

$$Fishing\ Shore\ Trips_{Parish} = \left(\frac{MRIP\ Shore\ Fishing\ Trips_{Parish}}{MRIP\ Boating\ Trips_{Parish}}\right) * DWH\ Boating\ Survey\ Trips_{Parish}$$

The results of this calculation are displayed in Table 3-23 below.

Table 3-23. Share of Fishing and Non-fishing Trips at Affected Aggregate Shoreline Sites

Aggregate Shoreline Site	Shore/Boating MRIP Trips	DWH Boating Survey Trips	Fishing Shore Trips	Non-Fishing Shore Trips	Total Shore Trips
Southern Barataria Basin	0.28	472,686	131,029	82,542	213,581
Northern Barataria Basin	0.50	216,931	108,715	322,300	431,015

Source: ECONorthwest analysis of DWH Shoreline Survey data

Due to the aggregation of many types of shoreline use (including fishing, hunting, and bird-watching) and a lack of site-specific characteristics, a single-stage conditional logit model regressing site choice on travel cost and a full set of alternative specific constants are used to predict site choice probabilities for each respondent.

3.5.2 Area of Potential Impacts

Projecting expected changes in recreational demand requires the identification of expected changes in relevant environmental attributes. CPRA has evaluated expected changes in salinity, temperature, and land cover along with resulting potential ecological impacts to recreationally important species in the NAA and Applicant's PA. These environmental changes serve as direct inputs into the recreational analysis and vary across geographic space, time, and the potential operations of the Project. Each of the expected environmental changes and their relevance for projecting recreational use is described in the sections below.

Public Lands

The region is home to several publicly owned and managed lands that recreators utilize for a variety of activities (Table 3-24). These public lands include wildlife management areas, refuges, conservation areas, as well as national and state parks. Near the basin there are two wildlife refuges, three wildlife management areas, one natural and scenic river, one national park, and two state parks[47].

46. 2013 data is used to correspond to the year the DWH surveys were conducted.

[47] MBSD DEIS Ch.3 pg. 233

Table 3-24: Public Lands Near Project

Public Lands	Managed by	Acres	Distance from Project (Miles, Direction)
Jean Lafitte National Historical Park and Reserve- Barataria Preserve	NPS	23,000	16 NW
Timken Wildlife Management Area	LDWF	2,900	19 NW
Bayou Segnette State Park	LSPD	580	21 NW
Salvador WMA	LDWF	32,000	23 NW
Grand Isle State Park	LSPD	210	26 S
Elmer's Island Wildlife Refuge	LDWF	1,100	31 SW
Bayou de Allemands Natural and Scenic River	LDWF	2,600	32 NW
Lake Boeuf WMA	LDWF	800	42 NW
Delta National Wildlife Refuge	USFWS	48,800	54 SE
Pass A Loutre WMA	LDWF	115,000	62 SE

Source: MBSD DEIS Ch. 3

Recreation activities on these lands may include fishing, hunting, wildlife viewing, and have the potential of being impacted by the project. Public lands near the basin allow wildlife viewers the opportunity to observe small mammals, reptiles, and between 120-254 different species of birds[48]. However, due to the relative distance of even the closest public lands from the project, direct and indirect impacts are likely to be negligible. Any changes in recreational use at these public lands will mirror broad changes in use throughout the basin.

3.5.3 Construction Impacts

No Action Alternative

Under the NAA, the proposed Project would not be constructed and therefore no impacts from construction would occur. Further, considering current, ongoing, and planned developments in the area, it is likely that at some future point in time the area of the proposed diversion complex may be developed for industrial or commercial purposes. However, it would be speculative to guess what exactly those future developments might be and how they might affect recreational use patterns.

Applicant's Preferred Alternative

Construction activities under the Applicant's PA are not expected to close or impair road access for recreators. There may be occasional highway or waterway traffic congestion from the mobilization of crews and equipment, which may contribute to short-term delays in accessing sites. However, due to the temporary and localized nature of these effects, the construction of the Project is likely to have no significant impact on recreation and tourism.

[48] eBird Hotspot Report for Delta NWR, Pass A Loutre WMA, Elmer's Island WR, Jean Lafitte NHP, Grand Isle SP. Access: https://ebird.org/hotspots

Other Alternatives

The construction impacts from the other alternatives would be no different than those for the Applicant's PA.

Operational Impacts

The following sections describe anticipated operational impacts under the NAA, followed by anticipated operational impacts under the Applicant's PA.

No Action Alternative

Continued sea-level rise and increasing storm events are expected to gradually and continually change the average salinity, temperature, and land cover in the Barataria Basin. Average Barataria Basin salinity is anticipated to increase over time, with effects more pronounced in the southern portion of the Basin. Water temperature is also expected to increase over time, with the effects being the most substantial during the winter months. Land loss occurring across the basin's shorelines and marshes is anticipated to continue, with models predicting an 84% loss of land in the basin over the next 50 years. These environmental changes may directly impact the abundance of recreationally important species. Anticipated operational impacts to recreational access, recreational fishing, recreational boating and general shoreline use are described below.

Recreational Access

Ongoing sea-level rise and significant storm events have the potential to change recreational access in the Basin through physical impacts to sites or navigation channels. These physical impacts can impose significant recreational impacts through site closure or restricted access. When this occurs, recreational users modify their behavior and either substitute to alternative locations or forego recreational trips entirely. Over the next 50 years, recreational access points (or roads leading to them) may become inundated and inaccessible as relative water levels in the Basin continue to rise. This may occur acutely during storm events initially, with potential additional permanent closure occurring at some point in the future. Currently, projections identify many recreational access points in Barataria Basin that will become inundated as a result of sea-level rise, storm events, or other phenomena relevant to the NAA. Table 3-25shows the near-term, mid-term, and long-term impacts sea-level rise, storm events, and other phenomenon will have on Barataria Bain recreational access points. As a result, it is anticipated that by 2070, without any mitigation, substantial changes to recreational access will occur in the Basin. However, these closure percentages assume no effort by the state or parish governments to maintain access to these points over the 50-year analysis period. It is reasonable to assume that the State will make efforts to maintain access to these sites through road elevation, beach nourishment, or other mitigation efforts. Details of these efforts, including beach and barrier island restoration can be found in the State's Coastal Master Plan. Nonetheless, in order to account for the possibility that sea-level rise, storm events, and other phenomena would eliminate such access, worst case percentages are shown here for all sites.

Table 3-25. Modeled Percent of Days with Restricted Access Due to Tidal Flooding

Access Point	Near-term	Mid-term	Long-term
Bobby Lynn's Marina	14%	77%	100%
Bridge Side Marina	13%	74%	100%
Buras	12%	62%	100%
Grand Bayou	33%	88%	98%
Grand Isle	14%	77%	100%
Lafitte	1%	24%	78%
Leeville	14%	77%	100%
Myrtle Grove	26%	74%	97%
Venice	0%	11%	89%

Note: This assumes no adaptation or mitigation to changes in tidal flooding and represents a worst-case scenario.
Source: The Water Institute.

Recreational Fishing

The Aquatics Analysis describes how direct changes in environmental conditions lead to expected changes in recreationally important fish in the basin. Furthermore, it evaluates the extent to which the long-term effects of sea level rise can potentially change the abundance of fish and wildlife that anglers, hunters, and birdwatchers seek out during recreational trips in the basin. Ecologists are unable to precisely predict how catch rates or sightings of species will change through 2070 however, there is sufficient information to generally describe how populations of recreationally important species will respond to changes in environmental conditions. In general, species are affected for a variety of reasons including: salinity changes, and reliance on marsh-dependent food sources. Some species including largemouth bass, waterfowl, and alligators, are more prevalent in lower-salinity environments. Other species, such as spotted seatrout, are more prevalent in higher-salinity environments. Others, including southern flounder, Atlantic croaker, red drum, and blue crab, can tolerate wide ranges in salinity and are most affected by the availability of marsh-dependent food. The combination of these effects determines whether the abundance of a given species will generally increase, decrease, or remain approximately the same.

- **Largemouth Bass** – The largemouth bass is commonly utilized as an indicator species – a species which helps measure the overall environmental health of freshwater habitat. Due to increasing salinity, largemouth bass in the Barataria Basin are likely to experience decreases in abundance under the NAA compared to existing conditions in the mid-term and long-term.
- **Spotted Seatrout** – Despite its high salt tolerance, losses in marsh habitat are expected to lead to a decline in spotted seatrout abundance in the long-term under the NAA as compared to existing conditions. Losses in marsh habitat are not anticipated to affect spotted seatrout abundance in the mid-term.
- **Southern Flounder** – Adult southern flounder found in Barataria Bay are often fished during their migration to the Gulf of Mexico between October and November. Southern flounder abundance is expected to experience decreases over the mid-term and long-term under the NAA compared to existing conditions due to declining food availability.
- **Red Drum** – Red drum spawn in the Gulf of Mexico and juveniles recruit to the mid-Barataria Basin in summer and fall. Declining food availability and losses in juvenile red drum nursery habitats is expected to cause red drum abundance to decline within the

Barataria Basin over the mid-term and long-term under the NAA compared to existing conditions.

- **Atlantic Croaker** – Found in shallow, sandy, and muddy areas of the Barataria Basin, Atlantic croaker abundance is anticipated to decrease in the mid-term and long-term under the NAA compared to existing conditions due to a decrease in prey abundance and loss in shallow water habitat.
- **Blue Crab**[49] – The blue crab is commonly found in the marshy areas along the mid-Basin during summer. Blue crab abundance is expected to experience decreases in the mid-term and long-term under the NAA compared to existing conditions. Blue crabs are euryhaline and their abundance is not generally affected by changes in temperature or salinity; however, blue crab abundance is affected by predation and they would be affected by the loss of marsh and SAV nursery habitats.

For all recreationally targeted species, abundance does not differ between under the NAA compared to existing conditions in the near-term. The expected changes in abundance for recreationally important aquatic species from the NAA is summarized in Table 3-26.

Table 3-26. Expected Trends in Barataria Basin Abundance in the NAA

Aquatic Species	Near-term NAA Compared to Existing Conditions	Mid-term NAA Compared to Existing Conditions	Long-term NAA Compared to Existing Conditions
Largemouth Bass	Neutral	Decrease	Decrease
Spotted Seatrout	Neutral	Neutral	Decrease
Southern Flounder	Neutral	Decrease	Decrease
Red Drum	Neutral	Decrease	Decrease
Atlantic Croaker	Neutral	Decrease	Decrease
Blue Crab	Neutral	Decrease	Decrease

Source: ECONorthwest interpretation of Abt/Confluence (2019). Aquatics Analysis.

Recreational Boating

To estimate the effects of changes in environmental conditions during the NAA on recreational boating, a scenario using the general characterization of impacts to each target species summarized in Table 3-26 is used to apply a corresponding general change in recreational fishing suitability to the boating site choice model. Any target species expected to see decreases in abundance is characterized by a decline in the share of anglers targeting that species. Conversely, any species expected to see increases in abundance are characterized by an increase in the share of anglers targeting that species.[50] Changes are applied to all sites in the basin, however, due to a lack of information on effects outside of the basin, all remaining sites are assumed to remain unchanged from existing conditions. Data on non-fishing boating trips (including hunting, birdwatching, or general boat-based recreation) as well as impacts on waterfowl and terrestrial species is limited, and effects on those trips are described qualitatively.

49. Although some users do target blue crab and shrimp recreationally, data used in this analysis does not explicitly identify these as a targeted species, and thus are not modeled independently.

50. Sensitivity analyses were conducted to test the implication of a change of 25%, 50%, and 75% change in the share of anglers targeting specific species. While the magnitudes of changes vary, the same general conclusions are reached.

The two-stage regression model, combined with the scenario analyses described above, produces a set of individual-trip, site-selection probabilities. The resulting probabilities are weighted and summed across specific geographies to produce an estimate of the expected number of trips to that area. Since this model reflects boating site choices but not a participation decision, the total number of trips remains unchanged. However, changes in site characteristics within the study area are evaluated relative to the characteristics of all coastal sites in Louisiana and Mississippi. This mirrors the common recreational-choice decision, where recreators choose a site based on its characteristics and the characteristics of all alternatives, including travel cost. The relative change in expected boating trips provides an indication of the type of impact expected as a result of the Project.

The boating site choice model analysis results for changes in boating user days for the four parishes adjacent to the Barataria Basin is summarized in Table 3-27. Results reveal that a decline in abundance of recreationally important species in the NAA relative to existing conditions (operationalized through the share of recreators targeting each of those species) causes boating recreators to substitute away from sites in Plaquemines, Jefferson, and Lafourche parishes. The relative decline in boating site quality leads a small fraction of those recreators to substitute to closer sites in St. Charles Parish. This implies that some recreators will travel to closer sites (with lower travel costs) as site quality or availability at distant sites declines.

Table 3-27. Changes in Boating User Days in the NAA Relative to Existing Conditions

Parish	Share of Existing Trips	NAA Relative to Existing Conditions[51]		
		Near-term	Mid-term	Long-term
Modeling Assumption	**N/A**	**25%/50%/75%**	**25%/50%/75%**	**25%/50%/75%**
Plaquemines	23%	18%/18%/18% **Decrease**	61%/59%/58% **Decrease**	84%/84%/84% **Decrease**
Jefferson	21%	3%/3%/3% **Decrease**	26%/27%/27% **Decrease**	60%/61%/61% **Decrease**
St. Charles	17%	0%/0%/0% **No Change**	3%/2%/1% **Increase**	3%/2%/1% **Increase**
Lafourche	39%	6%/6%/6% **Decrease**	32%/32%/31% **Decrease**	38%/39%/40% **Decrease**

Notes: Modeling assumption is the change in the share of anglers targeting affected species.
Source: ECONorthwest analysis of DWH Boating Survey data, MRIP (2013), and the Aquatics Analysis.

These modeled results reflect changes in trips as a result of changes in site access and fishing quality. Since the long-term impacts on site access are more dramatic (with potential full closure of a number of sites) than changes in fishing quality, similar changes may occur to non-fishing trips.

General Shoreline Use

To capture all the types of use that occur at shoreline sites in the basin, general changes in site quality are inferred from the projected abundance of recreationally important aquatic and terrestrial species. Scenarios are evaluated by applying marginal adjustments to the coefficients

51. These changes in trips are estimated using assumed changes in the share of anglers targeting a particular species at a given site. Sensitivity analyses report the same direction and relative magnitude of effect by Parish, while the absolute magnitude change at the Parish level varies proportionally.

on the alternative specific constants for shoreline sites most likely to observe any direct effect from the Project. These adjustments are applied relative to the direction of aggregate effects for aquatic and terrestrial species on the share of fishing and non-fishing shore trips, respectively. This approach is designed to provide an indication of the relative magnitude of substitution effects in the NAA.[52]

Impacts for fishing are derived directly from the overall expected impacts to boat-based fishing described above. Impacts for non-fishing trips are based on anticipated effects to terrestrial species (e.g. birds and alligators). Although terrestrial impact reports have not been completed at this time, this analysis assumes that ongoing land loss, increases in salinity, and flooding will cause the abundance of birds and alligators to decline in the NAA, resulting in a local decrease in the number of hunters, birdwatchers, and other general shoreline users. Since tag allotments for alligator hunting are determined by the number of habitat acres, a decrease in habitat would directly decreases the amount of alligator hunting available. For birdwatching, a decrease in habitat may result in fewer birds and potentially lower species diversity, which could decrease the number days spent birdwatching. These relative changes in site quality are summarized in Table 3-28 below.

Table 3-28. Relative Changes in Shoreline Site Quality, by Type of Use

Aggregate Shoreline Site	Type of Trip	Share of Existing Trips Within Parish	Near-term NAA Relative to Existing Conditions	Mid-term NAA Relative to Existing Conditions	Long-term NAA Relative to Existing Conditions
Southern Barataria Basin	Fishing	60%	No Change	Decrease	Decrease
	Non-Fishing	40%	No Change	Decrease	Decrease
Northern Barataria Basin	Fishing	25%	No Change	Decrease	Decrease
	Non-Fishing	75%	No Change	Decrease	Decrease
All Other Sites	All Trips	100%	No Change	No Change	No Change

Source: ECONorthwest analysis of DWH Shoreline Survey data, MRIP (2013), and the MBSD Aquatic and Terrestrial Impacts Reports.

The results of the general shoreline use model are displayed in Table 3-29 below and reveal that a decline in the abundance of recreationally important fish and terrestrial species in the NAA relative to existing conditions causes recreators to substitute away from sites in Plaquemines/Orleans and Lafourche/Jefferson Parishes to locations outside of the Basin.

52. Due to the lack of information on the relevant magnitude of the changes in site quality, hypothetical adjustments were applied and a sensitivity analysis indicates that the magnitude of the adjustment does not affect the direction of the change in use. Due to this limited information, magnitudes of changes are not reported for the shoreline analysis.

Table 3-29. Changes in Shoreline Trips in the NAA Relative to Existing Conditions

Aggregate Shoreline Site	Share of Existing Trips	Near-term NAA Relative to Existing Conditions	Mid-term NAA Relative to Existing Conditions	Long-term NAA Relative to Existing Conditions
Southern Barataria Basin	34%	No Change	Decrease	Decrease
Northern Barataria Basin	66%	No Change	Decrease	Decrease

Source: ECONorthwest analysis of DWH Shoreline Survey data, MRIP (2013), and Aquatics Analysis.

Participation Projection

While the boating and shoreline site choice models reflect how users will substitute as environmental conditions change, they do not estimate the number of individuals expected to participate in recreational fishing, hunting, birdwatching, general shoreline use, or how those participation rates will change in the future. To evaluate the total number of recreational trips likely to be affected, recreation participation over time is projected using a combination of historical participation estimates and existing population projections.[53] This approach assumes relatively fixed participation rates over time, and thus the number of future recreators potentially affected is dependent on regional population growth. Due to the inherent uncertainty of future conditions, this approach does not account for changes in participation as a result of changing environmental conditions, climate change, land loss, site quality, and general recreational preferences in the NAA or Applicant's PA. Furthermore, population projections beyond 2030 are not available and would be speculative to create. Therefore, this participation analysis only extends through 2030. For the purposes of analyzing impacts out through 2070, it was assumed that these general trends may continue, however quantitative estimates are not generated.

The share of the population participating in recreation in a year can be estimated from the NSFHWAR, which is conducted every five years.[54] This survey provides an estimate of the general population participating in several of the categories of recreation potentially affected by the Project. For example, over the last ten years, the NSFHWAR has estimated that between 12 and 17 percent of the population of Louisiana has participated in fishing, while a smaller portion (2% to 5%) has engaged in hunting, as shown in

53. Sometimes, participation decisions are incorporated into site-choice models to jointly determine the decision to participate as well as which site to visit. These are generally useful in measuring short-run effects where participation is affected solely by environmental conditions or changes in site characteristics. They are less useful when macroeconomic conditions (such as population and income) or fundamental preferences for recreation change, and thus are not applied here.

54. NSFHWAR. U.S. Fish and Wildlife Service. Available at https://www.census.gov/programs-surveys/fhwar.html. Accessed 11/30/2018.

Table 3-30. Across all survey years since 2006, the share of both the local and national population participating in fishing, hunting, and wildlife viewing has increased.

Table 3-30. Selected Participation Shares from NSFHWAR

Survey Year	Fishing		Hunting		Wildlife Viewing	
	Louisiana	National	Louisiana	National	Louisiana	National
2016	17%	14%	5%	4%	26%	32%
2011	15%	10%	2%	2%	24%	30%
2006	12%	9%	2%	2%	21%	31%

Note: Ages 16 and older.
Source: National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

LDWF also conducted a study to assess participation in recreation and the economic benefits thereof in Louisiana in 2006, and reported statewide participation estimates for wildlife viewing (Table 3-31). This shows that waterfowl and shorebirds are a key part of this section of non-fishing recreation.

Table 3-31. Participation Data for Louisiana Wildlife Viewers

Wildlife Type	Number of recreators observing, feeding, photographing:
Waterfowl	141,734
Songbirds	104,815
Birds of prey	52,423
Other birds	45,404
Shorebirds	101,686
Small land mammals	71,409
Activity Type	**Number of days**
Observing Wildlife	1,516,635
Photographing Wildlife	752,280
Feeding Wildlife	1,101,997

Source: LDWF The Economic Benefits of Fisheries, Wildlife, and Boating Resources, 2006, pp.29.

On a more granular scale, the number of fishing and hunting permits sold to residents of parishes adjacent to the Project area can help inform local participation levels. Different fishing and hunting licenses are available for different activities (e.g. saltwater versus freshwater, bow hunting versus waterfowl, etc.), to different sub-populations (e.g. resident, non-resident, military, etc.), and for different periods (e.g. single year or lifetime). Combination licenses can also be purchased. To determine the total number of unique individuals purchasing fishing and hunting licenses, the full suite of licenses and permits issued by the LDWF is aggregated across four categories of fishing and hunting permits: resident saltwater fishing, resident hunting, nonresident and military saltwater fishing, and nonresident and military hunting. Resident license sales data can also be used to illustrate the level of participation in recreational crabbing, trawling, and oyster harvesting. Permits related to big game, turkey, bowhunting, primitive firearms, trapping, for-hire, and charters[55] are excluded as they do not directly inform participation levels relevant for this analysis. License sales from 2013 through 2017 are

55. A charter fishing adjustment is used in the overall participation estimate and is included in Table **3-33**.

displayed in Table 3-32.[56] Since the trips and license sales are indirectly related, this only serves as an approximation of the local population participation.

Table 3-32. Resident License Sales in Parishes Adjacent to the Project

Parish	Year	Estimated Total Population	Population Required to Obtain Licenses[57]	Resident Saltwater Fishing License Sales	Resident Duck Hunting License Sales	Resident Non-Fin-fish Fishing License Sales[58]
Lafourche Parish	2013	96,914	57,900	13,661	2,929	772
	2014	95,764	55,251	13,987	2,845	758
	2015	101,521	58,708	14,389	2,462	890
	2016	95,174	57,068	13,520	2,352	924
	2017	97,638	55,721	12,642	2,041	867
Plaquemines Parish	2013	24,343	14,529	3,294	666	231
	2014	24,178	14,440	3,351	742	243
	2015	24,786	15,222	2,564	268	123
	2016	25,551	15,655	3,094	618	257
	2017	23,646	13,602	2,895	577	257
Jefferson Parish	2013	438,721	260,225	29,261	2,681	1067
	2014	443,958	261,227	29,720	2,715	1121
	2015	441,002	257,371	28,330	1,364	41
	2016	451,800	262,843	26,935	2,343	1158
	2017	438,800	253,253	25,212	2,231	1092

Source: LDFW Recreational License Sales by Parish. Population estimated from 2013-2017 American Community Survey.

Additionally, the LDWF conducts the LACreel survey to estimate the number of anglers and the number of trips taken. A component of this survey is a weekly telephone call to both in-state and out-of-state holders of Louisiana fishing licenses asking whether they fished in the previous week and, if so, where.[59] From 2013 through 2017, a total of 172,401 telephone and e-mail interviews were completed, with 16,954 respondents reporting 27,015 trips. Weighted up to the population, this represents an average of 2,343,795[60] trips per year, 566,343 of which were taken to the Barataria Basin. The annual number of trips estimated via the LACreel survey is displayed in Figure 3-14, and the distribution of trips throughout the year is shown in Figure 3-15 below.

56. Louisiana Department of Wildlife and Fisheries Recreational License Sales by Parish. Available at http://www.wlf.louisiana.gov/licenses/statistics. Accessed 11/30/2018.

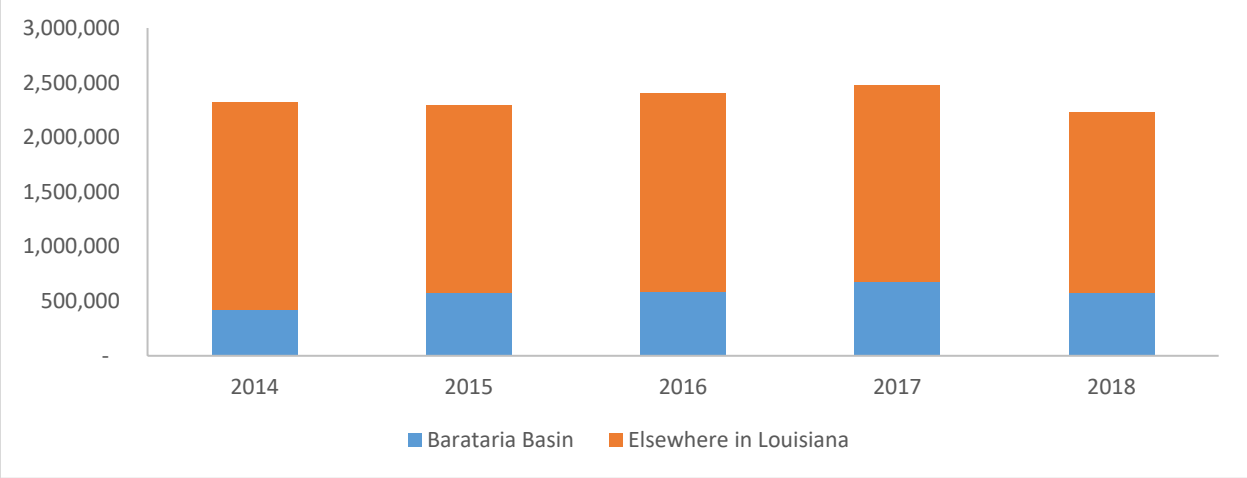
57. This is the relevant population relevant for the license sales estimates.

58 Includes licenses for crab traps, trawling for shrimp, oyster tongs, and crawfish traps.

59. Targeted species and catch are measured through a separate series of dockside intercept surveys.

60. This estimate is based on the approximate number of license holders by region.

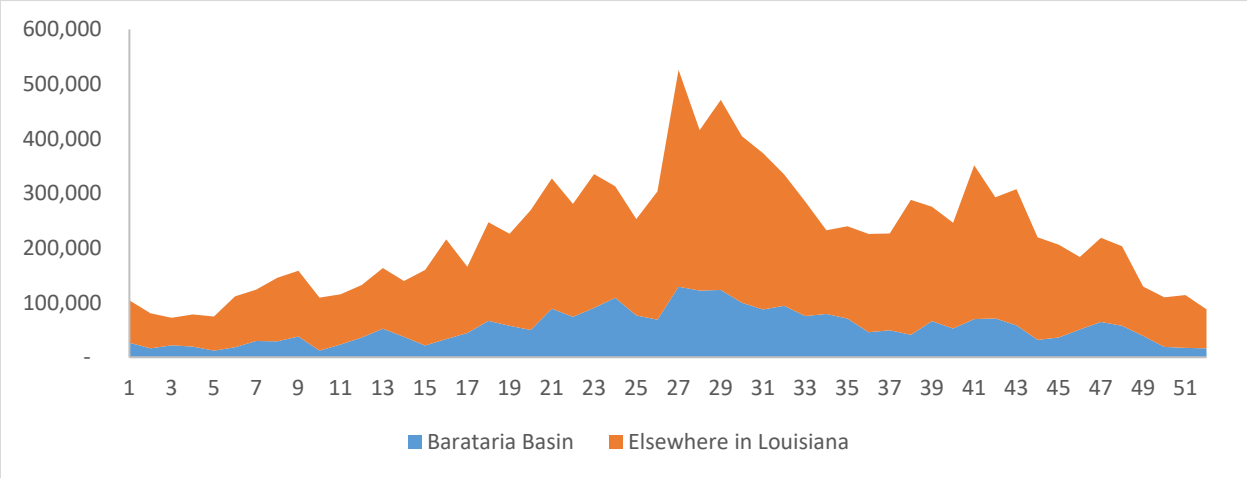
Figure 3-14. Estimated Fishing Trips in Louisiana from LACreel Telephone Survey, by Year



Note: Estimate based on Louisiana Recreational Saltwater Statistics Program and Approximate Licensed Anglers by Year.

While annual recreational use remains relatively constant from year to year, the seasonal pattern gives an indication of the magnitude of trips occurring throughout the year. The number of trips peaks in weeks 25 through 33 (mid-June through mid-August), while trips in the winter (weeks 1 through 12 and 47 through 52) are nearly 25% of trips during the summer months.

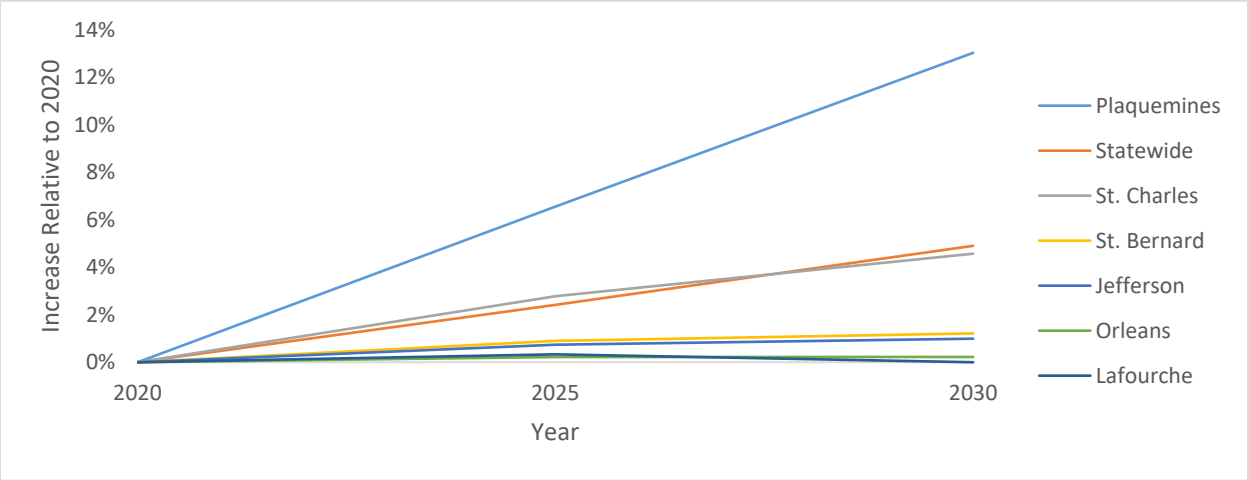
Figure 3-15. Average Fishing Trips in Louisiana from LACreel Telephone Survey, by Week



Note: Estimate based Louisiana Recreational Saltwater Statistics Program and Approximate Licensed Anglers by Year.

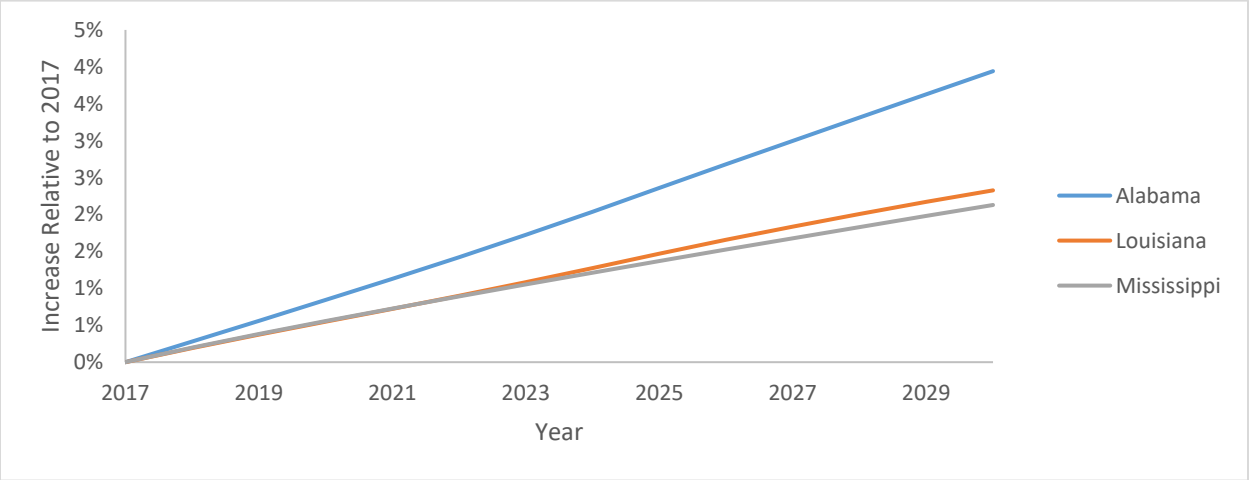
These various measures of participation inform historical recreational use. Future trends in the population are also important in characterizing future recreational demand. Figure 3-16 shows state and parish-level population projections in Louisiana, which inform participation projections for state residents. Figure 3-17 shows population projections in adjacent states (Alabama and Mississippi), from which many out-of-state recreators originate.

Figure 3-16. Projected Population Change in Louisiana, 2020-2030



Source: Louisiana State University (LSU). Louisiana Parish Population Projections Series, 2010-2030.

Figure 3-17. Projected State-level Population Growth



Source: CDC WONDER. State Population Projections 2004-2030. Available at https://wonder.cdc.gov/population-projections.html. Accessed 11/30/2018.

Using the observed trips collected in the DWH[61] and LACreel surveys, and license sales, the baseline participation projection for recreation fishing is detailed in

[61] A number of studies have found discrepancies between participation estimates based on onsite counts and general population surveys, including the DWH Lost Recreational Use Assessment. This analysis relies on estimates of boating days from general population surveys. Additional discussion of this issue is highlighted in Tourangeau, R., E. English, K. McConnell, D. Chapman, I. Flores Cervantes, E. Horsch, N. Meade, A. Domanski, M. Welsh. (2017). "The Gulf Recreation Study: Assessing Lost Recreational Trips from the 2010 Gulf Oil Spill." Journal of Survey Statistics and Methodology, 5 (3) pp. 281-309.

Table **3-33** below. Projected changes in private boating days, charter fishing days, shore fishing trips, hunting/birdwatching/other trips, and saltwater fishing trips are calculated using projected changes in regional and state populations using the general formula below:

$$Days_{Year} = Days_{2017} * \left[Resident\ Share * \left(\frac{Louisana\ Population_{Year}}{Louisana\ Population_{2017}}\right) + Out\ of\ State\ Share * \left(\frac{Regional\ Population_{Year}}{Regional\ Population_{2017}}\right)\right]$$

Statewide and local participation is calculated as the sum of the saltwater fishing and hunting participation rates times the projected state and local populations.

Table 3-33. Baseline NAA Participation Projection

Category	2017	2020	2030
Private Boating Days in Barataria Basin[62]	**377,974**	381,000	392,000
Charter Fishing Days in Barataria Basin[63]	**7,800**	7,800	8,100
Shore Fishing Trips to Barataria Basin[64]	**239,744**	242,000	249,000
Hunting, Birdwatching, Other Trips to Barataria Basin[56]	**404,842**	408,000	420,000
Saltwater Fishing Trips to Barataria Basin[65]	**566,343**	571,000	588,000
Resident[57]	**90%**	*90%*	*90%*
Out of State[6557]	**10%**	*10%*	*10%*
Regional Population[66]	**36,773,893**	**38,082,971**	**42,994,620**
Louisiana Population[67]	**4,693,413**	**4,719,160**	**4,802,633**
Resident Participation - Saltwater Fishing[68]	**17%**	*17%*	*17%*
Resident Participation - Hunting[60]	**5%**	*5%*	*5%*
Statewide Participants	1,032,000	1,038,000	1,057,000
Local Population[59]	**121,774**	**122,442**	**124,608**
Local License/Population Ratio - Saltwater Fishing[69]	**15%**	*15%*	*15%*
Local License/Population Ratio - Hunting[61]	**8%**	*8%*	*8%*
Local Participants	28,000	28,000	29,000

Note: Inputs are bolded and assumptions are italicized. The remainder are calculated values. The regional population includes Texas, Mississippi, and Alabama. While population projections only extend to 2030, this analysis presumes that these trends will continue though 2070.
Source: ECONorthwest

Assuming no change in participation rates, this analysis shows that projected population increases both adjacent to the Barataria Basin as well as regionally will increase the overall level of participation, with a projected 3.8% increase in the number of trips to the Barataria Basin by 2030. The participation rate may not be constant though in the future, and could be affected by many different variables over time that are not possible to account for at this point in time. As described earlier, this projection does not account for changes in environmental conditions, climate change, land loss, site quality, and general recreational preferences in the NAA or Applicant's PA scenarios; however, it does indicate the magnitude of potentially affected recreation.

62. DWH Boating Valuation Survey

63. 2013 MRIP, calculated as a proportional share to the private boating trips to Barataria Basin

64. DWH Shoreline Use Valuation Survey

65. LACreel

66. U.S. Census Bureau

67. Louisiana state population projections.

68. NSFHWAR

69. LDWF License Sales

Applicant's Preferred Alternative

Now that we've covered the NAA to existing conditions, we will compare the Applicant's PA to the NAA. Relative to the NAA, the Applicant's PA will decrease salinity throughout the basin, with the greatest effects near the Project outfall and during the period of peak diversion flow, by bringing in fresh water from the Mississippi River. The Mississippi River is generally cooler than water in the basin and thus diversion flows will also decrease water temperatures, again primarily near the outfall during peak flows in the late winter and early spring. Although land loss in the basin will continue over time, the Project will add sediment from the Mississippi River, which will create and help maintain marsh habitats near the diversion outfall.

Recreation Access

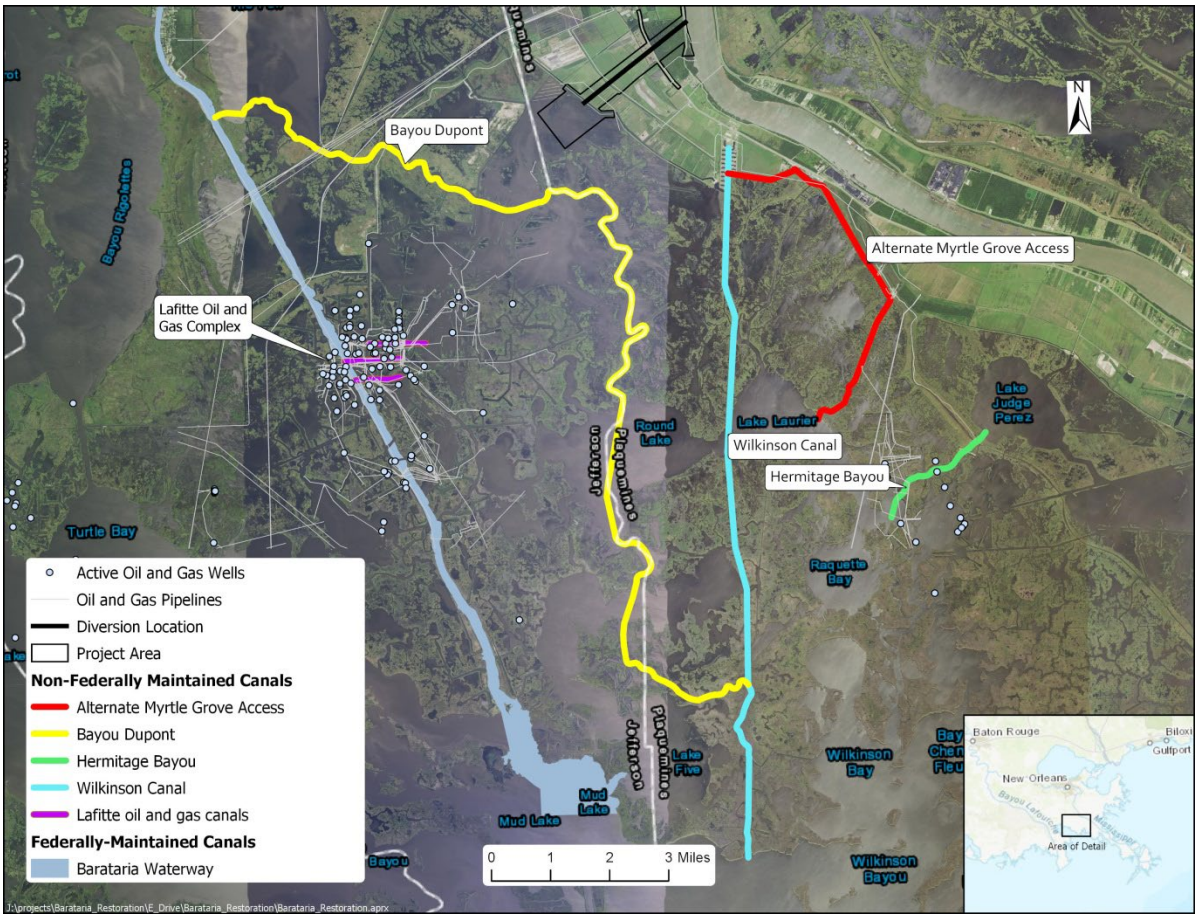
In the Applicant's PA, the volume of flow and transport of sediment during Project operations may affect boating at specific recreational access points. Although most recreational boating occurring in the area does not require substantial water depth, sediment may accumulate in areas that make access more difficult. These effects are limited to recreational boating and do not affect shore-based activities. The nearest major recreational access point to the Project is Myrtle Grove Marina,[70] a public boat launch with over 20,000 boating user days per year.[71] Due to its proximity to the Project outflow, access to the basin from this site may be impaired due to sedimentation if the canal is not periodically dredged or otherwise maintained to allow recreational boat passage.[72] As described in Section 3.5 Non-Federally Maintained Channels and Canals the sedimentation of canals into and near the Myrtle Grove area is expected to have long-term, moderate, adverse impacts on recreators using the marina and the canals. The location of these channels is illustrated in Figure 3-18 below.

70. http://www.myrtlegrovemarina.com/

71. Estimate of user days derived from the DWH Boating Valuation Survey.

72. See canal sedimentation analysis in section 3.6.

Figure 3-18. Navigation Channels near the Diversion



Source: Abt (2019).

Recreational Fishing

Operations under the Applicant's PA will affect the salinity conditions, habitat availability and availability of prey for recreationally important species (and in turn, their abundance) in the Basin, as described in the Aquatics Analysis. These changes in abundance as a result of the Applicant's PA are summarized relative to existing conditions in Table 3-34 and relative to the NAA in Table 3-35 below.

Table 3-34. Expected Trends in Barataria Basin Abundance from the Applicant's Preferred Alternative Compared to Existing Conditions

Aquatic Species	Near-term APA Compared to Existing Conditions	Mid-term APA Compared to Existing Conditions	Long-term APA Compared to Existing Conditions
Largemouth Bass	Increase	Increase	Increase
Spotted Seatrout	Decrease	Decrease	Decrease
Southern Flounder	Neutral	Neutral	Neutral
Red Drum	Increase	Increase	Decrease
Atlantic Croaker	Increase	Neutral	Neutral
Blue Crab	Neutral	Decrease	Decrease

Source: ECONorthwest interpretation of Abt/Confluence (2019). Aquatics Analysis.

Table 3-35. Expected Trends in Barataria Basin Abundance from the Applicant's Preferred Alternative Compared to the No Action Alternative

Aquatic Species	Near-term	Mid-term	Long-term
	APA Compared to NAA	APA Compared to NAA	APA Compared to NAA
Largemouth Bass	Increase	Increase	Increase
Spotted Seatrout	Decrease	Decrease	Decrease
Southern Flounder	Neutral	Increase	Increase
Red Drum	Increase	Increase	Increase
Atlantic Croaker	Increase	Increase	Increase
Blue Crab	Neutral	Increase	Increase

Source: ECONorthwest interpretation of Abt/Confluence (2019). Aquatics Analysis.

Recreational Boating

The range of potential effects to recreational boating are evaluated using the characterization of impacts to each target species described in the Aquatics Analysis as an indicator of recreational fishing activity. Any target species expected to see long-term gains in abundance relative to existing conditions is characterized by an increase in the share of anglers targeting that species. Conversely, any species expected to see long-term declines in abundance is characterized by a decrease in the share of anglers targeting it.[73] Changes in recreational access due to tidal flooding in the basin as well as sedimentation in the area surround Myrtle Grove marina are modeled as the partial or full loss of sites. As in the analysis of the NAA, all remaining sites are assumed to remain unchanged from existing conditions. These scenario changes reflect how a recreational angler's site preferences may change as a result of anticipated increases or decreases in abundance described in the Aquatics Analysis.

The results of the boating site-choice model describes the direction of the total change in trips for the four parishes adjacent to Barataria Basin and is summarized in Table 3-36. The Applicant's PA will lead to a relative increase in recreational site quality and a relative increase in trips in Jefferson, and Lafourche parishes, while there will be decreases in trips to St. Charles Parish relative to the NAA. There will be decreases in trips to Plaquemines Parish as a result of the projected loss of boating access at Myrtle Grove, however the other sites in the basin will not see equivalent gains as a result. This indicates that a large share of the trips to Myrtle Grove would substitute to sites outside of the basin should access be lost as a result of the Applicant's PA.

73. Sensitivity analyses were conducted to test the implication of a change of 25%, 50%, and 75% in the share of anglers targeting specific species. While magnitudes of changes vary, the same general conclusions are reached.

Table 3-36. Changes in Boating User Days of the Applicant's Preferred Alternative Relative to the No Action Alternative with no boating access at Myrtle Grove

Parish	Share of Existing Trips	Applicant's PA Relative to NAA[74]		
		Near-term	Mid-term	Long-term
Modeling Assumption	**N/A**	**25%/50%/75%**	**25%/50%/75%**	**25%/50%/75%**
Plaquemines	23%	3%/8%/17% Decrease	1%/4%/11% Decrease	9%/8%/7% Decrease
Jefferson	21%	55%/40%/27% Increase	45%/34%/23% Increase	7%/5%/1% Increase
St. Charles	17%	6%/5%/3% Decrease	8%/6%/4% Decrease	4%/3%/1% Decrease
Lafourche	39%	15%/14%/14% Increase	11%/9%/8% Increase	3%/3%/2% Increase

Notes: Modeling assumption is the change in the share of anglers targeting affected species.
Source: ECONorthwest analysis of DWH Boating Survey data, MRIP (2013), and the Aquatics Analysis.

Should boating access at Myrtle Grove be maintained[75], a different pattern of trips is expected, with gains in trips in Plaquemines Parish in the Applicant's PA relative to the NAA, as described in Table 3-37 below.

Table 3-37. Changes in Boating User Days of the Applicant's Preferred Alternative Relative to the No Action Alternative with access maintained at Myrtle Grove

Parish	Share of Existing Trips	Applicant's PA Relative to NAA[76]		
		Near-term	Mid-term	Long-term
Modeling Assumption	**N/A**	**25%/50%/75%**	**25%/50%/75%**	**25%/50%/75%**
Plaquemines	23%	61%/53%/42% Increase	113%/89%/79% Increase	276%/271%/250% Increase
Jefferson	21%	52%/37%/24% Increase	73%/59%/45% Increase	87%/79%/63% Increase
St. Charles	17%	8%/7%/5% Decrease	10%/8%/6% Decrease	6%/4%/2% Decrease
Lafourche	39%	22%/21%/21% Increase	69%/69%/68% Increase	68%/71%/72% Increase

Notes: Modeling assumption is the change in the share of anglers targeting affected species.
Source: ECONorthwest analysis of DWH Boating Survey data, MRIP (2013), and the Aquatics Analysis.

General Shoreline Use

When evaluated in the shoreline site choice model, the change in trips at a given site depends on the relative change in quality for that site as well as each of its substitutes for each type of use. Impacts for shore-based fishing are derived directly from the expected impacts to boat-based

74. These changes in trips are estimated using assumed changes in the share of anglers targeting a particular species at a given site. Sensitivity analyses report the same direction and relative magnitude of effect by Parish, while the absolute magnitude change at the Parish level varies proportionally.

75 This scenario assumes no loss in access as a result of sedimentation, however, impacts from future tidal flooding are still included.

76. These changes in trips are estimated using assumed changes in the share of anglers targeting a particular species at a given site. Sensitivity analyses report the same direction and relative magnitude of effect by Parish, while the absolute magnitude change at the Parish level varies proportionally.

fishing described above. Impacts for non-fishing trips are based on anticipated effects to terrestrial species (e.g. birds and alligators) as a result of the Applicant's PA relative to the NAA. The Applicant's PA is expected to result in an increase in habitat for both birds and alligators relative to the NAA. This would increase the number of tag allotments for recreational alligator hunting in brackish and freshwater marshes. For birders, this could potentially translate to more birds and greater species diversity, which could increase recreational wildlife viewing. These relative site-quality effects are summarized in

Table **3-38** below.

Table 3-38. Relative Changes in Shoreline Site Quality, by Type of Use

Aggregate Shoreline Site	Type of Trip	Share of Existing Trips Within Parish	Relative to Existing Conditions	Relative to NAA
Southern Barataria Basin	Fishing	60%	Decrease	Increase
	Non-Fishing	40%	Increase	Increase
Northern Barataria Basin	Fishing	25%	Decrease	Increase
	Non-Fishing	75%	Increase	Increase
All Other Sites	All Trips	100%	No Change	No Change

Source: ECONorthwest analysis of DWH Shoreline Survey data, MRIP (2013), and the MBSD Aquatic and Terrestrial Impacts Reports.

To evaluate a range of potential scenarios, a variety of adjustments were made to the coefficients on the alternative specific constants in the model. For sites in the southern portion of the basin, both the NAA and Applicant's PA were adjusted downward, with the NAA greater in (negative) magnitude. For sites north of the basin, the adjustments in the NAA are always negative but positive for the Applicant's Preferred Alternative.

The result of the general shoreline use model is displayed in Table 3-39 below. The shoreline use analysis reveals that as a result of the Applicant's PA, improvements in the relative abundance of recreationally important species mitigates some of the decreases expected in future conditions in the NAA. The relative improvement in sites leads to a global increase in trips in the basin. However, the relative increase north of the basin also draws away shoreline use trips from the southern basin, leading to no discernable change in trips relative to the NAA. As conditions for recreational fishing and birdwatching improve in the Applicant's PA relative to the NAA, the Applicant's PA is concurrently expected to lead to an increase in trips to Plaquemines/Orleans and Lafourche/Jefferson Parishes relative to the NAA.

Table 3-39. Changes in Shoreline User Days of the Applicant's Preferred Alternative Relative to Existing Conditions and NAA

Aggregate Shoreline Site	Share of Existing Trips	Near-term Relative to NAA	Mid-term Relative to NAA	Long-term Relative to NAA
Southern Barataria Basin	34%	No Change	Increase	Increase
Northern Barataria Basin	66%	Increase	Increase	Increase

Source: ECONorthwest analysis

Participation Projection

While changes in environmental conditions as a result of the Applicant's PA or NAA may lead to different overall participation rates under each scenario, variability in underlying macroeconomic conditions and preferences for recreation can make those differences difficult to measure, and even harder to predict. Therefore, this analysis evaluates how changes in regional populations may affect the overall number of recreators potentially affected under the NAA or Applicant's PA, but does not discern a magnitude of change between the two. Thus, all participation results in this analysis are identical for the Applicant's PA and the NAA. It is important to note though that under both scenarios the rate of participation may not be constant, and that it is subject to a number of variables that are difficult to predict.

Other Alternatives

In addition to the Applicant's PA (75,000 cfs), two other alternatives that divert less or more water (50,000 cfs and 150,000 cfs, respectively) into the basin are being considered. The salinity, temperature, and land cover impacts are related to the volume of diversion water, with the smaller diversion leading to less salinity and temperature changes, but less marsh creation/maintenance. Conversely, the larger volume diversion will lead to higher salinity, temperature, and land cover changes as described in the Aquatics Analysis.

Recreation and tourism impacts are expected to be correlated with changes in the abundance of ecologically important species. Thus, the 150,000 cfs alternative is anticipated to provide marginally greater net benefits to recreation and tourism, while the 75,000 CFS alternative is anticipated to provide marginally smaller net benefits compared to the Applicant's PA.

3.5.4 Summary of Potential Impacts

The impact the Applicant's PA has on recreation and general shoreline use demand has potential to be generally positive relative to the NAA, however the degree of precision in estimated changes in recreation demand is limited by available information, including projected changes in the ecological condition in the basin. Evaluating potential changes in recreation is conducted by assessing the scale of impacts between the NAA and Applicant's PA. Each set of results described in this report and summarized in Table 3-40 below capture the scope of potential impacts resulting from these general scenarios.

Table 3-40. Summary of Potential Impacts on Recreation

Activity	Expected NAA Recreational Use		APA Relative to NAA	
	2020	2030	Change in Site Quality	Change in the Number of Days/Trips
Recreational Boating Days[77]	381,000	392,000	General improvement, but dependent on species targeted	Increase
General Shoreline Use				
Shore Fishing Trips	240,000	249,000	General improvement, but dependent on species targeted	Increase
Hunting, Birdwatching, Other Trips	408,000	420,000	Improvement	Increase

Note: NAA trip estimate only accounts for population change, but does not account for changes in environmental conditions, climate change, land loss, site quality, and general recreational preferences. While population projections only exist through 2030, this analysis presumes that these trends will continue through 2070.
Source: ECONorthwest

Effects on Tourism

As illustrated throughout this section, there are several types of recreation that might draw people to the region including boating, recreational and shoreline fishing, as well as birdwatching and hunting. The recreators traveling to the area to participate in these activities support the local tourism industry, which is made up of the restaurants, hotels, grocery stores, gear and gift shops. As part of their recreational trip, these recreators spend money locally on food, lodging, fuel, equipment, or guided tours. This in turn translates to jobs, income, and tax revenue for those providing the goods and services demanded by travelers to the region.

For context, the Quarterly Census of Employment and Wages[78] provides information on the relative size of the tourism and recreation industry in the region. By total wages, the largest industries in the region include mining, transportation and warehousing, and manufacturing, which account for over half of all wages in the parishes. For comparison, accommodation and food services, arts, entertainment, and recreation, and retail trade only make up 5 percent of wages in Plaquemines, and 8 percent of wages in Lafourche Parish. By number of businesses, however, accommodation and food services industries ranked higher indicating that the wages may be low but tourism still plays a significant role in the regional economy.

A change in recreational trips could potentially have an effect on the recreational tourism industry and its associated economic outputs. These estimates of changes in recreation serve as a direct input into expected changes in tourism spending. Since the relative magnitudes of trips by recreation type do not change dramatically, it is assumed that spending patterns per user similarly remain unchanged. Thus, as trips for boating and general shoreline use increase relative to the NAA, so do expenditures associated with that recreational use. However, since the recreational demand models predict that some recreators may shift to alternative recreation sites and may incur increased travel costs associated with that change, there may be a related decrease in tourism spending. The degree to which changes in expenditures may occur as a result of a

77. Includes charter fishing adjustment.

[78] Quarterly Census of Employment and Wages, first quarter 2019. http://www.laworks.net/LaborMarketInfo/LMI_WageData2002toPresent.asp?year=2019&qtr=1

change in substitution patterns is difficult to quantify with sufficient precision to generate a quantitative estimate.

These expenditures provide significant contributions to the local economy. Previous research estimated average daily spending for saltwater anglers, wildlife watchers, and waterfowl hunters at $240, $281, and $85, respectively.[79] Assuming these spending patterns do not change, the scale of potential impacts of the Applicant's PA on tourism is expected to be positive relative to the NAA.

3.6. Non-Federally Maintained Channels and Canals

3.6.1 Area of Potential Impacts

The evaluation presented in this section is focused on impacts of the Project to non-federally maintained channels and canals and navigational activities associated with each within the Barataria Basin. Impacts to federally maintained channels in the Barataria Basin and the Mississippi River are discussed in Section 4.21 Navigation of the DEIS. The channels and canals evaluated in this section include Wilkinson Canal, Hermitage Bayou, alternative channel into Myrtle Grove and Bayou Dupont (see Figure 2-6). In addition, three canals that mainly serve active oil and gas operations were evaluated. While there are more canals within the basin that could be affected by the Project, those evaluated in this section provide a representative sample in order to provide an understanding of the potential impacts of the project alternatives that may occur to the many miles of channels and canals located in the Barataria Basin.

3.6.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the Project would not occur and there would be no impacts from the Project to navigation-related traffic in the non-federally maintained channels or oil and gas canals in the Barataria Basin. Traffic along these channels and canals will primarily be associated with recreational boats and commercial fishing and to service active oil and gas production facilities. For purposes of this analysis, it is assumed that current traffic levels will continue under the NAA.

Applicant's Preferred Alternative

Construction of the Project is expected to cause negligible impacts on non-federally maintained channels and oil and gas canals in the Barataria Basin because none would be used to transport construction materials or equipment to the Project site. With the exception of Bayou Dupont, non-federally maintained channels and oil and gas canals will not be used to transport materials and equipment that will be needed for construction of the Project. For Bayou Dupont, the Applicant's PA is expected to cause temporary, minor, adverse impacts on traffic capacity of the channel due to its use to transport construction materials and equipment to the Project site (see section 4.21 Navigation in the DEIS).

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79. Southwick Associates, Inc. (2008). The Economic Benefits of Fisheries, Wildlife and Boating Resources in the State of Louisiana. Available at http://www.wlf.louisiana.gov/sites/default/files/pdf/publication/32728-economic-benefits-fisheries-wildlife-and-boating-resources-state-louisiana-2006/southwick_2006_final_final_report_5-27-08_0.pdf

Other Alternatives

The other flow alternatives would also have negligible impacts on non-federally maintained channels and oil and gas canals because none would be used to transport construction materials or equipment to the Project site. The exception is Bayou Dupont which will be used to transport some construction materials and equipment. CPRA estimates that the width of the proposed Project conveyance channel under the 50,000 cfs alternatives would be narrower and construction timeframes shorter by several months compared to the Applicant's PA, and as such, marine traffic for construction deliveries to the construction footprint in the Barataria Basin would be about 20% less compared to the Applicant's PA (MBSD DEIS Section 4.21.5.1). This alternative is expected to have temporary, minor, adverse impact on marine traffic capacity of the Bayou Dupont channel.

For the 150,000 cfs alternatives, CPRA estimates that the width of the proposed conveyance channel would be wider and construction timeframes longer by several months as compared to the Applicant's PA. As such, marine traffic for construction deliveries would be about 50 percent more as compared to the Applicant's PA. This will result in a temporary, minor, adverse impact on navigation traffic for Bayou Dupont.

3.6.3 Operational Impacts

In order to evaluate the impacts of sedimentation of non-federally maintained channels and canals as a result of operation of the Project, CPRA identified a representative sample of non-federally maintained channels that may be of importance to the recreational fishing industry within the area of potential impact. This includes channels that provide access to the Myrtle Grove Marina (**Error! Reference source not found.**Figure 2-6). In addition, three canals that service oil and gas operations were evaluated for potential impacts. A summary of the semi-quantitative analysis is provided in Appendix C.

No Action Alternative

Under the NAA, the non-federally maintained channels are showing an increase in depths on average over time. This is most notable change is to Bayou Dupont. While the oil and gas canals also show an increase in depths over time, the increases are not as significant as those in other non-federally maintained channels. Note that the modeling results show some lengths of the channels and canals that are above ground under the NAA. This may be due to discrepancies in the Geographic Information System (GIS) and Delft modeling that may not represent actual on the ground conditions. Also, the hydrograph used for the analysis was 2006 and represents a low water year. Applicant's Preferred Alternative

Under the Applicant's PA, several of the non-federally maintained canals are showing an increase in sedimentation over time due to operation of the Project. For the Wilkinson Canal, sedimentation will increase each decade during the project study period. The Alternative Myrtle Grove Access channel will also experience increases in sedimentation over the study period as a result of the Applicant's PA. The Hermitage Bayou would also experience some sedimentation but impacts are expected to be negligible.

The sedimentation of channels into and near the Myrtle Grove area are expected to have long-term, moderate, adverse impacts on vessels using the marina and the canals, if no mitigation efforts are taken to maintain channel depths.. While the sedimentation is not expected to affect

smaller recreational boats as they can operate in depths as shallow as two feet in depth, some fishing vessels may be unable to operate in water under three feet in depth. As a result, there is likely to be an increase in maintenance dredging requirements in some parts of the channels and around other marine infrastructure which experience sedimentation.

To understand the potential magnitude of dredging costs that may be required to mitigate increases in canal sedimentation under the project alternatives, a semi-quantitative assessment was conducted using the results of the channel depth analysis to provide an illustrative example of the potential costs. Because of the uncertainties associated with the Delft and GIS modeling results and the number of variables needed to estimate costs of dredging, a range of costs were estimated to dredge only the Wilkinson Canal. The cost ranges shown in Table 3-41 represents a one-time cost in each decade and does not account for the frequency that dredging would need to occur in order to keep these lengths of the channel at the three-foot depth. A summary of the cost analysis is summarized in Appendix C.

Table 3-41. Estimated Dredging Costs for the Wilkinson Canal (0-2 foot depth bin)

Decade	Change Length of Canal in 0-2 Feet Depth Bin (APP-NAA) (meters)	Original Depth (feet)	Dredging Depth (feet)	Dredging Needs (cubic yards)[a]	Range of Estimated Dredging Costs[b] [b]
(1)	(2)	(3)	(4)	(5)	(6)
2020-2029	500	0	3	43,121	$86,000 to $345,000
2040-2049	1,100	0	3	94,866	$190.000 to $750,000
2060-2069	1,000	0	3	86,242	$60,000 to $230,000

[a] Assumes Wilkinson Channel is 240 feet wide based on GIS analysis.
[b] Estimated with a unit dredging cost of $4 cubic yard (Joffrion, 2019).
[c] Range of costs based on error bounds of -50% to +100%

Bayou Dupont is also showing a reduction in depths over the study period as a result of the Applicant's PA. Impacts to boaters and recreators from the sedimentation of the Bayou Dupont are expected to be long-term, minor and adverse. Because the bayou is located in an area of significant land building sedimentation is expected to occur that will force boaters to use alternative waterways to access the Barataria Basin which may increase time and travel costs for some trips.

The Applicant's PA is expected to have minor, adverse, long-term impacts to non-federally maintained canals and channels. Operation of the diversion will lead to an increase in sedimentation in channels and canals near the diversion that are important to both recreation boaters and commercial fishers. These waterways will see an increase in costs of dredging to maintain the channels at depths acceptable to most vessels. If depths are not maintained, access to the channels may be restricted for some boats. Sedimentation is also expected to increase under the Applicant's PA in the three oil and gas canals evaluated. This is likely to add to dredging requirements for canals with active oil and gas operations in the area of land building

resulting from the Project. However, the infilling of abandoned oil and gas canals and maintaining cover on active pipelines or flowlines are generally accepted as benefits of the Project to the oil and gas industry.

Other Alternatives

Impacts of the other alternatives on the non-federally maintained channels and oil and gas canals were also evaluated using the same approach as with the Applicant's PA. The modeling shows that the 50,000 cfs Alternative would also result in sedimentation to three of the four non-federally maintained channels evaluated with no additional sedimentation in Hermitage Bayou. In general the amount of sedimentation under the 50,000 cfs Alternatives is less than what is expected under the Applicant's PA. Changes in sedimentation in the oil and gas canals would be similar or slightly less than what is predicted under the Applicant's PA. The 50,000 cfs Alternative is expected to have minor, adverse, long-term impacts on the non-federally maintained channels and oil and gas canals. For the 150,000 cfs Alternatives, the modeling shows an increase in sedimentation over the study period to all the non-federally maintained channels) and oil and gas canals and the level of sedimentation would be slightly higher than what is predicted under the Applicant's PA. This alternative is expected to have long-term, moderate, adverse impacts on the channels and canals. While small boat traffic is not expected to be affected in the channels accessing Myrtle Grove, larger fishing vessels may not be able to access canals if water depths are less than three feet and may require additional maintenance dredging of certain parts of the channels and canals, or other marine infrastructure as a result of the increases in sedimentation. For boats that utilize Bayou Dupont, alternative waterway or canals could be utilized to access the Barataria Bay to avoid areas where the canal is experiencing increases in sedimentation.

3.7. Population and Migration

3.7.1 Area of Potential Impacts

The area of potential impacts to population and migration attributed to the proposed diversion is within the vicinity of the diversion complex and the outfall area and within the lower Mississippi River.

3.7.2 Construction Impacts

No Action Alternative

Under the NAA, the Project would not be constructed. Population levels and migration patterns in areas in the vicinity of the diversion and outfall area and within the lower Mississippi River would continue to follow current levels and trends under the NAA during the construction period.

Applicant's Preferred Alternative

The construction of the diversion under the Applicant's PA is expected to have negligible impact on populations and migration. While the construction activities may cause temporary, adverse impacts on a small number of residents and businesses, these impacts are not expected to lead to changes in population levels or migration patterns. Also, the construction of the Project is expected to require a workforce of approximately 1,600 individuals over the three to five-year

construction period. Some of these workers (skilled and specialized) are likely to originate outside of the Project Area. This temporary increase in the workforce is expected to have negligible impact on population and migration as workers would be expected to temporarily relocate to the larger New Orleans MSA region.

Other Alternatives

Similar to the Applicant's PA, the construction of the 50,000 cfs and 150,000 cfs alternatives are expected to have negligible impacts on population and migration. While temporary, adverse impacts are expected to occur to a small number of residents and businesses due to the construction of the Project, these impacts are not expected to result in changes in population levels or change migration patterns in the area.

3.7.3 Operational Impacts

No Action Alternative

Coastal Louisiana has experienced many episodes of economic and population growth and contraction over the past few centuries (Hemmerling, 2017). Although residents along the coast have been drawn to coastal areas to harvest marine, estuarine, and wetland resources in the past half century, in general, they have moved northward in the face of resource challenges and depletion, and coastal hazards (Hemmerling, 2017). In general, the coastal regions have experienced very low growth or declines in populations between 1950 and 2010; while the urban areas of New Orleans, Baton Rouge, and Lafayette have grown (Colten, 2017, cited in Hemmerling, 2017). For example, between 2000 and 2017, Plaquemines and Jefferson parishes lost 12.5% and 4.0% residents, respectively. This decline in population is largely attributable to Hurricane Katrina.

Access to employment and livelihood opportunities has been shown to influence and drive population changes and regional migration patterns. The loss of business and employment opportunities in certain communities are an important driver of population outmigration. With business displacement and repeated vehicle damage from inundation and flooding; and in anticipation of future storm risks, zoning changes, and/or land loss, many residents have engaged in self-regulatory behavior, migrating inland, away from the coast (Austin et al., 2014a).

To remain in natural resource jobs in coastal areas, some people have moved inland to live and commute either seasonally or daily to their jobs in coastal areas. Many who work in Plaquemines, Terrebonne, or Lafourche parishes live north within the parish or outside the parish (The Data Center, 2014). However, socioeconomic status can affect the ability of people to access and commute to employment opportunities, with relatively lower-income residents not able to afford to move and commute to coastal jobs. They are also less likely to have insurance and other resources to rebuild following an event.

Low-lying Louisiana communities are affected by flooding that comes from weather fronts and high tides many times a year, impacting roads, homes, and businesses. These events are expected to increase under the NAA as the coast degrades and sea levels rise. Under the NAA, outmigration population trends will continue in coastal areas in Louisiana, as people move inland from low-lying areas. This trend will likely be influenced by FEMA's updates to the digital flood insurance rate maps, which may change the zonal designation and require costly flood insurance (Austin et al., 2014a). While it is expected that the trend will be toward outmigration, flood

insurance costs may encourage some individuals to stay in their homes. However home owners insurance and car insurance are increasing. For those who own their homes outright and do not have a requirement of having flood insurance, difficulties may arise when these individuals try to sell their homes because new buyers will need to obtain insurance if a mortgage is required. Other people will move northward and inland, but commute to their jobs adjacent to the Barataria estuary in natural resource businesses and supporting industries. Any storm event or other coastal hazard would intensify these trends.

Some residents may be inclined to stay in place and those that do stay are likely to be engaged in local resource-based economies – mainly shrimp, oyster, and crab fisheries (Colten et al., 2018). In addition to livelihoods, home investments and the availability of flood insurance impose an additional anchoring influence. Federally built levees in several parishes now provide protection from storm surge; and within those lines of defense, homeowners can purchase federally subsidized flood insurance, prompting some people to remain in the coastal region. In addition, households will be increasingly strapped economically by increased insurance costs.

Applicant's Preferred Alternative

The Applicant's PA is expected to have minor, adverse impacts on population and migration patterns in areas affected by the operation of the diversion. In particular, diversion operations are expected to increase the frequency and duration of tidal flooding in communities that are located outside of the flood protection (Water Institute, 2019). For areas such as Myrtle Grove and Grand Bayou, increases in tidal flooding is expected to occur in the near and medium term. However, these areas and others will experience more frequent flooding in the long-term primarily from relative sea level rise and land subsidence. Diversion operations in the near and medium-term may lead to a reduction in the number of individuals that live and work in these communities, though the population of these communities is small relative to the parish and the overall Project Area resulting in minor, adverse impacts to population and migration in these areas.

Other Alternatives

The 50,000 cfs and 150,000 cfs alternatives are also expected to have minor, adverse impacts on population and migration in the Project Area. The 50,000 cfs alternative would have impacts less than those predicted under the Applicant's PA as the changes in tidal flooding are expected to be lower under this alternative. For the 150,000 cfs Alternative, the impacts from increases in tidal flooding are expected to be slightly higher than the Applicant's PA and thus impacts to population and migration are also expected to be slightly higher than predicted under the Applicant's PA.

3.8. Land Use and Property Values

3.8.1 Area of Potential Impacts

During construction, the majority of impacts on land use and property values would occur in the immediate vicinity of the Project construction footprint, generally within one-half mile. During operations, the area of potential land use and property value impacts would extend throughout the Barataria Basin and the birdfoot delta due to gradual changes in land mass.

3.8.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the proposed Project would not occur. The existing land use and property values would be similar to existing conditions described in Chapter 3, Section 3.16 of the DEIS in the short-run.

Applicant's Preferred Alternative

Construction of the Project would result in a permanent, moderate, adverse impact to land use and property values in areas in and near the Project footprint. Construction is expected to impact approximately 1,034 acres of uplands, wetlands, and open water in Jefferson and Plaquemines Parishes (see Table 4.16-1 and Figure 4.2-1 in the DEIS), with the majority of impacts occurring in uplands (see Section 4.2, Table 4.2.1 for Project component acreages in the DEIS). The upland portion of the construction footprint would impact a mix of agricultural, forested, developed, and open land. This includes a loss in cultivated crops (314 acres) pasture/hay (17 acres) and grasslands (8-acres). While land currently in agricultural production will be purchased from private land owners for construction of the Project, there will still be a reduction in economic activity with the loss of agricultural production in the regional area.

For the purposes of applying a value to the loss in agricultural production it is assumed that the loss of these cultivated crops and pasture/hay is all hay production. According to the US National Agricultural Statistics Service, hay yields in the state of Louisiana were 2.2 tons/acre in the year 2018 and commanded a price of $102 per ton in the same year (NASS, 2019). After adjusting this price for inflation to 2019$ it is estimated that a loss of 331 acres of cultivated crops and pasture/hay producing hay would result in the annual reduction of $75,785. This value represents less than one percent of all agricultural revenues in Plaquemines Parish as of the last Agricultural Census taken in 2017, after adjusting for inflation. This adverse impact is expected to be minor given the small amount of acreage that will be affected.

Direct impacts would occur on lands where active construction occurs, as well as any exclusion areas established by the installation of safety fencing. Temporary, minor impacts could also occur on adjacent lands, including nearby residences and businesses, from construction noise and dust; disturbance or removal of lawns, trees, landscaped shrubs, or similar vegetation; and the relocation of existing infrastructure within the Project Area. Construction of the Project is not expected to change land use or property values in the outfall area or birdfoot delta.

Other Alternatives

The 50,000 cfs and 150,000 cfs Alternatives are expected to have similar moderate, adverse impacts on land use and property values in the area within and adjacent to the Project footprint. Because the other alternatives will have a similar construction footprint to the Applicant's PA, the other alternatives are expected to have similar land use and property value impacts during the construction phase.

3.8.3 Operational Impacts

No Action Alternative

Under the NAA, land use and property values are expected to be directly and indirectly affected by a number of factors in local areas. Continued increases in water levels and land subsidence

(see discussion in Section 3.1) will directly affect the ability of owners to use land parcels for their intended purposes, which will in turn affect these properties' values. In many cases, land uses will be limited and values will decline. It is also expected that the demand for residential and business properties will decline in southern areas of the Barataria Basin as the population migrates north and inland as a result of land loss, and increases in storm surge and inundation.

Applicant's Preferred Alternative

The operation of the Project under the Applicant's PA is expected to have permanent, moderate, adverse impacts on land use and property values. For areas within the Project footprint, land uses will be permanently altered once the Project is built including some areas that are zoned for industrial and commercial development, agricultural uses and borrow pits used to build levees and other water management structures in the area. In addition, operation of the Project is expected to increase the frequency and duration of tidal flooding in communities outside of the flood projection in and near the outfall area. This increase in tidal flooding may increase the number of residences, fishing camps, or businesses that cannot be accessed. These temporary, more frequent occurrences in flooding may lead to a reduction in property values over time. As a result, operation of the Project is expected to have permanent, minor, adverse impacts on land uses and property values in the outfall area.

Additionally, as noted under construction impacts above, the construction of the Project will also result in the permanent loss of agricultural lands. This loss accounts for less than one percent of all agricultural revenues received in the parish as of the 2017 Agricultural Census; therefore, this adverse impact is expected to be minor given the small amount of acreage that will be affected over the long term.

Other Alternatives

Operation of the other alternatives are expected to have similar impacts on land use and property values as the Applicant's PA. The exception is the impacts to property values in communities outside of the flood protection. The 50,000 cfs Alternatives would have a slightly smaller impact on property values due to the lower occurrence of tidal flooding caused by this alternative compared to the Applicant's Preferred Alternative. The 150,000 cfs Alternatives would have a slightly greater impact on property values with a higher occurrence of tidal flooding expected under this alternative than predicted under the Applicant's PA.

3.9. Property Tax Revenue

3.9.1 Area of Potential Impacts

Construction and operation of the Project has the potential to impact property tax revenues to both local jurisdictions. Additionally, during construction of the Project, sales and use taxes to the state and local government jurisdictions may be affected. Section 3.12 Economic Impacts of Design, Engineering, Planning and Construction of MBSD describes the economic impacts and tax implications of the Project in more detail. Construction and operation of the Project will also affect property taxes to local jurisdictions primarily Plaquemines and Jefferson parishes.

3.9.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the Project would not occur and there would be no impacts from the Project to tax revenues, sales and use taxes and property taxes in areas near the diversion site would be expected to be similar to current levels during the construction period.

Applicant's Preferred Alternative

Construction of the Applicant's PA is expected to have a minor, beneficial impacts on sales and use tax revenues to both the State of Louisiana and local jurisdictions. Section 3.12 Economic Impacts of Design, Engineering, Planning and Construction of MBSD describes the economic impacts of the Project. In addition, to these economic benefits of the Project, tax revenues are expected to increase with the purchase of some materials and increased spending from construction and professional service personnel traveling to the area during the construction period.

There are 12 assessor's parcel numbers assigned to properties that are fully or partially located within the construction area of the Project. In 2020, these parcel numbers had a reported assessed land value was $10.9 million (2020$) with a property tax receipts of approximately $611,000 (2020$) (Plaquemines Parish, 2020). Multiple properties can be included under the same assessor's parcel number, and may not be located contiguous one-another. For this analysis, it was assumed that only those portions of properties that fall within the project footprint would be acquired and have an impact on property tax revenues.[80] If only portions of the properties that lie within the diversion are purchased then property tax impacts may be as low as approximately $54,000 (2020$).

In addition to the diversion, the Project will also require temporary use of areas as construction laydown areas. It is expected that land within this construction laydown area would only be temporarily used during the construction of the Project. For these properties, the applicant would acquire a temporary use right (lease or other temporary servitude) and pay the owner an agreed/appraised sum for the right to use the property during the construction period. Because these agreements would not require a change in ownership, no change in property taxes are expected.

As shown in

Table 2-8, total property tax receipts for Plaquemines Parish were $65 million in 2018. The quantifiable tax impacts from construction of the Project and removal of taxable land from the parish represent less than half of a percent of all property tax receipts taken in by the parish in 2018, after adjusting for inflation. Therefore, the Project is expected to have minor, adverse impacts on property tax receipts with a change in land use and property values within the Project footprint area. The Project is also expected to have minor, long-term, adverse impacts on property tax receipts with a change in land use and property values within the outfall area.

[80] Note that some of the assessor's parcel numbers include non-continuous parcels that are located outside of the project footprint. It was assumed that these parcels would not be affected by the project and were thus not included in the property tax calculation.

Other Alternatives

The other alternatives are also expected to have minor, beneficial impacts on sales and use taxes and minor, adverse impacts to property taxes receipts. The 50,000 cfs Alternative would likely have a smaller beneficial impact on sales and use taxes than the Applicant's PA due to the smaller expenses on materials and a shorter construction period. This alternative would have a minor, adverse impact on property taxes though the impact is expected to be less than the Applicant's PA. The 150,000 cfs Alternative would have a minor, beneficial impact on sales and use taxes though this impact would be larger than what is expected under the Applicant's PA due to higher levels of spending on materials and a longer construction period. Impacts to property taxes are also expected to be minor adverse under the 150,000 cfs Alternative though these impacts are expected to be slightly higher than what is predicted under the Applicant's PA.

3.9.3 Operational Impacts

No Action Alternative

Decreases in population and outmigration/relocation and changes in land use and housing due to increases in land loss, storm surge, and inundation are expected to have a negative impact on the property base in many areas of the Barataria Basin. As a result, tax revenues, especially those tied to property and business activities, are expected to continue to decline over the study period. This is especially true for communities and parishes in the southern parts of the Project Area.

Applicant's Preferred Alternative

Operation of the diversion under the Applicant's PA is expected to have minor, adverse and long-term impact on property tax receipts during the study period. Reductions in property taxes are expected with changes in land use within the Project footprint. In addition, if the Project causes increased tidal flooding then it is possible that affected properties could have lower property values over time. As a result property tax revenues generated from affected properties are likely to fall over time. The number of properties expected to be affected by the Project are small relative the number of taxable properties within each of the two parishes, and reductions in overall property taxes are expected to be negligible.

Additionally, there may be indirect impacts to local property tax receipts as a result of the deposition of sediment in Wilkinson Canal which serves privates residences. If the Wilkinson Canal is impacted by sediment deposition such that waterway access and usability of the canal is impacted, as described in section 3.5.3, the ability of the private residences located at the north end of this canal to access the bay and gulf from their properties may be reduced. This may result in future lower assessed property valuation of these residences resulting in a lower property tax assessment, and subsequent reduction in property tax receipts by the parish.

Other Alternatives

Operations under the two other alternatives are expected to have minor, adverse impacts on property taxes. Under the 50,000 cfs Alternative, property tax receipts are expected to decline for properties within the Project footprint with a change in land use. In addition, tidal flooding impacts are expected to adversely impact property values for some communities outside of the flood protection. Property tax receipts from these properties are also expected to decline over the study period but those impacts are expected to be slightly lower than the Applicant's PA. The

150,000 cfs Alternative is expected to have slightly higher, minor, adverse and long-term impacts on property tax revenues over the study period than under the Applicant's PA.

3.10. Public Services

3.10.1 Area of Potential Impacts

The proposed diversion could potentially impact the delivery of public services if the Project were to affect tax revenues to jurisdictions where the Project is located. Thus, the area for potential impacts for public services is defined as Plaquemines and Jefferson parishes.

3.10.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the Project would not occur and there would be no impacts from the Project on public services. It is expected that the demand for public services in the two parishes would be similar to existing conditions in the short-term. In addition, tax revenues during the construction period will remain at similar levels and not impact the ability of parishes and other local governmental entities to provide certain public services (e.g., schools).

Applicant's Preferred Alternative

Construction of the Project under the Applicant's PA is expected to have minor, adverse impacts on property tax receipts. This will likely result in minor, adverse impacts to the delivery of some public services in Plaquemines parishes.

Other Alternatives

Construction of the other alternatives are also expected to have minor, adverse impacts on public services in the short-term. These impacts can be tied to a reduction in property taxes derived from properties within the Project footprint. The 50,000 cfs Alternative are expected to have slightly smaller impacts on public services than the Applicant's PA while the 150,000 Alternative would have a slighter larger adverse impact.

3.10.3 Operational Impacts

No Action Alternative

Decreases in population and outmigration/relocation under the NAA in some parts of the two parishes are likely to affect the demand for public services in certain parts of the Project Area. Simultaneously, declines in tax revenue will impact the ability of parishes and local governments to provide certain public services (e.g., schools). Current trends of closures and decreases in services in schools, health care facilities, emergency response, libraries, and post offices are expected to continue under the NAA.

Applicant's Preferred Alternative

Operation of the Project under the Applicant's PA is expected to have minor, adverse, long-term impacts on public service delivery in Plaquemines Parish. These impacts would occur with a permanent reduction in property taxes expected to occur as a result of the Project affecting the ability of parishes and local governments to provide public services to their residents.

Other Alternatives

Operation of the Project under the other alternatives is also expected to have minor, adverse and long-term impacts on public services as a result of a permanent reduction in property tax revenues. The 50,000 cfs Alternative would have a slightly smaller adverse impact than the Applicant's PA while the 150,000 cfs Alternative would have a slightly bigger adverse impact.

3.11. Environmental Justice

3.11.1 Area of Potential Impacts

The construction and operation of the Project has the potential to impact EJ populations that live and work in the vicinity of the Project footprint and the outfall area. In addition, operation of the Project has the potential to impact important commercial fisheries that are a source of employment and income for some EJ populations. Subsistence activities may also be impacted with operation of the Project. The impact area tied to commercial fishery and subsistence fishing is the Barataria Basin.

3.11.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the Project would not occur and there would be no impacts from the Project on EJ populations. Environmental justice populations would continue to be affected by and potentially adapt to changes in environmental conditions under the NAA in the short-term, which are very challenging.

Applicant's Preferred Alternative

Construction of the Project under the Applicant's PA is expected to have minor, temporary adverse impacts on EJ populations that live, work and fish near the diversion footprint. Communities such as Ironton that are located within 0.5 miles of the proposed diversion will experience minor, temporary adverse impacts due to increased noise levels, dust, and transportation delays during the approximate three to five-year construction period. Increases in respiratory illness or episodes of asthma are also common impacts. Close proximity to noise can also have adverse effects.

Individuals that access the Barataria Basin using channels located near the diversion site for subsistence fishing activities may also experience minor, temporary, adverse impacts. Increased traffic on some channels such as Bayou Dupont, to transport equipment and materials to construct the diversion may cause impacts to subsistence fishers and recreators using the same channels to access the basin.

Other Alternatives

The other alternatives are also expected to have minor, temporary, adverse impacts on EJ populations during the construction period to individuals that live, work and fish near the diversion footprint. Adverse impacts associated with construction of the Project are expected to be similar in intensity to the Applicant's PA but for a shorter duration under the 50,000 cfs alternative due to the shorter construction period. The 150,000 cfs Alternative is also expected to

have impacts of similar intensity to the Applicant's PA but for a longer duration due to the longer construction period.

3.11.3 Operational Impacts

No Action Alternative

Under the NAA, low-income and minority populations would be adapting to the same environmental changes that would be affecting other populations throughout the Project Area, including land loss, storm surge, and increases in inundation. In addition, low income and minority populations will be affected by declines in natural resource industries that are also affected by changes in environmental conditions such as declining activity in commercial fishing. Impacts to low-income and minority groups may be more pronounced than those experienced by other populations. For example, under the NAA, environmental change and coastal land loss may have a differential impact on migration depending on the community and its residents. In coastal Louisiana, socially vulnerable families are potentially caught in a situation where they lack the resources to evacuate or find housing, and cannot afford to pay higher flood insurance rates as well as homeowners and automobile insurance. Elderly residents and others tied to their traditional lands and lifeways are resisting migration while younger residents have been migrating northward and inland for decades (Colten et al., 2018). Selective out-migration of younger adults leaves an older, poorer, and more vulnerable population behind, but also provides a supplementary source of income and social links to inland locales (Colten et al., 2018). For example, younger family members that have moved inland often provide monetary support to their elderly family members and offer alternative living space when needed.

In addition, because many low income and minority populations are dependent on fishing as a source of income and for subsistence activities, these populations will be highly affected by changes in fisheries expected over time under the NAA. Although in the short-term under the NAA, commercial fisheries and the supporting economic activities would continue to persist in communities adjacent to and within the estuary; in the long-term, the loss of land and increases in salinity will cause many of these fisheries to begin to decline (Lindstedt, 2005), which will impact individuals and communities dependent on these resources.

Applicant's Preferred Alternative

Operation of the Project under the Applicant's PA is expected to impact low income and minority populations in three ways: changes in frequency and duration of tidal flooding, changes in the frequency and intensity of storm surge, and changes in commercial and subsistence fishing. Table 3-42 below provides a summary of impacts to communities identified to have low income and minority populations within the area of potential impacts.

Section 3.1 discusses the impacts of Project operations on coastal land loss. Operations under the Applicant's PA is expected to increase land building in the Basin which will have beneficial impacts especially in areas near the diversion. This includes benefits to some minority and low-income populations living in these areas.

Section 3.2 discusses the impacts of Project operations on the frequency and duration of tidal flooding. Operation of the Project under the Applicant's PA is expected to increase the occurrence and subsequent impacts associated with periodic tidal flooding in the near and mid-

term in some communities located outside of the flood protection. All of these communities are known to have low income and minority populations (e.g. Grand Bayou). Many of these communities, which are typically small and located in unincorporated areas, have implemented measures to reduce damages from frequent inundation (e.g. elevating structures). However, increases in impacts associated with tidal flooding may include damage to infrastructure such as roads, water supply, and waste water systems that have not been further protected. These impacts may require an accelerated investment in the infrastructure needed to maintain the functionality of residences and businesses in areas affected by the flooding.

Increases in frequency and intensity of tidal flooding associated with the Applicant's PA is expected to have adverse impacts to some environmental justice populations in the short-term though these impacts are not expected to be disproportionately high because many areas and populations have in the past adapted to the frequency and impacts of tidal flooding events. However, there may be a number of low income or minority residents in the impacted areas outside of flood protection that could experience disproportionate high adverse impacts in the future due to unique vulnerabilities such as inadequate housing or infrastructure and a lack of resources to make investments to improve resiliency, a reduction in social capital (e.g. family and community support networks), and inability or resources to relocate to other areas. This includes populations living in and near communities such as Myrtle Grove, Wood Park, Suzie Bayou, Hermitage, Happy Jack and Grand Bayou (See Figure 2-5).[81] Tidal flooding impacts associated with the Project are not expected to occur to areas south and west of Grand Bayou. In the long-term, impacts associated with increases in periodic, tidal flooding tied to the Project are expected to be minor to environmental justice populations because most impacts will be a result of RSLR.

Impacts from changes in storm surge and inundation are described in Section 3.3. Modeling results show that while operation of the Project is expected to result in a reduction in storm surge in areas north of the diversion, areas to the south of the diversion will experience an increase in storm surge during storm events (See Public Health and Safety Section of DEIS). Without the Project, storm surge is anticipated to increase between 2.7 and 4.7 feet from the diversion outfall to the south. The additional surge generated by the Applicant's PA is up to 1.7 feet after 50 years immediately adjacent to the diversion outfall. This includes populations living in and near communities such as Myrtle Grove, Wood Park, Suzie Bayou, Hermitage, Happy Jack and Grand Bayou (See Figure 2-5). Specifically, increases of up to 0.7 feet in 20 years and up to 1.7 feet in 50 years are projected in Myrtle Grove. By comparison, these increases decrease to 0.2-0.3 feet in 20 years and 0.4-0.5 in 50 years further to the south near Grand Bayou. Storm surge impacts are not expected to occur to areas south and west of Grand Bayou. Also, while storm surge is anticipated to increase, the Applicant's PA is projected to cause a reduction in wave heights in those areas affected by increased storm surge. For example, wave heights are expected to decrease by 0.8 feet in 20 years and 0.9 feet in 50 years in and near Myrtle Grove. As storm surge increases diminish further south of the diversion, benefits in the form of reduced wave heights also diminish.

[81] Note that all of these communities are too small to be a Census Designated Place so the data used to determine low income and minority populations is for a larger area (census block) than the actual community boundary.

While storm surge impacts are expected to occur to all residents living south of the diversion, some low income and minority populations may experience a disproportionate adverse impact from the Applicant's PA These impacts are expected to be disproportionately adverse because of unique vulnerabilities of minority and low-income populations such as a lack the resources to adapt to increases in storm surge events that may be amplified with operation of the Project. However, many of these communities have adapted to tidal flooding and storm surge impacts in these areas in the past. These impacts from tidal flooding and storm surge are not expected to be high, however, because the vast majority of change in storm surge and wave heights projected over the analysis period will occur irrespective of the diversion (i.e., occur under the No Action Alternative) and are offset by corresponding decreases in wave height and are offset by corresponding decreases in wave height. As a result, the Applicant's PA is expected to have disproportionate adverse impacts in the long-term to some low income and minority populations in areas south of the diversion.

Impacts to Commercial and Subsistence Fishing

Commercial and subsistence fishing activities will be affected in various ways by the operation of the Applicant's PA. For example, species such as brown shrimp and eastern oysters are expected to experience a decrease in abundance due to reductions in salinity relative to the NAA. This decline in abundance may lead to major, adverse, short-term and long-term impacts to the brown shrimp and oyster fisheries, especially in subbasins of the Barataria Basin closest to the diversion (subbasins 209, 210, and 211).

Communities located in these subbasins of the Barataria Basin have shown to be relatively dependent on brown shrimp and oysters. Within the Project Area, zip codes that have ahigh dependence on brown shrimp include 70358 (Grand Isle) and 70354 (Galliano) (see Section 3.4.5). Among areas closer to the diversion that may experience more acute impacts, zip code 70067 (Lafitte, Jean Lafitte and Barataria), which is located just east of the diversion, showed brown shrimp made up 37 percent of landing value in 2018 (see Figure 3-9). Zip code 70083 (which include the communities of Port Sulphur, Empire, Ironton, Myrtle Grove, and Grand Bayou) also showed a reliance on brown shrimp with nearly 20 percent of landing value attributable to this species. These zip codes also include low income and minority populations. However, there is no known data available that correlates brown shrimp landings to low income or minority populations in any specific communities.

Because oysters are sensitive to low salinity levels, there is the potential for major, adverse, short-term to long-term impacts to the commercial fishery for oysters, up to and including the complete loss of a commercial fishery for oysters in Barataria Basin. Within the Project Area, zip codes that have a high dependence on oysters include 70037 (Belle Chasse, Live Oak), 70082 (Port Sulphur, Pointe à la Hache, and Bohemia) and 70083 (Port Sulphur, Empire, Ironton, Myrtle Grove, and Grand Bayou). However, there is no known data available that correlates brown shrimp landings to low income or minority populations in any specific communities. These areas encompass many of the low income and minority populations in Plaquemines Parish and the potential loss of the commercial fishery for oysters may pose particular challenges for this area. There is no known data available that correlates oyster landings to low income or minority populations in these specific communities.

Other species are expected to benefit from the Applicant's PA. For instance, the Aquatics Analysis concluded the abundance of blue crab, gulf menhaden, saltwater finfish (except for

seatrout) and the freshwater finfish are expected to increase relative to the NAA over the long-term.

Low income and minority populations dependent on commercial fishing are expected to have both adverse and beneficial impacts depending on how certain species are affected. For those individuals that depend on brown shrimp and oysters in sub-basins expected to be impacted by the Applicant's PA, impacts are expected to be short-term and long-term, adverse and major. For others that fish outside of the impacted sub-basins and do not rely on brown shrimp and oysters, the impacts are expected to be negligible. This includes much of the areas of Lafourche Parish and parts of Jefferson and Plaquemines parishes.

Declines in the abundance of brown shrimp may affect low income and minority populations in communities such as Grand Isle and Galliano where over 40 percent of catch is attributable to this species. Because of a lack of data correlating the fisheries harvest to low income or minority communities, households or individuals, however, the extent to which the impact on the fishery will translate to an impact on low income and minority populations cannot be determined. Adverse impacts may also occur to low-income and minority populations in communities in southern Plaquemines Parish such as Empire, Port Sulphur, Venice and Buras. While these areas are not as reliant on brown shrimp, they have very high levels of engagement and reliance on commercial fishing as an economic activity (See Section 3.4.5 and Table 3-14). Reductions in the abundance of oysters is also expected to adversely affect low-income and minority populations most acutely in Belle Chasse, Live Oak, Port Sulphur, Pointe a la Hache, Bohemia, and Ironton.

Adverse impacts to low-income and minority populations will vary depending on the species and circumstances of individual fishers. For those that are dependent on brown shrimp and oysters, the impacts are expected to be more acute. For others that do not depend on these species or that can adapt to changing environmental conditions caused by the Project by substituting to other areas (e.g. Terrebonne Basin, off shore) or other species the impacts of the diversion are minor However, substitution that requires traveling long- distances or expensive equipment changes come with additional costs that may be challenging for some low income and minority fishers. In addition to economic barriers, low income and minority populations may be less likely to adapt to changing environmental conditions because switching to other industries due to age, educational or training background, cultural or language barriers is difficult. Also, these populations may be less likely or able to relocate to other geographic areas for alternative employment opportunities due to economic or cultural reasons. As a result, this is likely to represent a disproportionate high adverse impact on those low income and minority fishers that are unable to adapt to changing environmental conditions that may be caused by the Applicant's PA that negatively impact certain species important to their livelihoods.

It is also expected that the Applicant's PA will have disproportionate, high adverse impacts on low income and minority populations that depend on brown shrimp and oysters from the Barataria Basin for subsistence fishing.

Table 3-42. Summary of Potential Impacts to Communities that include Low Income and Minority Populations from Applicant's PA

Parish	Community	Areas with Low Income and Minority Populations Potentially Impacted by the Applicant's PA			
		Tidal Flooding Impacts	Storm Surge and Inundation	Commercial Fishing	Subsistence Fishing
Plaquemines Parish (35% minority; 19% living below poverty level)	Belle Chasse CDP			X	X
	Live Oak			X	X
	Ironton			X	X
	Myrtle Grove	X	X	X	X
	Grand Bayou	X	X	X	X
	Port Sulphur CDP			X	X
	Empire CDP			X	X
	Buras CDP			X	X
	Triumph CDP				
	Boothville CDP				
	Venice CDP			X	X
	Braithwaite				
	Scarsdale				
	Woodlawn				
	Wills Point				
	Phoenix				
	Davant				
	Pointe à la Hache CDP			X	X
	Bohemia			X	X
Jefferson Parish (47% minority; 16% living below poverty level)	Estelle CDP				
	Woodmere CDP				
	Harvey CDP				
	Timberlane CDP				
	Crown Point				
	Jean Lafitte (town), CDP			X	X
	Barataria CDP			X	X
	Lafitte CDP			X	X
	Grand Isle CDP			X	X
Lafourche Parish (23% minority; 16% living below poverty level)	Thibodaux City CDP				
	St. Charles				
	Raceland CDP				
	Des Allemands CDP				
	Gheens				
	Mathews CDP				
	Lockport CDP				
	Larose CDP				
	Cut Off CDP				
	Galliano CDP			X	X

Parish	Community	Areas with Low Income and Minority Populations Potentially Impacted by the Applicant's PA			
		Tidal Flooding Impacts	Storm Surge and Inundation	Commercial Fishing	Subsistence Fishing
	Golden Meadow CDP				
	Leeville				
	Port Fourchon*				

Other Alternatives

Operation of the other alternatives are also expected to result in disproportionate, adverse impacts to some low income and minority populations due to increases in periodic tidal flooding. Increases in storm surge are also expected with the other alternatives that could result in disproportionate adverse impacts to some low income and minority populations located south of the diversion site. The other alternatives are also expected to impact commercial and subsistence fishing which can have disproportionate, high adverse impacts on individuals that are dependent on certain species for their livelihood. These impacts are expected to be somewhat less under the 50,000 cfs Alternative than under the Applicant's PA and somewhat larger under the 150,000 cfs Alternative.

3.12. Community Cohesion

3.12.1 Area of Potential Impacts

The area of potential impacts to community cohesion will be the same as population and migration, and include areas within the vicinity of the diversion complex and the outfall area and the area within the lower Mississippi River.

3.12.2 Construction Impacts

No Action Alternative

Under the NAA, construction of the Project would not occur and there would be no impacts from the Project on community cohesion. Community cohesion in areas in the vicinity of the diversion and outfall area and within the lower Mississippi River would be similar during construction to existing conditions under the NAA.

Applicant's Preferred Alternative

The construction of the diversion under the Applicant's PA is expected to have a negligible impact on community cohesion. While construction activities may cause temporary, adverse impacts on a small number of residents and businesses (in the form of land acquisition, noise, dust and traffic), these impacts are not expected to lead to changes in population levels or migration patterns or community cohesion within the affected communities.

Other Alternatives

The construction of the diversion under the other alternatives is also expected to have negligible impacts on community cohesion. While construction activities may cause temporary, adverse impacts on a small number of residents and businesses, these impacts are not expected to lead to

changes in population levels, migration patterns, or community cohesion within the affected communities.

3.12.3 Operational Impacts

No Action Alternative

The Louisiana coast has over 1.4 million acres of coastal wetlands that provide significant natural resources and unprecedented biodiversity. As such, the individuals that have built communities, raised their families, and earned a living along the coast of Louisiana have a deep connection to place, interwoven with and dependent on the rich natural resources (Gramling and Hagelman, 2005). Over the time, rural populations living in coastal areas have adapted to various occupations, including fisheries, recreation, agriculture, and coastal/offshore oil and gas activities. Communities grew southward as individuals were attracted to these industries. Growth has periodically been modified or halted with the occurrence of large storm events, which can change the configuration of future development patterns. As already discussed, outmigration and population declines in some parts of the Barataria Basin are expected to continue as a result of land loss, and increases in storm surge and inundation from storms. For these areas, community cohesion is also expected to decline under the NAA as individuals and families are dispersed to different areas within and outside of coastal Louisiana.

Applicant's Preferred Alternative

Operation of the Applicant's PA is expected to have minor, long-term adverse impacts on community cohesion during the study period. The Project is expected to have minor, adverse impacts on populations in some communities outside of the flood protection. While these communities are small and dispersed, the Project may result in minor, adverse impacts to community cohesion if individuals relocate due to Project impacts.

Other Alternatives

The other alternatives are also expected to have negligible impacts on community cohesion. While minor adverse impacts are possible under the other alternatives to population, these impacts are expected to occur in small, dispersed communities and are not expected to cause disruptions in community cohesion.

3.13. Economic Impacts of Design and Construction of MBSD

Abt Associates used IMPLAN® to estimate the regional economic impact of the design and construction of the alternatives. The methodology used to estimate the economic impacts associated with the Project are described in Appendix D. Cost estimates for each alternative were derived from the Preparation of Engineering and Design Basis of Design Report, Appendix F, Construction Cost Estimates, prepared by AECOM Technical Services for the Louisiana Coastal Protection and Restoration Authority (October 2018), as inputs to the IMPLAN® model. Specifically, the Basis of Design (BOD) Class 3 Cost Estimates, 15% Design, were used from Appendix F (starting on p. 118 of the document) for the Applicant's PA. The cost estimates for the other alternatives (50,000 cfs and 150,000 cfs diversion structures), were obtained from the AECOM Cost Memorandums (AECOM Design Team, April 2019 and November 2018). Alternatives that include terrace features add an additional $1.3 million to the project costs. All project cost estimates used in this evaluation are reported in 2018 dollars. The construction cost

estimates used in the evaluation do not include any escalation costs as reported in the BOD. In addition, construction costs associated with feature options (e.g., T-wall intake option) for each alternative were not included in the analysis. Table 3-43 summarizes the construction cost estimates used in the evaluation.

Table 3-43. Construction Costs of Alternatives (BOD 15%, 2018$)

Alternative Feature	Applicant's Preferred Alternative 75,000 cfs	50,000 cfs Alternative	150,000 cfs Alternative
Open cut U-frame intake	$245,010,743	$220,793,767	$327,000,145
Gated diversion structure	$61,031,245	$52,442,842	$101,816,911
Transitions and wingwalls	$53,244,418	$51,499,881	$60,403,944
Railroad bridge	$44,388,923	$42,540,056	$48,100,502
Highway 23 roadway and bridge	$53,249,158	$50,243,558	$60,542,158
Channel and levee	$258,752,377	$266,594,979	$412,575,376
Interior drainage	$28,073,199	$26,746,290	$33,391,151
Secondary site features	$4,574,804	$4,574,804	$4,574,804
Utility relocations	$32,955,000	$32,684,600	$41,784,600
Temporary construction features	$30,215,510	$30,215,510	$30,215,510
Beneficial use material	$997,500	$973,665	$1,947,330
Allowance for flood of cofferdam during construction	$2,000,000	$1,500,000	$4,000,000
Mobilization and demobilization	$24,434,786	$23,424,299	$33,790,573
Insurance	$8,473,169	$8,042,343	$11,601,430
Performance bond	$8,473,169	$8,122,766	$11,717,444
Total (not including escalation costs)	**$855,790,108**	**$820,399,360**	**$1,183,461,878**

Sources: Basis of Design 15%, Appendix F, Construction Cost Estimates, p. 118; AECOM Cost Estimate Memoranda (2018, 2019).

The impact analysis also included costs associated with the design of the Project ($118.5 million) and other engineering, planning, and permitting support provided by CPRA ($119 million).

This section describes the results of the economic impact analysis, including both the design and construction phases of the Project.

Design, Engineering, Planning, and Permitting

Economic benefits associated with the design, project management, and permitting of the project would be the same for all alternatives. The vast majority of these benefits would occur over a three- to five-year period. Because IMPLAN® is an annual model, all the engineering and design expenditures were run through IMPLAN® as if occurring in a one-year period. Table 3-44 summarizes the total impacts of these costs over all years (top half of Table 3-44). Over $256 million in economic output would be supported by the engineering and design expenditures across all years. These total impacts were then averaged to get an understanding of annual impacts that would occur during the design phase (shown in the lower half of **Table 3-44**). If the design phase were to last over a four-year period, 430 jobs would be supported on average; with an average annual labor income, gross regional product, and sales of $30.2 million, $36.4 million, and $64.04 million, respectively.

Table 3-44. Economic Benefits of the Design Phase for Each Alternative (2018$)

Impact Type	Employment	Labor Income	Gross Regional Product	Economic Output (sales)
Total Economic Impacts for All Engineering and Design Costs				
Direct effect	758	$76,763,000	$73,135,000	$130,276,000
Indirect effect	392	$20,676,000	$28,929,000	$49,587,000
Induced effect	569	$23,375,000	$43,718,000	$76,272,000
Total effect	1,720	$120,814,000	$145,782,000	$256,135,000
Average Annual Impacts over a Four-Year Time Period				
Direct effect	190	$19,191,000	$18,284,000	$32,569,000
Indirect effect	98	$5,169,000	$7,232,000	$12,397,000
Induced effect	142	$5,844,000	$10,930,000	$19,068,000
Total effect	430	$30,204,000	$36,446,000	$64,034,000

Notes: Employment includes full-time and part-time jobs. IMPLAN® is an annual model; in the first part of the table, all engineering and design costs were run in IMPLAN® through one year.

Construction Impacts

No Action Alternative

Under the NAA the Project would not be constructed. The economic benefits that would occur as a result of the Project would not materialize.

Applicant's Preferred Alternative

The construction of the Project is anticipated to occur over a three- to five-year period. Because IMPLAN® is an annual model, all the construction expenditures were run through IMPLAN® as if occurring in a one-year period. Table 3-45 summarizes the total economic impacts for all construction expenditures, as well as the average annual impacts if construction were to occur over a four-year period. A total of $1.2 billion in economic output or sales would be supported by the construction expenditures across all years. During the 5-year period, 2,000 jobs would be supported, with an average annual labor income, gross regional product, and sales of $103.8 million, $141.1 million, and $236.2 million, respectively. On average over a 5-year period, there would be a temporary construction workforce of approximately 1,300 workers (direct effect).[82]

82. The employment estimate is an average annual number and represents the number of workers that would be working onsite throughout the entire year. We estimated annual employment impacts as those associated with total construction costs averaged across a four-year construction period.

Table 3-45. Economic Benefits from Construction – Applicant's Preferred Alternative (2018$)

Impact Type	Employment	Labor Income	Gross Regional Product	Economic Output (sales)
Economic Impacts for all Construction Expenditures				
Direct effect	6,500	$365,641,000	$430,734,000	$683,676,000
Indirect effect	1,000	$52,181,000	$95,235,000	$183,438,000
Induced effect	2,400	$96,085,000	$179,691,000	$313,817,000
Total effect	9,900	$513,907,000	$705,661,000	$1,180,931,000
Average Annual Impacts over a Five-Year Time Period				
Direct effect	1,300	$73,128,000	$86,147,000	$136,735,000
Indirect effect	200	$10,436,000	$19,047,000	$36,688,000
Induced effect	500	$19,217,000	$35,938,000	$62,763,000
Total effect	2,000	$102,781,000	$141,132,000	$236,186,000

Notes:
Totals may not sum due to rounding.
Employment includes full-time and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® through one year; therefore, the employment column represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, commercial and industrial machinery, and equipment rental and leasing.

Other Alternatives

75,000 cfs Diversion Structure with Terraces

The economic impact of constructing the marsh terraces would support approximately 8 direct and a total of 12 jobs. Total labor income, gross regional production, and economic output (sales) for this construction activity would support $649,000, $996,000, and $1.7 million, respectively. These economic impacts would be in addition to those described under Applicant's PA.

50,000 cfs Diversion Structure

Table 3-46 summarizes the total economic impacts for all construction expenditures, as well as the average annual impacts if construction were to occur over a four-year period. During the 5-year period, an average of 1,900 jobs would be supported, with an average annual labor income, gross regional product, and sales of $99.7 million, $137.8 million, and $229.3 million, respectively. On average over a 5-year period, there would be a construction workforce of approximately 1,300 workers (direct effect). A total of $1.1 billion in economic output or sales would be supported by the construction expenditures across all years.

Table 3-46. Economic Benefits from Construction – 50,000 cfs Alternative (2018$)

Impact Type	Employment	Labor Income	Gross Regional Product	Economic Output (sales)
Economic Impacts for All Construction Expenditures				
Direct effect	6,300	$352,099,000	$418,673,000	$655,625,000
Indirect effect	900	$50,130,000	$91,445,000	$176,085,000
Induced effect	2,300	$92,553,000	$173,085,000	$302,283,000
Total effect	9,500	$494,782,000	$683,203,000	$1,133,994,000
Average Annual Impacts over a Five-Year Time Period				
Direct effect	1,300	$70,866,000	$84,324,000	$132,556,000
Indirect effect	200	$10,142,000	$18,499,000	$35,689,000
Induced effect	500	$18,712,000	$34,994,000	$61,060,000
Total effect	1,900	$99,720,000	$137,817,000	$229,304,000

Notes: Totals may not sum due to rounding.
Employment includes full-time and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® through one year; therefore, the employment column represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, and commercial and industrial machinery, and equipment rental and leasing.

50,000 cfs Diversion Structure with Terraces

The construction economic benefits for the marsh terraces would be the same as those described under Applicant's PA with terraces alternative. These economic impacts would be in addition to those described under the 50,000 cfs Alternative.

150,000 cfs Diversion Structure

Table 3-47 summarizes the total economic impact for all construction expenditures, as well as the average annual impacts if construction were to occur over a four-year period. A total of $1.6 billion in economic output or sales would be supported by construction expenditures across all years under 150,000 cfs Alternative. During the 5-year period, 2,700 jobs would be upported, with an average annual labor income, gross regional product, and sales of $142.3 million, $196.1 million, and $322.4 million, respectively. On average over a 4-year period, there would be a construction workforce of approximately 1,800 workers (direct effect).

Table 3-47. Economic Benefits from Construction – 150,000 cfs Alternative (2018$)

Impact Type	Employment	Labor Income	Gross Regional Product	Economic output (sales)
Economic Impacts for All Construction Expenditures				
Direct effect	9,200	$508,608,000	$604,652,000	$933,784,000
Indirect effect	1,300	$69,855,000	$127,160,000	$244,068,000
Induced effect	3,300	$132,865,000	$248,472,000	$433,949,000
Total effect	13,800	$711,328,000	$980,283,000	$1,611,801,000
Average Annual Impacts over a Five-Year Time Period				
Direct effect	1,800	$101,722,000	$120,930,000	$186,757,000
Indirect effect	300	$13,971,000	$25,432,000	$48,814,000
Induced effect	700	$26,573,000	$49,694,000	$86,790,000
Total effect	2,700	$142,266,000	$196,057,000	$322,360,000

Notes:
Totals may not sum due to rounding.
Employment includes full-time and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® through one year; therefore, the employment represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, and commercial and industrial machinery, and equipment rental and leasing.

150,000 cfs Diversion Structure with Terraces

The construction economic benefits for the marsh terraces would be the same as those described under the Applicant's PA with terraces. These economic impacts would be in addition to those described under 150,000 cfs Alternative.

3.14. Synthesis of Socioeconomic Impacts

This section provides a synthesis of the socioeconomic impacts that are expected to occur as result of each of the alternatives.

No Action Alternative

Low-lying Louisiana communities are affected by flooding that comes from weather fronts and high tides many times a year, impacting roads, homes, and businesses. These events are expected to increase under the NAA as the land subsides and sea levels rise. Under the NAA, outmigration population trends will continue in coastal areas in Louisiana, as people move inland from low-lying areas. Commercial fisheries will continue to be a valuable economic activity for the region in the short-term but will start to decline in the mid to long term with a decline in environmental conditions. Populations in communities in coastal areas will continue to decline as individuals move inland to avoid increasing implications of declining environmental conditions.

Applicant's Preferred Alternative

Operation of the Applicant's PA is expected to result in major, beneficial direct and indirect impacts on land building in the Barataria Basin. The Project would introduce significant volumes of sediment into the Barataria Basin, and much of that sediment is expected to be retained, with an expected net addition of 53 million cy of sediment retained in the outfall area by 2030 and 310 million cy by 2070. These additions are projected to result in the net creation of 4,830 acres (7.5 square miles) of land by 2030, and 13,300 acres (20.8 square miles) by 2050 (see Table 4.2-4 in DEIS). Increasing land building in the outfall area under the Applicant's PA is expected to have major beneficial socioeconomic impacts. Areas were sediment would be deposited and largely maintained would provide protection to some areas within the New Orleans MSA, which is one of the more densely populated and heavily built areas in coastal Louisiana. Barnes and Virgets (2017), estimated that a future without action could result in economic damages from coastal land loss of $1.7 billion in infrastructure replacement costs and another $1.7 billion in business disruptions for the New Orleans region. While the Project would not be able to completely reduce expected damages likely to occur in the New Orleans region with coastal land loss and storm surge, the benefits provided are likely to be major and beneficial.

Under the Applicant's PA additional land building resulting from the diversion will increase protection against storm surge in areas north of the diversion site. Reducing storm surge with the operation of the diversion will generate significant benefits in terms of avoided damages, lost economic productivity and decreases in morbidity and mortality rates associated with large storm events. However, the Applicant's Preferred Alternative will also increase storm surge impacts to areas south of the diversion (by up to 0.6 feet in 2040 and 1.7 feet in 2070).

In addition, operation of the Applicant's PA is predicted to have immediate, adverse impacts on some communities located outside of the flood protection. Communities such as Myrtle Grove are expected to experience an increase in tidal flooding in the short-term when the diversion is operating. Some of the communities are known to have environmental justice populations (e.g. Grand Bayou). While many of these communities and unincorporated areas have implemented measures to reduce damages from inundation (e.g. elevating structures), increases in tidal flooding can damage infrastructure such as roads, water supply, and waste water systems. There may also be a disruption in economic activity as a result of additional periodic, tidal flooding caused by the Project. This may result in a need to accelerate investment in infrastructure needed to maintain the functionality of residences, businesses and recreational properties.

The commercial fishing industry is expected to be impacted by decreases in landings of brown shrimp, oysters, and seatrout. Those individuals and businesses dependent on these species are expected to experience moderate near and long-term adverse impacts. Other commercial operations may experience minor short and long-term beneficial impacts as species they are dependent on will increase in abundance under the Applicant's PA. Across the industry, some substitution across species and areas is expected to offset a portion of these impacts. However, these types of substitutions typically require additional expenditures further limiting the value of such adjustments. The potential for major adverse impacts to those landing brown shrimp and oysters will lead to broader economic impacts for nearby communities because of the value of these important species to the industry.

The impact the Applicant's PA has on recreation and general shoreline use demand has potential to be generally positive relative to the NAA. These estimates of changes in recreation serve as a

direct input into expected changes in tourism spending. Since the relative magnitudes of trips by recreation type do not change dramatically, it is assumed that spending patterns per user similarly remain unchanged. Thus, as trips for boating and general shoreline use increase relative to the NAA, so do expenditures associated with that recreational use. These expenditures provide significant contributions to the local economy. Thus, across all recreational activity types, the scale of potential impacts of the Applicant's PA on recreation and tourism is expected to be positive relative to the NAA.

Low income and minority populations dependent on commercial fishing are expected to have both adverse and beneficial impacts depending on how certain species are affected. For those individuals that depend on brown shrimp and oysters that originate in sub-basins closest to the diversion, impacts are expected to be short-term and long-term, adverse and moderate. Some individual fishers may be able to adjust but moving to other areas and switching to other species that are not negatively impacted by the diversion. However, substitution that requires traveling great distances or equipment changes may challenging for low income and minority fishers. It is also expected that subsistence fishing for brown shrimp and oysters will also be adversely impacted with larger impacts to those populations that depend on these species.

Construction of the Project is expected to generate economic benefits to the state of Louisiana and local communities. The construction of the Project is anticipated to occur over a three- to five-year period. A total of $1.2 billion in economic output or sales would be supported by the construction expenditures across all years. During the construction period, 2,500 jobs would be supported, with an average annual labor income, gross regional product, and sales of $128.8 million, $176.8 million, and $296.0 million, respectively. On average there would be a construction workforce of approximately 1,625 workers.

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Appendix A: Literature Review

The project team reviewed relevant studies and research associated with coastal Louisiana to help inform the environmental justice (EJ) impact analysis for the Mid-Barataria Sediment Diversion (MBSD) project. These studies included:

- Impacts of other projects on natural resource activities and uses;
- Research on important determinants of subsistence hunting, fishing, and consumption;
- Characteristics of EJ populations in coastal Louisiana;
- Issues and concerns of EJ populations regarding diversion projects;
- Traditional ecological knowledge (TEK); and
- Other topics relevant to the analysis.

Table A.1 summarizes the literature that has been reviewed to date, the issues or topics covered, and the relevance for the EJ analysis. Section A.1 provides a detailed description of each relevant study.

Table A.1. Literature review summary and relevance for EJ analysis

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Austin et al., 2014a	Offshore Oil and *Deepwater Horizon*: Social Effects on Gulf Coast Communities, Volume I: Methodology, Timeline, Context and Communities	Provides timeline of events affecting coastal Louisiana parishes; community descriptions of Lafourche and Plaquemines parishes; descriptions of race and ethnicity, social networks, and specific minority groups.	Context for Lafourche and Plaquemines communities; cumulative impact analysis; anecdotal information for evaluation.
Austin et al., 2014b	Offshore Oil and *Deepwater Horizon*: Social Effects on Gulf Coast Communities, Volume II: Key Economic Sectors, NGOs, and Ethnic Groups	Reviews five economic sectors in coastal Louisiana – offshore oil and gas, commercial fisheries, tourism, shipbuilding and repair, and retail.	Commercial fishing and recreation/tourism context; cumulative impact analysis; community descriptions; anecdotal information for evaluation.
Bailey et al., 2014	Complexities of Resilience: Adaptation and Change within Human Communities of Coastal Louisiana	Describes how residents of coastal Louisiana are in the process of adapting to changing conditions and identifies four different approaches that might be taken by coastal residents in the future, including staying in place with major structural, spatial, or physical community changes; taking adaptation, mitigation, and non-structural actions; commuting for harvesters and seasonal use of the coast; and relocating.	Specific examples of communities mitigating increasing flooding and storm risks; describes context for communities.

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Bethel et al., 2011	Blending Geospatial Technology and Traditional Ecological Knowledge to Enhance Restoration Decision-Support Processes in Coastal Louisiana	Provides mapping products showing TEK; worked with residents of Grand Bayou and Native Americans of the Atakapa Tribe; perspectives on historical land loss [Note: study was updated in 2014 (see Bethel et al., 2014)].	Context and community information on Grand Bayou residents; local perspectives on land loss.
Bethel et al., 2014	Sci-TEK: A GIS-Based Multidisciplinary Method of Incorporating Traditional Ecological Knowledge into Louisiana's Coastal Restoration Decision-Making Processes.	Provides local ecosystem and restoration knowledge, perspectives, and priorities in geographic information system (GIS) format; TEK from experts and fishers/trappers/hunters in Plaquemines and Jefferson parishes in Barataria Basin.	Perspectives on restoration actions by communities; describes local priorities and locations for restoration actions.
Brown and Toth, 2001	Natural Resource Access and Interracial Associations: Black and White Subsistence Fishing in the Mississippi Delta	Describes local fishers fishing five tributaries of the Mississippi River in the Yazoo River basin; differences and similarities between Black and White fishers; subsistence activities.	Description of subsistence fishing activity, disaggregated by community type.
Burley et al., 2007	Place Attachment and Environmental Change in Coastal Louisiana	Describes coastal Louisiana's communities' perspectives on wetland loss, and restoration planning and process; attitudes regarding sense of place, displacement, and loss of culture; communities of Grand Isle, Dulac, Chauvin, and Cocodrie interviewed in 2002 and 2003; causes of land loss and saltwater intrusion.	Context and community information; attitudes and perspectives regarding restoration planning (including communities' alienation from the process), land loss, and sense of place.
Coalition to Restore Coastal Louisiana, 2017	Shrimping with Diversions: Understanding the Resilience of Southeast Louisiana Shrimpers in Response to Large-Scale Ecological Restoration Projects	Fifty shrimpers of varying socioeconomic backgrounds shared their knowledge of operating a business as a shrimper in a series of facilitated discussions; participants from five fishing communities across Plaquemines, St. Bernard, and Jefferson parishes. Report describes shrimpers' concerns about ecological impacts of sediment diversions on shrimp, sociological impacts to their quality of life, economic impacts to their businesses, potential ways they could adapt, and mechanisms influencing their ability to do so.	Describes potential impacts to shrimpers from the diversion.

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Colburn et al., 2016	Indicators of Climate Change and Social Vulnerability in Fishing Dependent Communities along the Eastern and Gulf Coasts of the United States	Developed and described a set of social indicators for fishing community vulnerability and resilience; used National Oceanic and Atmospheric Administration (NOAA) Fisheries Community Social Vulnerability Indicators; coastal Louisiana communities were not assessed (data not available at time of study).	Use approach to define fishing community engagement, reliance, and resiliency.
Colten, 2014	Scenario Building Workshops	Workshops conducted with informed community members to evaluate projects for the master plan for a sustainable coast in 2014; futures with various actions/plan scenarios with cascading effects were elicited; one of the groups in St. Bernard-Plaquemines parish focused on the MBSD project on effects of lower salinity levels. Separate assessments presented for Terrebonne-LaFourche and St. Bernard-Plaquemines parishes.	Descriptions of effects of and perspectives on the MBSD project.
Colten, 2015	A Place for Humans in Louisiana Coastal Restoration	Describes need for human-centered component of restoration planning; historical context of environmental policy, Mississippi River projects, and state's restoration approach and the associated impacts to residents and natural resource economies.	Description of perspectives on restoration plan and actions; general context and background.
Colten, 2017	Environmental Management in Coastal Louisiana: A Historical Review	Describes coastal Louisiana resiliency practices (social networks, mobility, ingenuity); and concerns about sediment diversions and impact on shrimp and oyster fisher folks.	Description of community/fisherman resilience and adaptations; perspectives on restoration actions and impacts.
Colten et al., 2012	Community Resilience and Oil Spills in Coastal Louisiana	Addresses resiliency, especially "inherent community resiliency," in terms of four aspects – anticipation, reduced vulnerability, response, and recovery; contingency planning for oil spills fails to recognize and foster inherent community resiliency (economic and geographic mobility, social networks, economic relief programs of unemployment, and law suits).	Describe resiliency in coastal communities.
Colten et al., 2015	Oil Spills and Community Resilience: Uneven Impacts and Protection in Historical Perspective	Describes resilient activities for coastal communities in the aftermath of disruptive events; three key traditional resilient capacities of social networks, mobility, and ingenuity; oil spills and freshwater diversions have longer-term impacts to natural resources and more psychological stress than do hurricanes; fishing as a "immovable" industry.	Descriptions of how communities will address or respond to environmental change; populations that are both vulnerable and resilient.

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Colten et al., 2018	Social Justice and Mobility in Coastal Louisiana	Describes effects of coastal land lost on marginalized populations; geographic and economic mobility is key to community resilience; regional and local migration (mostly by younger residents) and impacts on populations that stay behind; natural resource livelihoods, home investments, and flood insurance incentivize staying in place; vulnerable populations remain in coastal communities.	Descriptions of how communities will address or respond to environmental change, with emphasis on out-migration; populations that are both vulnerable and resilient.
Deseran and Riden, 2000	Louisiana Oysterman… Surviving in a Troubled Fishery	Describes oyster fishery in Louisiana, including demographics, the nature of operations, and fishers' beliefs and perceptions about oystering.	Description of oyster fishery.
Gramling and Hagelman, 2005	A Working Coast: People of the Louisiana Wetlands	Describes overview of coastal communities in Louisiana, ethnic groups, and relationship to coastal environment; inter-play of fishing and oil and gas occupations; commercial fishing species and the prevalence of shrimping and crabbing due to minimal required investments.	Description of shrimping industries and reliance on multiple sources of employment.
Hemmerling, 2017	A Louisiana Coastal Atlas: Resources, Economies, and Demographics	Provides maps illustrating coastal Louisiana in terms of the changing population, demographics, and industries over the years and currently. Maps showing land loss, fisheries landings and values, minority and poverty populations, closures in post offices, and other topics are included.	Demographic information; showing context of the impacts facing coastal Louisiana communities.
Hemmerling and Colten, 2004	Environmental Justice Considerations in Lafourche Parish, Louisiana: Final Report	Provides characterization of offshore oil and gas extraction, transport, and processing activities and hazards on low-income and minority populations in Lafourche Parish; uses a hazards of place model that shows disproportionate impacts occurring, notably in the southern part of the parish, with impacts to wildlife habitats affecting the Houma Indian populations.	Cumulative impacts; descriptions of EJ and vulnerable communities and associated natural resource-based activities in Lafourche Parish.
Impact Assessment, Inc., 2005	Identifying Communities Associated with the Fishing Industry in Louisiana: Final Report	Report provides information on coastal parishes and communities, including Lafourche, Livingston, Orleans, Plaquemines, Rapides, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Landry. Parish and community profiles include a history of the area, demographic and economic data from federal sources, fisheries data, industry data, and other information.	Information for community profiles in the affected environment.

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Ingles and McIlvaine-Newsad, 2007	Any Port in a Storm: The Effects of Hurricane Katrina on Two Fishing Communities in Louisiana	Describes hurricane impacts on Empire-Venice (large Vietnamese population) and Grand Isle; economic activities are primarily oil and gas and shrimping, which has been over-capitalized; description of shrimping industry (market prices, fuel costs, competition).	Cumulative impacts; descriptions of industry activities in Empire-Venice and specifically the shrimp industry.
Jepson and Colburn, 2013	Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions	Developed measures of social well-being, sustainability, vulnerability, and resilience for use in social impact assessments (SIAs); data on more than 2,900 coastal communities in 19 states were used to create 14 social vulnerability and fishing dependence indices.	Identify vulnerable EJ populations engaged or reliant on fishing.
Jepson and Jacob, 2007	Social Indicators and Measurements of Vulnerability for Gulf Coast Fishing Communities	Provides vulnerability index for Gulf Coast fishing communities using data on poverty, industrial mix, comparison to national growth, average wage or salary; 67 profiles of fishing communities along coastal Louisiana.	Identify vulnerable EJ populations engaged in fishing.
Laska et al., 2005	At Risk: The Human, Community and Infrastructure Resources of Coastal Louisiana	Describes an SIA associated with no action and a series of projects to restore the barrier islands; includes a description of human elements and activities in the Barataria/Terrebonne Estuary System (BTES).	Perspectives on social impacts of coastal land loss and restoration actions.
Lewis and Ernstson, 2017	Contesting the Coast: Ecosystems as Infrastructure in the Mississippi River Delta	Describes historical context for water infrastructure in the New Orleans area, including political tensions and opposition to river diversions; main concerns with diversions; winners and losers for diversions; positive and adverse impacts of the Caernarnon diversion on oyster productivity; lessons to address socioecological cleavages.	Perspectives and effects of diversions on communities; background context.
Lindstedt, 2005	Renewable Resources at Stake: Barataria-Terrebonne Estuarine System in Southeast Louisiana	Describes status and future of coastal BTES indicators, including species, land loss, water quality, and business patterns; and how many fish and wildlife will decline in the estuary with decreasing marsh habitat, notably oysters, menhaden, and shrimp, among others.	Benefits of freshwater and marsh creation on fish and wildlife; general information.
Lowlander Center, 2017	Building the Resilience of Small Coastal Businesses	Provides profiles of communities, including three relevant communities of Golden Meadow/Leeville, Jean Lafitte, and Lower Plaquemines; includes Census demographic and economic data as well as mitigation and risk-reduction strategies and projects undertaken by communities.	Demographic information and prevalence of fishery business for specific communities.

Article citation	Article title	Issues or topics covered	Relevance for EJ analysis
Marks, 2012	The Political Economy of Household Commodity Production in the Louisiana Shrimp Fishery	Describes market impacts to the Louisiana shrimping industry and nature of the shrimp industry (owner-operators are self-funded); fewer younger people are in the industry and household income has been reduced, resulting in need to supplement income with other job opportunities.	Cumulative impacts to Louisiana shrimpers (markets, costs, number of employees).
Martinich et al., 2013	Risks of Sea Level Rise to Disadvantaged Communities in the U.S.	Uses the Social Vulnerability Index (SoVI) to identify geographic areas in the contiguous United States to experience disproportionate impacts of sea level rise (SLR), and to determine if and where socially vulnerable populations would bear disproportionate costs of adaptation. SoVI and SLR output from a coastal property model were used to evaluate threats of inundation and the economic efficiency of adaptation approaches.	Context of vulnerable populations to SLR in the Gulf in Louisiana.
Regis and Walton, 2015	Subsistence in Coastal Louisiana, Volume I: An Exploratory Study.	Describes subsistence activities in Terrebonne and Lafourche parishes regarding hunting and fishing; subsistence activities are connected to family and communities and central to personal, cultural, and regional identity; describes how access can be an issue to private lands and waterways.	Description of subsistence activities.
Tulane Institute on Water Resources Law and Policy, 2014	Community Resettlement Prospects in Southeast Louisiana: A Multidisciplinary Exploration of Legal, Cultural, and Demographic Aspects of Moving Individuals and Communities	Reviews legal mechanisms used by the federal government to relocate individuals and resettle communities; provides a history of community dislocation in southeast Louisiana; and presents a demographic analysis of Louisiana communities facing the highest risk of displacement.	Description of vulnerable populations.
Yen et al., 1995	Determinants of Participation and Consumption: The Case of Crawfish in South Louisiana	Describes and statistically models participation and consumption of crawfish in south Louisiana; significant predictors of consumption include unemployed, not retired, skilled labor, Catholic, and some college education.	Description of subsistence activities and demographics of crawfish producers and consumers.

A.1 Annotated Bibliography

Austin, D., B. Marks, K. McClain, T. McGuire, B. McMahan, V. Phaneuf, P. Prakash, B. Rogers, C. Ware, and J. Whalen, "Offshore Oil and Deepwater Horizon: Social Effects on Gulf Coast Communities, Volume I: Methodology, Timeline, Context and Communities," OCS Study Bureau of Oceanic Energy Management No. 2014-617, 2014a.

This report is based on research done by the Bureau of Applied Research in Anthropology (BARA) at the University of Arizona that began right after the *Deepwater Horizon* (DWH) rig exploded and continued over a 20-month period. BARA developed a research partnership with anthropologists at Louisiana State University and with local institutions, community-based organizations, and independent community researchers. Key local partners included the Katrina Research Center at the University of Southern Mississippi; the United Houma Nation; Bayou Grace Community Services of Chauvin, Louisiana; and the Dulac Community Center of Dulac, Louisiana.

The report is organized in two volumes, which are both reviewed in this appendix (see Austin et al., 2014b, for a review of the second volume. The first volume begins with a summary of major findings of the research. Next is a discussion of the approach and methodology of the study and the selection of the study communities. This is followed by a summary and then a detailed timeline of key events in the unfolding disaster that triggered local effects. The timeline allows the reader to better understand the complicated and rapidly changing conditions under which people in the coastal communities were living and working during the study period. The remaining chapters establish the context within which this disaster occurred, and describe the communities that were the focus of the study, highlighting in each some of the locally specific and synergistic effects of the disaster. Chapters 2 (the spill, response, and cleanup), 3 (the context), 4 (interplay of migration, ethnicity, and social networks along the Gulf Coast), 7 (Point-a-la-Hache, Empire, Port Sulphur, and Plaquemines Parish, Louisiana), and 8 (Larose, Cut Off, and Lafourche Parish) were reviewed because they were most relevant for this project.

Chapter 2 includes a timeline that highlights key events that directly or indirectly caused social effects within the region between April 20, 2010 and April 20, 2012. The events are organized into nine categories: Spill Response & Cleanup, Offshore Drilling Moratorium/Suspension/ Permitting, Public Health, Claims Process/Legal, Commercial Fisheries, Economic Issues, Environmental Restoration, Social Services, and Nongovernmental Organizations.

Chapter 3 includes a description of the context in which the hurricane occurred in the Gulf. Sections within this chapter include oil and gas activities, hurricanes, and DWH and other oil spills. Chapter 4 includes descriptions of race and ethnicity in the region; social networks; and specific minority groups, including Native Americans, Vietnamese and Vietnamese-Americans, and Hispanics. Chapters 7 and 8 provide detailed descriptions about the communities, and hurricane and DWH oil spill impacts on the Point-a-la-Hache, Empire, and Port Sulphur communities in Plaquemines Parish, Louisiana; and the Larose and Cut Off communities in Lafourche Parish, Louisiana, respectively.

Austin, D., S. Dosemagen, B. Marks, T. McGuire, P. Prakash, and B. Rogers, "Offshore Oil and Deepwater Horizon: Social Effects on Gulf Coast Communities, Volume II: Key Economic Sectors, NGOs, and Ethnic Groups," OCS Study Bureau of Oceanic Energy Management No. 2014-618, 2014b.

The report is based on research done by BARA at the University of Arizona that began right after the DWH rig exploded and continued over a 20-month period. BARA developed a research partnership with anthropologists at Louisiana State University and with local institutions, community-based organizations, and independent community researchers. Key local partners included the Katrina Research Center at the University of Southern Mississippi; the United Houma Nation; Bayou Grace Community Services of Chauvin, Louisiana; and the Dulac Community Center of Dulac, Louisiana.

The report is organized in two volumes, which are both reviewed in this appendix (see Austin et al., 2014a, for a review of the first volume). The second volume describes five key economic sectors in the region – offshore oil and gas, fishing, tourism, shipbuilding and fabrication, and retail – and summarizes how the disaster has impacted the people, businesses, and communities involved in each of those sectors.

Bailey, C., R. Gramling, and S.B. Laska, "Complexities of Resilience: Adaptation and Change within Human Communities of Coastal Louisiana," in Perspectives on the Restoration of the Mississippi Delta, J.W. Day et al. (eds.), 2014.

Coastal ecosystems and particularly deltaic coastal ecosystems are among the most productive in the world, and this certainly is true of coastal Louisiana. Residents have a long history of fishing, hunting, cattle raising, and farming, which means that they have drawn on a diversity of natural resources and engaged in a seasonal round of activities that has limited their vulnerability to loss associated with any one activity. Local residents have a storehouse of ecological knowledge based on generations of living with storms but are increasingly facing the need to make decisions about strategic retreat from the coast. Strong emotional ties link people to the land and water of coastal Louisiana as well as to their cultural communities. This study describes how residents of coastal Louisiana are in the process of adapting to changing conditions and identifies four different approaches that might be taken by coastal residents in the future, which include staying in place and making major structural, spatial, or physical community changes; staying in place and taking adaptation, mitigation, and non-structural actions; relocating harvesters inland, resulting in long commutes, and seasonal use of the coast; and relocating. Also included is a description of mitigation measures for Jean Lafitte, Barataria, Crown Point, Delcambre, Ycloskey, Port Fouchon, Grand Isle, Golden Meadow, Cocodrie, and Bayou Dularge.

Bethel, M.B., L.F. Brien, E.J. Danielson, S.B. Laska, J.P. Troutman, W.M. Boshart, M.J. Giardino, and M.A. Phillips, "Blending Geospatial Technology and Traditional Ecological Knowledge to Enhance Restoration Decision-Support Processes in Coastal Louisiana," Journal of Coastal Research 27(3):555–571, 2011.

The goal of this study is to provide coastal resource managers with a decision-support tool that allows for a more comprehensive method of assessing localized ecological changes in the Gulf Coast region. The project team used remote sensing and GIS mapping products with TEK to achieve this goal. This approach was applied with the help of Grand Bayou residents, who self-identified as predominately Native American of the Atakapa Tribe who can trace their ancestry within this region back 200 to 300 years. Grand Bayou residents describe themselves as hunters,

fishers, and trappers; and depend on natural resources of the surrounding ecosystem to sustain their way of life. Researchers combined remote sensing, GIS, and other geospatial technology with TEK knowledge to assess historical land loss in the study area and the evolution of that landscape to its current condition.

Bethel, M.B., L.F. Brien, M.M. Esposito, C.T. Miller, H.S. Buras, S.B. Laska, R. Philippe, K.J. Peterson, and C. Parsons Richards, "Sci-TEK: A GIS-Based Multidisciplinary Method of Incorporating Traditional Ecological Knowledge into Louisiana's Coastal Restoration Decision-Making Processes," Journal of Coastal Research 30(5), September 2014.
An interdisciplinary team of physical and social scientists, coastal restoration managers, and fishers/resource harvesters of affected coastal Louisiana communities collaborated on this study, with the goal of enhancing restoration decision-making by engaging local ecosystem knowledge holders in the process. The study investigated the feasibility and benefits of integrating the TEK of a coastal population with geospatial technology and scientific datasets to assess how the resulting knowledge might inform project planning and implementation for coastal restoration. The primary goal was to provide coastal resource managers with a more comprehensive and transferrable method of assessing localized stakeholder priorities, and translating that information into a format compatible with or comparable to products of existing coastal restoration decision-support tools for Louisiana. This was achieved by using remote sensing, science-based datasets, and GIS to produce mapping products that represent the local fishers' and harvesters' TEK.

The study sought to use the stakeholder engagement process to help address the general lack of understanding by physical scientists and managers/decision-makers of the value of TEK, and to illustrate how this participatory process helps to bridge the communication gap that typically exists between scientists and traditional knowledge holders. This study builds on a previous study by Bethel et al. (2011) – see below – that worked with residents in Grand Bayou by including additional TEK knowledge holders, expanding the area of study, and incorporating spatial multi-criteria decision analysis and an analytic hierarchy process to inform coastal restoration decision-making. Spatial multi-criteria decision analysis is a set of systematic procedures for analyzing complex decision problems. For the Sci-TEK study, these two approaches were used to analyze and delineate relationships between the relevant issues and/or restoration project types and their location factors. The results were then used to build a spatial representation of the TEK experts' project prioritization reasoning.

The study area is located within the Barataria Basin in southeast Louisiana. The researchers and the Coastal Protection and Restoration Authority identified the project's focus issues: ridge restoration, freshwater diversions planning, marsh creation, and freshwater diversion operation. The study then focused on identifying TEK experts within the study area – the communities of Jean Fafitte, Lafitte, and Barataria in Jefferson Parish; and Myrtle Grove, Grand Bayou, Port Sulphur, and Empire in Plaquemines Parish – as well as identifying resource user groups, including shrimpers, oyster farmers, trappers/hunters, and others.

The study results are displayed as maps depicting priorities based on TEK for marsh creation/island restoration and for freshwater introduction. These maps are overlaid with the 2012 master plan projects. In general, there was consensus that the barrier islands represent priority areas based on the assumption that restoration must be implemented first in the outer areas so that marsh areas on the ''inside'' can be better protected. The TEK experts generally

believe that once the barrier islands are restored, restoration of ‘‘inward’’ areas (i.e., the upper Barataria Basin) will be easier. The TEK experts also give priority to areas adjacent to, or relatively near, existing or planned restoration projects, such as levees or ridge restoration, in order to maximize benefits and help protect the investments already made at those locations. In terms of freshwater introduction, the TEK experts believe that areas most preferable for fresh water introduction are those marsh areas where significant land loss has occurred but where remnant marsh can effectively be nourished. These preferable areas include locations near Bayou Dupont and Grand Bayou, and between Bay Sansbois and Adams Bay. Their view is that remnant marsh areas can more effectively contain the introduced fresh water, allowing more sediment to settle out of the water, thereby increasing deposition and counteracting land loss. Areas viewed as not preferable from the stakeholders' perspective include open water bodies and areas where too much freshwater adversely impacts saltwater fisheries.

Brown, R.B. and J.F. Toth Jr., "Natural Resource Access and Interracial Associations: Black and White Subsistence Fishing in the Mississippi Delta," Southern Rural Sociological Association, 17:81–110, 2001.

The study assesses how racial divisions between Black and White fishers factor into access, harvesting strategies, and use of natural resources in subsistence fishing activities in the Mississippi River Delta. When compared to other Black-majority areas in the United States, the delta has fared worse economically, primarily due to low educational attainment. The authors chose the upper Yazoo River basin of the Mississippi Delta for the study site because it contains five major tributaries that can be fished: the Coldwater River, the Little Tallahatchie River, the Tallahatchie River, the Yalobusha River, and the Yocona River. The area is rich in water resources that are used for a variety of fishing activities. The data consist of observations of, and informal and semi-structured interviews with, local fishers in the targeted towns and surrounding areas, and at various fishing sites.

The Black fishers in the delta do not use commercial gear, and therefore are limited in the amount of fish caught and harvested. Whites, on the other hand, because of their traditional access to the rivers and lakes through their commercial gear, can harvest larger fish in larger quantities. Local fishers identified with the tools they used and the type of harvesting the tools allowed. The analysis of subsistence-oriented activities revealed not only the relationship between people and natural resources, but the relationships between groups of people as they interact through natural resources. Both the White and Black subsistence fishers in this study treat fish primarily as a food source. However, fish is also used or considered as food security, social contact, and social status.

Burley, D., P. Jenkins, and S. Laska, "Place Attachment and Environmental Change in Coastal Louisiana," Organization & Environment 20(3):347–366, September, 2007.

This article examines how residents of communities frame environmental change. Specifically, how do Louisiana's coastal community residents understand coastal wetland loss? For this article, the authors relied on 47 in-depth interviews from communities in two coastal parishes (i.e., counties): the communities of Grand Isle, Dulac, Chauvin, and Cocodrie. These communities suffered significant damage but not total annihilation from Hurricanes Katrina and Rita. In the interviews, respondents were given the opportunity to convey meanings they give to land loss through constructing a narrative of place, which revealed a strong degree of place attachment where ideas of fragility and uniqueness are employed to frame the place in which

they live. The authors suggest that the slow onset disaster of coastal land loss forces a constant and heightened awareness of place attachment. Data for this study were collected during 2002 and 2003.

The study used a phenomenological approach that focused on respondents' subjective experiences (Creswell, 1997; Smith, 2004), and narratives about place served as subjective interpretations of place-associated experiences. The authors first used names of residents to contact and interview. The residents then in turn recommended others to contact; this technique is referred to as the snowball sampling process.

Scientists and agencies such as the U.S. Army Corps of Engineers began studying land loss and proposing and implementing small-scale projects. Residents that live within the coastal region for generations feel they have an intimate knowledge of the land and waterways, and largely feel shut out of the restoration process. Further frustrating residents is that restoration has been slow to materialize. Residents believe that scientists "only want to study the problem," and the process has left many of Louisiana's coastal residents feeling alienated, adding to the anxiety they already experience from continued land loss.

Hurricanes Katrina and Rita have further diminished the wetlands. Estimates by the U.S. Geological Survey's National Wetlands Research Center (2006) reveal that "217 square miles of Louisiana's coastal lands were transformed to water after Hurricanes Katrina and Rita." But scientists agree that nearly 70% of coastal land loss is directly or indirectly the result of human action on the ecosystem (Farber, 1996). The Mississippi River was levied off, eliminating seasonal flooding that naturally replenished the sediment deposits that built the Mississippi Delta. Canals dug by oil companies have broken up the wetlands and increased saltwater saturation from the Gulf of Mexico. Furthermore, runoff and pollution from exploration and extraction compound the problem, making oil and gas activity along with the leveeing of the Mississippi River the two major contributors to Louisiana's coastal land loss (Hecht, 1990; American Planning Association, 1997).

Residents, as they have for generations, connect themselves to a place, while remaining aware of the ever-looming possibility of its loss. Potential displacement is more likely as the land disappears; thus, the salience of place is acknowledged more than in less-threatening times. It is through this strong connection that we can understand the skepticism that many heap onto outsiders who would rectify the problem. The region's unique quality is not separate from its fragility. As the land erodes and changes, so do the cultural aspects of place. Residents often do not trust outsiders who they feel make little attempt at including them in restorative processes. Many coastal residents believe that the inaction of government agencies has allowed the enhanced destructiveness of storms, and it is unlikely that they will blindly accept new or additional proposals from agencies they deem untrustworthy and threatening to their place attachment constructs.

Coalition to Restore Coastal Louisiana, "Shrimping with Diversions: Understanding the Resilience of Southeast Louisiana Shrimpers in Response to Large-Scale Ecological Restoration Projects," 2017.

Through a community-based engagement process, 50 concerned shrimpers of varying socioeconomic backgrounds shared their knowledge of operating a business as a shrimper in a series of facilitated discussions. Participants were from five fishing communities across

Plaquemines, St. Bernard, and Jefferson parishes. The resulting synthesis of information in this report provides a description of shrimpers' concerns about the ecological impacts of sediment diversions on shrimp, the sociological impacts to their quality of life, economic impacts to their business, potential ways they could adapt, and mechanisms influencing their ability to do so. These adaptations include catching more shrimp, selling their catch for more money, or finding alternative sources of income. The Coalition to Restore Coastal Louisiana identified why and how shrimpers would adapt and, more importantly, the avenues and obstacles to accomplishing various adaptations. The most alarming finding was that if shrimpers' concerns are realized, there is a segment of the population that will not be able to accomplish adaptation without assistance. This research provides the opportunity to understand where assistance may be needed and creates a compelling argument for developing a plan to help the most vulnerable shrimpers.

The purpose of this work was to gain a better understanding of vulnerability and economic resilience within the southeastern shrimping community. This will help inform strategies developed to aid the shrimping community should impacts to the fishery occur. Furthermore, this report demonstrates a preliminary process framework for understanding community resilience through facilitated discussions of community needs, obstacles, and strategies for adapting to ecological disturbance. The shrimpers had three common concerns: decreases in shrimp abundance, redistribution of shrimp populations to other areas, and a smaller average size of shrimp. The uncertainty of impacts that diversions could have on shrimp populations was commonly mentioned as contributing to the inability to plan for and an increased risk of decision-making. The effects of this problem include either waiting to make investments or making more risky investments, both of which exacerbate the difficulties of adaptation and potentially hinder effectiveness. The uncertainty of diversion impacts also discouraged the succeeding generation of shrimpers from entering the industry. An avenue identified that could help address this obstacle was simply to get more up-to-date and easily accessible information on impacts of sediment diversions to the affected shrimping communities. A notable concern related to this obstacle was that there is a legacy of mistrust of political leaders and appointees who are typically responsible for disseminating this type of information.

Colburn, L.L., M. Jepson, C. Weng, T. Seara, J. Weiss, and J.A. Hare, "Indicators of Climate Change and Social Vulnerability in Fishing Dependent Communities along the Eastern and Gulf Coasts of the United States," Marine Policy 74:323–333, 2016.

NOAA developed a set of social indicators of fishing community vulnerability and resilience to evaluate the impacts of changes in fishery management policies. Building off this initial set of community social vulnerability indicators, NOAA developed additional indicators that will consider climate change vulnerability for communities in U.S. Eastern and Gulf coasts. A full set of indicators has yet to be developed for communities along the Gulf Coasts and in southern Louisiana.

Colton, C., "Scenario Building Workshops," The Water Institute of the Gulf, August 29, 2014.

A series of scenario-building workshops with informed community members were facilitated by the Water Institute of the Gulf to gather information that can be used by decision-makers to evaluate projects included in the Comprehensive Master Plan for a Sustainable Coast. Through the scenario-building process, participants were able to identify a series of cascading events that might occur in the future with and without certain restoration projects. Two workshops, one in Lafourche-Terrebonne and one in Plaquemines-St. Bernard, were held in April 2014. Each

workshop considered a Master Plan project. Participants in the Lafourche-Terrebonne workshop considered the Belle Pass-Golden Meadow Marsh Creation project, and participants in the St. Bernard-Plaquemines workshop considered the MBSD project. The St. Bernard-Plaquemines workgroup identified an initial outcome (lower-salinity levels) of the MBSD that would result in several related outcomes (i.e., saltwater marsh die off, oyster die off).

Colten, C.E., "A Place for Humans in Louisiana Coastal Restoration," Labor & Engenho 9(4):6–18, 2015.

Louisiana faces a serious coastal land loss crisis and has embarked on an ambitious plan to restore its littoral landscape. Yet the very populations that depend on this environmental setting for their traditional livelihoods and that will be immediately impacted will not be able to participate in the planning process as they would like. This article (1) reviews the state's historical approach to environmental policy in order to expose a pattern of neglecting public wishes, (2) traces past efforts to re-engineer the Mississippi River and their impacts to natural resource economies as a source of lingering contention between residents and government officials, (3) relates the recognition of the coastal crisis with ensuing engineering works and litigation that contributed to tensions between citizens and state agencies, and (4) considers how recent planning efforts have neglected natural resource-based economies despite advice to the contrary. Together these related observations offer useful insights for incorporating a long-term, human-centered component into coastal restoration planning.

Colton, C.E., "Environmental Management in Coastal Louisiana: A Historical Review," Journal of Coastal Research 3(33):699–711, May 2017.

This paper reviews the changing management regimes in coastal Louisiana, their impacts on public access to resources once held in common, the adaptations made by families engaged in resource-based economies, the role of public participation in environmental management, and the introduction of new human-environment relationships that have prompted human adaptations. Over the past three centuries, coastal Louisiana has been subject to several dominant environmental management schemes. Three in particular have had long-lasting effects: flood protection, wetland reclamation, and wetland restoration, with wetland reclamation and restoration emerging as the dominant regime over the last several decades. Critics have noted that the current management regime should move beyond the focus on the biotic, geologic, and hydrologic environment; and include provisions for socioeconomic resources as well. Louisiana's coastal residents have demonstrated an array of resilient practices that have enabled them to remain in a place required for adaptation to both natural and human-driven change. Three adaptive mechanisms – social networks, mobility, and ingenuity – are important to helping residents adapt to changes in environmental conditions.

In 2015, the state announced plans to build the Mid-Barataria and Mid-Breton Sediment Diversion projects. At the community level, there is much concern about the size and scale of the diversions and the impacts they will have on oyster leases and shrimp populations. The percentage of individuals involved in resource-based activities has fallen to below 5% in many of the coastal parishes, though there are pockets of fisherfolk in the Plaquemines and Jefferson parishes. Despite extensive environmental change, local residents have adapted to the arrival of 20th century industries by assisting in the exploration of oil and gas in the marshes, by working irregular shifts on offshore rigs, building and piloting crew and supply ships, building the rigs

that populate the Outer Continental Shelf (OCS), and working on the waterfronts and watercraft that operate in the region.

Colten, C.E., J. Hay, and A. Giancarlo, "Community Resilience and Oil Spills in Coastal Louisiana," Ecology and Society 17(3):5, 2012.

This paper employs a comparative historical analysis to examine practices that natural resource-dependent residents deploy to cope with disruptions and that are retained in their collective memory. The analysis classifies activities taken in advance of and following a series of oil spills within Wilbanks' four elements of community resilience: anticipation, reduced vulnerability, response, and recovery. The study examines the relationship between inherent community resilience or locally based capacities to cope with disruption and formalized contingency plans. Inherent resilience includes the ability to pursue natural resources in alternate areas, shift the object of natural resource collection, draw on kin and local social networks to respond to disruptions, and seek economic relief through existing programs such as unemployment compensation and law suits. In contrast, there are formal resilience-directed government and private sector practices (e.g., oil spill contingency plans). The document examines oil spills in the 1970s, the tanker release in 1984, and the DWH oil spill in 2010; and the resilience capacity and measures for each event. The historical analysis shows that a range of inherent resilience capacities have functioned largely in response and recovery elements.

The authors conclude that federal contingency planning since 1990 has expanded the outreach of compensation programs, but the planning has not directly engaged with the core components of inherent resilience described in this article. Because inherent resilience operates at a local level, it is easy for post-event inquiries to neglect these capacities. Furthermore, current contingency planning does little to reveal either the local or personal level of impacts, and fails to recognize or operate through the local networks that can most effectively enhance inherent resilience. The distribution of sums of money through emergency programs redirects local efforts from restoring their own economies toward securing external funds. In effect, this process can contribute to an unraveling of local kin and social networks that have been central to community resilience in the past, and fostering complacency at the local level. The authors suggest that state and federal plans should strive to incorporate local mobility and familial networks in the future in their contingency plans.

Colten, C.E., A.A. Grismore, and J.R.Z. Simms, "Oil Spills and Community Resilience: Uneven Impacts and Protection in Historical Perspective," Geographical Review 105(4):391–407, 2015.

Louisiana's coastal residents have endured centuries of hurricanes and decades of oil spills. Locally based, inherent resilient practices have enabled them to persist in place. This paper documents the evolution of actions taken by Louisiana's coastal residents that constitute effective resilient activities in the aftermath of disruptive events. The article explores the definitions of resiliency. Experience with devastating hurricane events has reinforced three key traditional resilient capacities – social networks, mobility, and ingenuity – which have enabled individuals to either relocate geographically to safer locations or to shift economic activities to ride out the disruption. Ingenuity and inventiveness have provided means to adapt and regroup in the wake of extreme weather.

Oil spills have been a recurring threat to livelihoods in this region since the 1930s; however, they pose a different set of challenges than hurricanes. Oil spills after the 1990s have exposed an inability of communities to adapt to the uncertainties that they produce, particularly in light of

the very different legal climate that frames these events. While housing and economic infrastructure can be destroyed and residents may be forced to find temporary shelter or livelihoods for many months with coastal storms and hurricanes, typically there is less damage to the actual natural resources upon which local economies rely. Oil spills and diversions can present a different type of event, with potentially long-lasting impacts to natural resources. Comparative analyses suggest that technological hazards (e.g., oil spill, sediment diversion) produce more psychological stress than natural events, a concept supported by local attitudes and analyses. In addition, local people in the fishing industry tend to be skeptical of government programs and efforts to protect coastal resources and people. Residents who participate in fishing desire to live close to the water to efficiently pursue their livelihoods and they cannot relocate their operations inland. They are engaged in "immovable industries" (see Burley and others, 2007).

Colten, C.E., J.R.Z Simms, A.A. Grismore, and S.A. Hemmerling. 2018. "Social Justice and Mobility in Coastal Louisiana," Regional Environmental Change 18(2):371–383.

Louisiana faces extensive coastal land loss that threatens the livelihoods of marginalized populations. These groups share two key traits that frame this discussion: dedicated attachments to a perilous place and a heavy reliance on resource-based livelihoods. Their determination to continue traditional practices in their current locations in the face of state efforts to rebuild the coast represents a social justice struggle. Mobility is one of their most-effective resilient practices – either geographic movements or movement among multiple economic pursuits. Local mobility refers to movement within the bounds of the linear communities (i.e., within a distance where daily activities remain within reach of the same stores, schools, churches, traditional jobs, and family connections). Regional migration entails long-term movement out of the linear coastal communities into cities such as Baton Rouge, Lake Charles, or Houston; where an entirely new group of stores, schools, churches, and employment frame daily activity.

Residents most inclined to stay in place are families engaged in local resource-based economies – mainly shrimp, oyster, and crab fisheries. In addition to livelihoods, home investments and the availability of flood insurance impose an additional anchoring influence. Federally built levees in several parishes now provide protection from storm surge, and within those lines of defense, homeowners can purchase federally subsidized flood insurance, prompting some people to remain in the coastal region. Most homes in the coastal zone are mortgaged. These financial commitments may have a dual impact on lower-income borrowers. Not only would low-income homeowners be hard-pressed to find a buyer, they would be less likely to be able to afford a second mortgage or rent farther inland. As a result, mobility as a resilient practice can be undermined.

Facing environmental changes that will include coastal restoration programs, elderly residents are resisting migration while younger residents continue a decades-long inland migration. Interviews with elderly residents in coastal Louisiana in natural-resource industries were conducted with 76 residents. Local mobility has been central to cultural survival and longer-distance mobility is on the rise. In terms of social justice, selective out-migration of younger adults leaves an older, poorer, and more vulnerable population behind; but also provides a supplementary source of income and social links to inland locales. Economic mobility is an important resilience element when threats to livelihoods occur. After more recent oil spills, fishermen worked in different areas to avoid catching tainted shrimp (Colten et al., 2012).

Changing technologies, international competition, and rising fuel prices have also spawned additional adaptations among shrimpers.

Deseran, F.A. and C. Riden, "Louisiana Oystermen….Surviving in a Troubled Fishery," Louisiana Sea Grant College Program, May 2000.

The report summarizes results from a survey of Louisiana commercial oyster harvesters. The purpose of the research was to identify factors that affect decisions to pursue or to abandon oyster harvesting as an occupation or a way of life. Oyster survey recipients were from St. Bernard, Cameron, Houma, Empire, Port Sulphur, and Montegut. About 90% of respondents reported living in the following six parishes (order of highest first): St. Bernard, Plaquemines, Terrebonne, Cameron, Lafourche, and Calcasieu. This report provides demographic characteristics of oyster farmers, including age, ethnicity/race, marital status, income, and education. The report also provides oyster operation characteristics, including vessel age and ownership status, harvesting effort, and participation. The report describes the "personal" commitment to oyster harvesting, working outside of oyster harvesting, community satisfaction and local involvement, and opinions and perceived problems. One finding was that over half of the oyster harvesters had earned income from work other than oyster harvesting in the past 12 months.

The report summarizes that Louisiana's oyster fishing industry is one of the oldest and most well-established fisheries. More oysters are harvested from Louisiana waters than from anywhere else in the United States. Most oyster harvesting in Louisiana has been bottomland leased from the state by individual oystermen, further restricting their flexibility to deal with problems such as changes in water salinity or pollution. In general, most oystermen do not believe that their children should take up the profession. As large operators exit the industry due to retirement or other reasons, the authors state that they would expect that the fleet would become increasingly comprised of smaller, part-time operators.

Gramling, R. and R. Hagelman, "A Working Coast: People of the Louisiana Wetlands," Journal of Coastal Research SI 44:112–133, Spring 2005.

This article provides a summary of the human element of the Louisiana coastal environment, including how people relate to the environment and how various ethnic groups have adapted over time; the human activities that have evolved in coastal Louisiana (e.g., ports, fisheries, oil and gas); and the clusters of communities that are present in coastal wetlands and how those communities differ in their relationships to the coastal environment.

The most important commercial species are shrimp, menhaden, blue crab, and oysters; but yellowfin tuna, red snapper, mullet, and black drum are also part of the mix. Shrimp and blue crabs are the most commonly sought species in coastal Louisiana because they are a common property resource and large investments are not necessary for their harvest. Shrimp and crabs can be taken by anyone with a boat, minimum equipment, a license, and access to public waters. Many individuals who own a small boat buy a commercial license in order to shrimp part-time or only during the inland season. Recreational fishing is primarily focused on speckled trout and red fish, and hunting is primarily for ducks.

The oil industry, being a source of employment for many individuals, has allowed those working in the industry to maintain traditional coastal occupations. Because of offshore work schedules, many coastal workers continue their traditional occupations during their time off, which means

that boats, gear, and knowledge are maintained. The primary Louisiana oil-field ports are Fourchon, Iberia, Morgan City, and Venice; with Fourchon and Venice being almost exclusively offshore supply ports. The linear development along the Mississippi River shows a mix of human activities, from industrial development to fisheries.

Hemmerling, S.A., A Louisiana Coastal Atlas: Resources, Economies, and Demographics (Introduction by C. Colten), Louisiana State University Press, 2017.
The Introduction by Craig Colten provides information on the oil, agricultural, and shrimping industry; as well as a section on "human adaptations in a perilous place." The remainder of the book consists of large maps of coastal Louisiana and small descriptions that illustrate post office closures, post office relocations, poverty, minority percentages, prevalence of children and elderly, pounds and value of fisheries landed by port, oysters landed, population changes, among other topics.

Hemmerling, S.A. and C.E. Colten, "Environmental Justice Considerations in Lafourche Parish, Louisiana: Final Report, OCS Study MMS 2003-038, U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA, 2004.
The study provides a characterization of potential impacts of OCS oil and gas extraction, transport, and processing activities on vulnerable populations in Lafourche Parish, Louisiana, a principal land-based supply center for offshore oil and gas activities in the Gulf of Mexico. Impacts to minority and low-income populations were identified through a GIS exercise that integrated data on OCS-related activities and hazards with demographic data from the census. Five different classes of OCS-related activities were identified a being potentially hazardous to nearby communities, including transportation corridors, oil and natural gas pipelines, petroleum bulk storage facilities, shipyards, and a natural gas processing plant.

The results show many of the OCS facilities have a disproportionate impact on low income or minority populations, especially in southern reaches of the parish with a high percentage of Native American populations near these facilities. The exception is Port Fourchon which is sparsely populated and Thibodaux which is a densely populated urban area with very limited OCS-related activities. The areas with the greatest potential environmental justice impact occurs in the communities living along the levees in the southern portion of Bayou Lafourche. Potential environmental justice impacts are a concern with the impacts to wildlife habitats to the Houma Indian populations who still hunt, fish and trap in the area (wetlands west of Golden Meadow).

Impact Assessment, Inc., Identifying Communities Associated with the Fishing Industry in Louisiana: Final Report, Volume II: Lafourche Parish through St. Landry Parish Communities. Prepared for U.S. Department of Commerce, NOAA fisheries, Southeast Office. December 2005.
This report provides both parish profiles as well as community descriptions for coastal communities for the following parishes: Lafourche, Livingston, Orleans, Plaquemines, Rapides, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Landry. Economic data is provided as well as demographic and housing. Detailed community information is also provided, such as numbers of boats with various types of commercial gear, marinas and boat ramps, landings of fish, fishing license holders, among other. The data is from 2000 to 2003, prior to Hurricane Katrina.

Ingles, Palma and Heather McIlvaine-Newsad. 2007. "Any Port in a Storm: The Effects of Hurricane Katrina on Two Fishing Communities in Louisiana" Annuals of Anthropological Practice" Vol. 28, Issue 1 69-86.

This study evaluated the impacts of Hurricane Katrina on the fishing communities of Empire-Venice and Grand Isle in Louisiana. Baseline data was collected in 2004, including the nature of the fishing industry, for both communities. Data and information collected in 2006, focusing on changes to the fishing industry, individuals, and communities after the hurricane. Both communities were and are still heavily involved with the commercial shrimp fishery industry that has been overcapitalized for years.

Before Hurricane Katrina, the shrimp fishery was the most important fishery in the Gulf of Mexico and an important fishery in the U.S. Shrimp boats in the Gulf range in size to as small as 25 feet to over 90 feet. In general, smaller boats mostly fish in estuaries and bayous of state waters, while larger boats fish offshore in federal waters. The shrimp fishery in the Gulf of Mexico has been in decline since 2001 because of high costs of fuel and equipment and lower prices shrimpers receive at the dock because of competition from low-priced, imported shrimp. Today over 85% of shrimp consumed in the U.S. is imported, and most of that is farm raised.

In Louisiana, most of the fishing infrastructure from Grand Isle east was destroyed by Hurricane Katrina. For Grand Isle, the oil industry and commercial fishing remain the two dominant industries. Most of the commercial fishing boats survived the storm, because they were moved behind the locks or to other locations. The major industries in the Empire-Venice area is also oil and commercial fishing with the shrimp fishery the most valuable, though menhaden, crabs and oysters are also important. Today the majority of fisherman in the Empire-Venice area are of Asian descent. Empire-Venice received more damage from Hurricane Katrina than Grand Isle and many of the boats were uninsured, with 50% to 65% destroyed in the storm, making recovery more difficult than in Grand Isle.

Jepson, Michael and Lisa Colburn, Development of Social Indicators of Fishing Community Vulnerability and Resilience in the U.S. Southeast and Northeast Regions. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/SPO-129, April 2013. 64 pp.

Viable measures of social well-being and sustainability, including measures of vulnerability and resilience, were developed for coastal fishing communities. The authors developed a suite of social indicators for use in fisheries social impact assessments (SIA). We used the Pollnac et al. (2006[2008]) fisheries SIA conceptual model of well-being as an organizing framework for the development of quantitative measures of vulnerability. Data from more than 2,900 coastal communities in 19 states from Maine to Texas were used to create 14 social vulnerability and fishing dependence indices. Each index was developed using a factor analysis of secondary data obtained primarily from government sources, supplemented by a few private sources. Using cluster analysis, a group of 20 communities was developed to evaluate all 14 indices of social vulnerability (Houma and Cameron in Louisiana). We assembled the data for every Census Designated Place (CDP) from a set of predetermined coastal counties along the Eastern and Gulf coasts.

Jepson, Michael and Steve Jacob, "Social Indicators and Measurements of Vulnerability for Gulf Coast Fishing Communities" National Association for the Practice of Anthropology Bulletin 28, pp. 57-68, September 2007.

This article describes the creation of a "vulnerability index" consisting of measures of employment opportunity and community well-being from census and other data sources that was used as part of the social impact discussion. The index provides an indication of which fishing communities might be affected the most by restoration projects (the article focuses on the Essential Fish Habitat (EFH) Amendment for the Gulf of Mexico Fishery Management Council (GMFMC)). Time and monetary constraints have dictated the use of rapid appraisal methods and the collection of secondary data sources to provide indicators of vulnerability in fishing communities. Social scientists within fishery management agencies need to be able to quickly assemble existing data into tools to assist with their analyses. The vulnerability index uses secondary information in this rapid appraisal method.

Early in 2002, the GMFMC contracted with the Marine Resource Assessment Group (MRAG) of Tampa, Florida to develop a generic EFH Amendment and (EIS (GMFMC, 2004). The MRAG subcontracted several components of the Amendment and EIS to scientists and consultants throughout the region. One of those subcontracts was to identify fishing communities within the GMFMC jurisdiction and conduct the social impact assessment for the Amendment (GMFMC, 2004), which was the basis for this article. Given the rather narrow timetable, data collection needed to be limited to secondary data that could be collected through various governmental agencies including, NMFS, the US Census Bureau, and the Bureau of Economic Analysis.

There were 67 community profiles assembled with the census data and various permit data for vessels and dealers for the five states in the Gulf coast region. The combined data provided a time comparison from 1970 to 2000 for the socioeconomic variables. The vulnerability index includes employment opportunities and an indication of community well-being. Specifically, it included three components of a shift share analysis (a comparison to national growth, industrial mix, and competitive shares), the poverty rate, and average wage or salary for a community. These indicators were compared to the indicators for the county in which the community was located, thereby providing some indication of community wellbeing in contrast to the larger regional economy. The shift share analysis, which is an indication of how much regional job growth (or contraction) can be attributed to national trends and how much is due to unique regional factors, was conducted at the county level and covered a two decade period from 1980 to 2000. Each of the five factors was rated between -1 to 1, with a total score range for each community between -5 and 5. From the GIS map of the Gulf in the article, it appears (though difficult to read) that many of the fishing communities in Barataria Basin are in the "very vulnerable" category. Growing coastal populations, increased dependence on tourism and recreational economies, gentrification, and degraded ecosystems have all been noted as having important impacts to fishing communities.

Laska, Shirley, George Wooddell, Ronald Hagelmann, Robert Gramlings, and Monica Teets Farris, "At Risk: The Human, Community and Infrastructure Resources of Coastal Louisiana" Journal of Coastal Research, SI 44, p. 90-111, Spring 2005.

The authors provide information on the social impacts to human activities and communities near coastal restoration projects within the shoreline protection zone (SPZ) in Louisiana. This includes a more detailed discussion of the human activities within the Barataria/Terrebonne

Estuary System (BTES). The barrier shoreline of Louisiana coast provides direct protection for communities from wave surges associated with storms, as well as indirect protection of the usable renewable natural resources. Without healthy marshes, the traditional renewable resource extraction cultures of the Louisiana coast would not exist. If the Louisiana coastal wetlands continue to disappear, there will be a relocation of human populations and activities that will likely have ripple effects throughout the nation.

When ethnic populations are analyzed for the SPZ, they are clustered rather than distributed evenly. African Americans are more densely represented within the eastern parts of the coast, from the Atchafalaya Basin eastward to New Orleans, and more inland within the agricultural areas, principally where sugar cane is grown. As of 1990, 22% of Plaquemines Parish fishers are African American. Native American clusters are found in both areas along the western coast and in the lower Barataria-Terrebonne close to the coast. Asian populations are scattered throughout the coasts with some clusters in New Orleans and communities downriver from the city and are primarily engaged in commercial fishing activities.

Lewis, Joshua A, Henrik Ernstson. 2017. Contesting the coast: Ecosystems as infrastructure in the Mississippi River Delta. Progress in Planning. December.

This study traces several large-scale hydrological engineering projects with origins in the early 20th century, which aimed to restructure the landscape for more effective maritime transportation, flood protection, and urban drainage. New conceptual language is beginning to permeate research and planning initiatives along urbanized coasts – adaptation, ecosystem-based, resilience, emergence, uncertainty. This represents a turn from approaches that have typically emphasized engineering, equilibrium, and command and control. The intensification of marine processes in the estuary has undermined the region's natural storm defenses, while at the time, rendered its fisheries more abundant and more easily accessed. Deteriorating salt and brackish marshlands provide ideal habitat for key commercial fisheries (Muth, 2014).

Many coastal scientists and engineers claim that the master plan to prevent the delta from sinking into oblivion depends chiefly on the construction of largescale river diversions. The analysis shows how the development of water infrastructure systems in the New Orleans region have produced cleavages in the region's body politic and eco-hydrology, generating disputes that threaten to slow or obstruct the plan's implementation. While some features of this plan (dredge and fill, shoreline protection, oyster reef construction) enjoy broad support from the region's residents, the implementation of river diversions has emerged as the major political sticking point. The political contention is often rooted in past decisions regarding the placement, operation, and maintenance of large-scale water infrastructure in the region.

Political contention and opposition has been caused by historic management of the Missouri River and the maritime waterways in the Gulf estuaries. These projects and events include: the excavation of the Industrial Canal by the Port of New Orleans, which interrupted how tidal action operated in the region by adding a deep-water connection between Lake Borgne and Lake Pontchartrain; breaching the levee at Caernarvon in 1927, which was perceived as intentionally flooding the city of New Orleans periphery (St. Bernard Parish) to secure the city's core population and infrastructures (the flooding into Breton Sound in 1927 killed many commercial species – muskrats, mink, and otters); shipping waterways such as the Gulf Intercostal Waterway, dredged during the early 1940s, and the Mississippi River-Gulf Outlet (MRGO), connecting the Industrial Canal in New Orleans with the Gulf through the Lake Borgne and

Breton Sound estuaries, were dredged between 1957 and 1963, which impounded drainage flows, allowing erosion and salinity to creep into the estuary. In 2008, the US Congress ordered the Army Corps to close the channel to ships permanently, and funded the construction of a rock barrier that would close the gap and recreate the ridgeline that formerly regulated salinity in the estuary. In 2010, the largest storm surge barrier in the United States was constructed directly across the MRGO and GIWW. The new closure structures almost immediately impacted salinities across the entire region (Poirrier, 2013).

This report describes the perspectives and history behind the perspectives associated with the 1991 Caernarvon diversion (7,000 cfs). The environmental effects of Caernarvon and other diversions continue to be a source of controversy between proponents of the diversions in the 2012 master plan and the fishing industry. While oyster productivity increased up to 300% in some areas in the estuary, it collapsed in areas closer to the Caernarvon diversion itself (Avenal vs. State of Louisiana, 2004).

Possible lessons to address the socioecological cleavages include the following. One lesson for large-scale planning efforts might be too much earlier and explicitly fund and promote autonomous interdisciplinary research groups that can carry out situated, textured and historical ecological studies to sensitize the planning situation to multiple ways of knowing as part of a broader notion of democratic planning. A possible lesson for planning theory is to look at case studies of longer processes of public engagement between experts and residents, what Whatmore (2009; Whatmore et al., 2011; Whatmore and Landström, 2011) has coined ‘competency groups,’ and ask how this type of civic-public formations could more explicitly grapple with socioecological cleavages and knowledge controversies. This in turn, and finally, brings home that planning practice cannot be viewed as an objective or neutral activity, accompanied with signifiers like ‘everybody wins’.

Lindstedt, Dianne, “Renewable Resources at Stake: Barataria-Terrebonne Estuarine System in Southeast Louisiana” Journal of Coastal Research SI 44, p. 162-175, Spring 2005.
This article describes important indicator fisheries (commercial and recreational), birds, mammals, amphibians, and reptiles that depend on the marshes, wetlands, and barrier ecosystems. The description includes the important species in terms of ecological value, economic value, and the abundance of the species harvest over the past couple of decades. Finally, there is a description about how continued losses of marsh and barriers habitats (and increasing salinity) will negatively affect these species. Notable impacts to the menhaden and shrimp are briefly described.

The wetlands and shallow estuarine waters of the BTES are extremely productive, supporting diverse recreational opportunities and one of the largest commercial fishing industries in the country. These industries, with a large share coming from the BTES, generate more than $2 billion annually in fish and wildlife-associated activities, making the BTES a critical component of Louisiana’s and the nation’s economy. Unfortunately, Louisiana’s wetlands are deteriorating rapidly, severely threatening the sustainability of the entire system and the assets of its renewable resources. Over the last 50 years, loss rates in the BTES have ranged from 18 square miles per year between 1956 and 1978 to 22 square miles per year between 1978 and 2000, claiming at least one-half of the land loss occurring in the entire state. Currently, the land loss rate for BTES is more than 15 mi-/y (BAKRAS et al., 2003). Most of this loss is inland

marsh habitat, which is critical for survival of fish and wildlife populations and for protection of people who live in the system.

Menhaden are the fourth most abundant fish in the estuary (Thompson and Foreman, 1987) and the largest fishery by volume in Louisiana and the BTES. Menhaden are small, oily, estuary-dependent fishes. Ecologically, this fish is very important as food for large, predatory fish. It is also the basis of a huge commercial industry and is used to manufacture pet food, fish oil, fertilizers, and fish meal. Landings of menhaden in the state peaked in 1983-1984 at 1.7 billion pounds. In 2002, more than one billion pounds were harvested in Louisiana (NMFS, 2004), providing 62% of the total U.S. harvest. As of 2003, Gulf menhaden populations are on the decline in the estuary, and without the protection of shallow shore and marsh habitat for early life stages, populations and commercial fisheries will continue to decline.

Two species of shrimp, brown shrimp and white shrimp, make up the majority of the shrimp fishery in the BTES. These estuary dependent species spawn offshore in the Gulf of Mexico and then migrate through the tidal passes into the estuary to forage and grow into adulthood. Once grown, they move offshore to spawn. There are two distinct harvest seasons in the spring and fall in coastal Louisiana for the brown and white shrimp. Because the movement in and out of the estuary is so important to the livelihood of the shrimp, a breakdown in ecosystem structure and loss of habitat could have serious implications for population levels. Barrier islands and barrier shorelines and the associated tidal passes are an integral part of the mechanics of the life cycle of the shrimp.

Lowlander Center, "Building the Resilience of Small Coastal Businesses." Funded through a grant from Entergy. This report was developed in association with Water Works, L3C; Disaster Resilience Network; French and Associates; and Malmay & Associates, LTD. 2017.
This report reviewed recent reports on adaptation and economic impacts, as well as data on businesses in coastal communities. After completing these steps, the team reviewed academic literature on impacts to businesses from disasters and focused on disasters that have severely affected coastal Louisiana communities. More targeted risk reduction is needed given that a significant percentage of small/medium-sized businesses do not return after a disaster and at-risk coastal communities cannot afford to lose the critical contribution of these businesses. A notable challenge when engaging in risk reduction for the commercial sector is that many owners are focused on day-to-day operations and economic survival of their businesses, leaving them little time to focus on concerns such as natural hazards and other climate-related risks.

The goal of this project was simply to understand: How can small/medium-sized businesses gain more control over their storm-risk? And, how can public utilities play a role in supporting resilience for a major class of its customers who have limited resources?

The project team tested five approaches to engagement across eight (8) coastal communities in order to understand each business community's approach to risk reduction and identify appropriate support mechanisms. The communities included (from West to East): Delcambre, Morgan City, Houma, Golden Meadow/Leeville, Jean Lafitte, Gretna, Lower Plaquemines and Chalmette. Appendix A of the report provide profiles of these communities, including demographic and economic data as well as risk reduction and resiliency projects and strategies. The report offers recommendations for small/medium businesses to improve their resilience.

Marks, Brian, "The Political Economy of Household Commodity Production in the Louisiana Shrimp Fishery," Journal of Agrarian Change, Vol. 12, Nos. 2 and 3, April and July, 2012, p. 227-251.

The author uses information obtained through two surveys conducted with Louisiana shrimpers in 2004 and 2011 to describe the responses to the severe socio-economic crisis of the early 2000s which consisted of collapsing shrimp prices and mounting production costs. This crisis was in addition to four major hurricanes in 2005 and 2008 and the Deep Water Horizon Oil Spill in 2010, which had significant impacts on the shrimp fishery. Due to rising competition for imports, dockside shrimp prices in Louisiana fell by 25 percent and larger shrimp originating in the Northern Gulf of Mexico fell by half; most of which occurred between 2000 and 2003. This was compound by the doubling of diesel prices in the 2000s.

The nature of Louisiana shrimp industry with over 90 percent of shrimpers being owner-operators and suppling most of the labor power and much of the capital for their vessels out of their household economies, allowed shrimpers the flexibility to adapt operations to the cost-price squeeze at least in the short-term. The immediate result of the crisis was a reduction in household income while production costs continued to rise leaving little surplus to compensate household labor. As a result many shrimpers exited the market in 2003-4 with shrimp licenses falling by nearly a quarter in those two years. Apart from the hurricanes the cost-price squeeze did the most harm to Louisiana shrimp fishery in the latter half of the 2000s. For those that remained in the industry, many became more dependent on onshore employment to supplement household income. This is especially true for inshore shrimp fisherman.

In the longer term, the crisis has resulted in a reduction of intergenerational succession with young people leaving the family business or never entering the sector leaving it to aging men and woman who stayed for various reasons. The crisis also has affected inter-firm relationships between shrimpers, processors and shrimp-processing sheds, with a shifting of socially embedded relations toward less-complementary forms, eroding the trust and reciprocity that existed in the industry prior to the crisis.

Martinich, J., J. Neumann, L. Ludwig, and L. Jantarasami, "Risks of Sea Level Rise to Disadvantaged Communities in the US," Mitigation and Adaptation Strategies for Global Change 18(2):169–185, 2013.

This study applies an analytic tool to identify geographic areas in the contiguous United States that may be more likely to experience disproportionate impacts of SLR, and to determine if and where socially vulnerable populations would bear disproportionate costs of adaptation. The SoVI, used to identify socially vulnerable coastal communities, is combined with output from a SLR coastal property model that evaluates threats of inundation and the economic efficiency of adaptation approaches to respond to those threats. The populations that reside in coastal communities will be faced with three general options in response to SLR risks: (1) hold back the sea, (2) accommodate a receding shoreline, or (3) retreat. The authors assessed low-, mid-, and high-SLR scenarios to identify areas at risk and the economically efficient adaptation response (i.e., abandon, protect, or nourish) for each of these areas.

Disadvantaged communities were identified along the contiguous U.S. coastline by calculating SoVI scores according to the methods outlined in Cutter et al. (2003) for each coastal Census tract. To estimate human response to the threat of SLR and the economic impacts on coastal properties, the authors applied the national coastal property model. This framework employs GIS

to structure and overlay available data, including coastal elevations and parcel-level property value data covering the contiguous U.S. coastline. The model combines elevation data with SLR and sub-regional land subsidence rates to identify inundation risk information along the coast. The tool then models a response to the SLR threat over time, and reports estimates of response mode, properties at risk, property damages, and costs of adaptation in both graphical (map and chart) and tabular form.

The results show that more land area is likely to be abandoned than protected in the higher social vulnerability categories. In addition, a larger share of the population affected in the highest SoVI category is located in areas likely to be abandoned due to the threat of SLR. Overall, a greater number of people are at risk of SLR in the Gulf and North Atlantic regions, while less are at risk in the Pacific and South Atlantic regions. The Gulf region has the largest population at risk of SLR and also the largest population located in areas that are likely to be abandoned in response to the threat.

Regis, H. and S. Walton, "Subsistence in Coastal Louisiana, Volume I: An Exploratory Study," U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA, OCS Study BOEM (Forthcoming,).

A partial objective of this study was to produce preliminary data about a range of subsistence activities in coastal Louisiana. The research focused on Terrebonne and Lafourche parishes, where researchers spoke with individuals involved with duck hunting, deer hunting, fishing, alligator hunting, shrimping, crabbing, oystering, and other activities. Subsistence activities in coastal Louisiana were found to be both ordinary and pervasive. Participants in subsistence activities worried that rapid environmental changes will threaten hunting and fishing activities. Subsistence activities are connected to family and communities in complex ways. Commercial activities and wage labor often support or underwrite subsistence activities, making them possible. Subsistence activities are central to personal, cultural, and regional identity. Access is an issue for hunting and fishing in coastal Louisiana as most people do not have the ability to walk in the woods and hunt. Fishing is more accessible through a multitude of free, accessible fishing spots. Hunting and fishing are state-regulated and require access to where the animals are located – land, water marshes, and most of the land and many inland waterways (often canals) in south Louisiana are owned by private entities. To date there has been no systematic studies of this important economic activity and way of life for many residents in coastal Louisiana. As such, researchers have little understanding of the role wild harvesting plays in the lives of coastal residents, to what extent families are dependent on wild harvesting, and what portions of diets or budgets comprise wild harvesting.

Tulane Institute on Water Resources Law and Policy, "Community Resettlement Prospects in Southeast Louisiana: A Multidisciplinary Exploration of Legal, Cultural, and Demographic Aspects of Moving Individuals and Communities," principal authors: C. Dalbom, S.A. Hemmerling, and J.A. Lewis, September 2014.

The paper reviews legal mechanisms used by the federal government to relocate individuals and resettle communities, provides a history of community dislocation in southeast Louisiana, and presents a demographic analysis of Louisiana communities facing the highest risk of displacement. The federal government has displaced individuals and communities for a wide variety of reasons – from public development projects to national security concerns – and used a variety of statutory authorities. The statutes enabling dislocation often have proven much more

effective at relocating individuals than resettling entire communities; however, history shows that both relocation and resettlement programs have a difficult time in being successful. Both federal and local support and funding often prove unreliable or unsustainable. Examples to relocations and resettlements from southeastern Louisiana include St. Malo and Manila villages, Old Shell Beach, and Fazendeville, all in St. Bernard Parish.

Exploratory data analysis reveals that the communities most directly in harm's way and potentially in need of resettlement are largely minority, poor, and rural. Policy responses to increasing coastal hazards – in the form of federally subsidized flood insurance and Louisiana's 2012 Coastal Master Plan – have tremendous potential to impact population stability and regional migration. Analysis of the populations residing in the 100-year floodplain reveals that any rate increases in the National Flood Insurance Program are likely to be borne disproportionately by the state's minority populations.

How Louisiana chooses to address these challenges (or ignore them) will determine their consequences. The "relocation" of individuals in southeast Louisiana is inevitable and the resettlement of communities is far from guaranteed. Relocation is the default; individuals can and do relocate all the time, and relocation across Louisiana because of environmental hazards is happening across Louisiana right now. Coastal parishes are losing populations, and towns are shifting inland and shrinking. It would take a concentrated, organized effort to keep these communities together while moving them out of harm's way. That effort would be "resettlement," and history shows that it is very hard to do. This study makes an assumption that in this area, community resettlement, an option to be exercised only after all else fails, is greatly preferred over the relocation of individuals. These communities have distinctive, proud, and valued cultural histories. People of this area have strong ties to place and community; the loss of either would be a tragedy.

Yen, S.T., L.E. Dellenbarger, and A.R. Schupp, "Determinants of Participation and Consumption: The Case of Crawfish in South Louisiana," Journal of Agriculture and Applied Economics 27(1):252–262, July 1995.

The authors apply a generalized, limited dependent variable model to evaluate participation and consumption of crawfish in southern Louisiana. As Louisiana represents one of the major seafood landing states in the United States, its households have large number of sources of seafood available on an almost year-round basis. Seafood consumption is likely higher in coastal regions than in non-coastal regions. The model included income, household size, and dummy variables for profession types, employment status, education, religion, and race. Model results show households that are more likely to consume crawfish have the following attributes: higher income, larger households, skilled labor, Catholic, and White. The authors also conclude that crawfish consumption is income-inelastic.

Appendix B: Summary of Additional Data Collection Efforts

The project team conducted informational interviews with subject-matter experts (SMEs) from academic institutions and nongovernmental organizations with knowledge of potential environmental justice (EJ) populations in the Mid-Barataria Sediment Diversion (MBSD) project area. The objective of these interviews was to collect information on EJ population characteristics within the MBSD project area and potential impacts of the proposed MBSD project on these populations.

The project team originally identified 11 SMEs, which included several contacts provided by the U.S. Environmental Protection Agency (EPA) through the Socioeconomic Working Group. Each SME was first contacted by email to introduce the topic and request a phone interview. Phone calls consisted of a semi-structured interview to obtain information from each SME on their work with EJ populations in the region and how the MBSD project may affect these populations. Questions varied by SME, but generally included:

- What is your knowledge of the diversion projects?
- Have you worked on any projects or issues related to EJ populations in one or more areas near the project site? What was the nature of that work?
- What is your familiarity with low-income and minority populations in coastal Louisiana?
- Have you performed any research associated with low-income, minority, or other vulnerable populations in coastal Louisiana? What was the focus of that research?
- Do you have any information or insights regarding how other diversion projects have affected EJ populations with which you are familiar?
- Do you have information or insights regarding how the MBSD might affect EJ populations?
- Do you have any community contacts for low-income or minority populations in coastal Louisiana?

To date, the project team has completed five interviews with SMEs. Table B.1 summarizes the findings from these interviews, and Section B.1 provides the detailed notes from each call.

Table B.1. Interview summary and relevance for EJ analysis

Interviewee	Issues or topics covered	Relevance for EJ analysis
Kristina Peterson, Lowland Center	• Ms. Peterson's work at the Lowland Center on applied mitigation work to reduce social constructed vulnerability. • Discussed Ms. Peterson's knowledge of EJ communities in the region and the potential impacts of the project on these communities.	• Suggested community distrust of diversion projects due to inadequate participatory planning processes. • Emphasized potential cascading impacts of loss of livelihood in communities.
Richie Blink, Plaquemines Parish District 8	• Mr. Blink's experience as a councilmember for Plaquemines Parish, where he represents the fallout area for the diversion project. • The challenges facing communities in Mr. Blink's district from the MBSD project due to impacts on fishing.	• Suggested that there needs to be investment in an equitable transition for people who rely on water for their livelihoods. • Discussed the potential for psychological impacts on these populations due to stress.
Mark Cognevich, Plaquemines Parish District 9	• Discussed the economic activity in Mr. Cognevich's district. • Mr. Cognevich's concerns about the project.	• Emphasized beliefs of community that project may not be successful and will negatively impact their livelihoods. • Concerns that the planning process did not meaningfully engage with community members.
Monica Barra, University of South Carolina, School of the Earth, Ocean & Environment, Department of Anthropology	• Ms. Barra's work as a cultural anthropologist in Plaquemines Parish studying the relationship between engineering projects and racial histories in the region. • The need for sustained economic study on the socioeconomic impacts of the diversion project and the challenges posed by community characteristics for this type of analysis. • Ms. Barra's understanding of community concerns about the MBSD.	• Discussed the importance of timing in mitigation: compensation after a damaging event is different than pre-emptive actions. • Indicated that community participation was lacking in project planning. • Suggested community distrust of diversion project because there has not been a demonstration that there are funds for improving levies or home elevation.

Interviewee	Issues or topics covered	Relevance for EJ analysis
Arthur Johnson, Chief Executive Officer, Lower 9th Ward Center for Sustainable Engagement and Development	• Mr. Johnson's work at the Lower 9th Ward Center for Sustainable Engagement and Development, which was established for Hurricane Katrina recovery efforts. Focus efforts on providing education and advocacy for underserved communities affected by these types of projects. • Discussed Mr. Johnson's knowledge of the MBSD project and his opinion on how disadvantaged communities, particularly minority small businesses, could be impacted by the project.	• Indicated that there are adverse effects to minority communities that make their living off of the water, which will adversely affect some populations, and require compensation and recognition of compromise and equitable outcomes. • Noted that small businesses that could benefit from the MBSD are also made up of residents in the community with a vested interest in quality of life, not just their business.
Craig Colten, Department of Geography and Anthropology, Louisiana State University (LSU)	• Dr. Colten's work, including projects evaluating the long-term impacts of sediment diversion projects and studies on building community resilience for environmental change. • Dr. Colten's opinions on how disadvantaged communities could be affected by the MBSD project.	• Suggested community distrust of diversion projects due to inadequate participatory planning processes. • Indicated significant impacts of sediment diversion projects to natural resource-based economies, which can lead to inland migration and social and cultural fragmentation.
Matthew Bethel, Associate Executive Director of Research, Louisiana Sea Grant, LSU	• Dr. Bethel's work, particularly with using traditional ecological knowledge to map land loss hot spots and restoration priorities in Grand Bayou, and working with the National Oceanic and Atmospheric Administration's (NOAA's) Integrated Ecosystem Assessment Work Group for the MBSD project. • Dr. Bethel's opinions on fishing and Tribal perspective on the MBSD project.	• Indicated that commercial fishermen are largely concerned about anticipated salinity changes from diversion projects. • Indicated that Tribes are largely concerned about land loss, but also dependent on fishing so concerned about the short-term impacts of the MBSD project to fisheries, such as oyster leases. • Also noted distrust of the state because of poor responses to similar projects in the past, and negative effects of past diversion projects (e.g., Caernarvon diversion) to fisheries.
Khai Nguyen, Mary Queen of Vietnam Community Development Corporation	• Mr. Nguyen's knowledge of the MBSD project, and his work with the Vietnamese community. • Mr. Nguyen's opinions on how the Vietnamese community could be affected by the MBSD project, as well as the major obstacles or challenges that Vietnamese communities will face over next five years.	• Vietnamese community's primary concern is that freshwater diversions affect the location of the shrimp fishing activity, often pushing shrimping farther out in the water, which affects fuel costs. • Other obstacles or challenges (cumulative actions and effects) include disasters such as oil spills; competition from imported seafood; climate change and land loss; and low shrimp prices. There is also a language barrier.

Interviewee	Issues or topics covered	Relevance for EJ analysis
Scott Hemmerling, Director of Human Dimensions, The Water Institute of the Gulf	• Dr. Hemmerling's work, including scenario-building workshops focused on the sediment diversions.	• Indicated that there are negative reactions to the MBSD project because communities have seen negative impacts from other sediment diversion projects. Can use a scenario process to work through the decision tree for diversion projects. • Touched on the cultural perspective of these projects, where communities are concerned about losing people and their culture.
Susan Testret-Bergeron, Dean Blanchard Michael Massimi, Barataria-Terrebonne National Estuary Program	• The BTNEP is 1 of 28 National Estuary Programs funded through EPA with a state match, whose primary mission is to protect and preserve the estuary.	• In general, BTNEP supports the diversions, although there support has a number of caveats because they believe there could be considerable impacts. • Potential impacts include: impacts to induced flood risk; impacts to commercial fisheries; impacts to other living resources; impacts to induced shoaling and shipping; impacts from nutrients and contaminants; impacts to EJ populations.

B.1 Interview Notes

The project team conducted ten informational interviews with SMEs from academic institutions and nongovernmental organizations with knowledge of potential EJ populations in the MBSD project area. The objective of these interviews is to collect information on EJ population characteristics within the project area and potential impacts of the proposed MBSD project on these populations. Below we provide detailed notes from each interview.

Kristina Peterson, Lowland Center
Interview date: 1/21/2019

Abt attendees: Lisa McDonald and Holly Bender

Including social scientists on the Environmental Impact Statement team

- Need to have social scientists – sociologists and anthropologists – working for the U.S. Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority (CPRA). There is much background to consider.
- Need to have several social scientists writing the report or overseeing the writing of the report.
- With all kinds of studies, it is difficult to know what is appropriate for its application; literature is on micro and macro scales, and need to discern what the issue is and apply it appropriately.

Provide some information on your work with low-income and minority communities in this region

- Committed to doing applied mitigation work to reduce socially constructed vulnerability and to look at ways that adaptation can take place that builds capacity of communities and the region.

- Focused not only on the human dimensions but physical and biological resources that come together to form the web of life.
- Focus on how best communities can adapt in the face of hazards.
- Climate is just one of the many issues we are looking at; we have focused on various ways of approaching hazards and have been very involved in these issues for many years.
  - Various dimensions of these hazards – policy, human dimensions, and physical interaction with humans.
- I have been working in this region since Hurricane Andrew in 1992.
- Shirly Laska started one of the first centers for evaluate hazards; the Center for Hazards Assessment, Response and Technology at the University of New Orleans, which was the first applied hazards center in the country.
- So important to bridge science and communities to have academic, policy, and community engagement and involvement.
- This is the way in which we operate – with the community as part of the collegial group.
- Margaret Davidson with NOAA Coastal Services is no longer with us; she was very well-respected, helping the various branches of government with coastal issues and development and climate. She understood resiliency 20 years ago.
- The Center for Hazards Assessment, Response & Technology at the University of New Orleans and the Pontchartrain Institute for Environmental Sciences have integrated communities into conversations of coastal protection and restoration.
- Matt Bethel with Louisiana Sea Grants was initially a student there and focused on participatory processes.
- Communities want to be engaged – it makes sense to incorporate traditional ecological knowledge into restoration, which is critical.
- We worked with Tribes of the Isle de Jean Charles to hone visions with the Clinton Global Initiative in 2007–2008 and the Rockefeller Foundation on a proposal that we submitted through the state.
- The Lowlander Center has a grant from Entergy and the research looks at how businesses in the Lower Bayou are doing in terms of adaptation. We received the Travelers Excellence in Community Resilience Award for our work.
- We work with architectural schools and other affiliations (e.g., Louisiana Resiliency Assistance Program) to ensure that the best practices from a global perspective – using the best that we can – in dealing with adaptation and structural solutions.
- Need to evaluate which communities can withstand and recover from major storm events and why. For example, Jean Lafitte recovered very quickly after Katrina. The Lowlander Center worked in Jean Lafitte for a while.
- Worked with Grand Bayou ever since Hurricanes Isaac and Lili on mitigations, actions, and processes to save the culture and the land. Since then, we worked on resources and teaching through the Joint Environmental Study Group of the North American Free Trade Agreement, which looks at EJ issues in the agreement. We have had dialogues with Grand Bayou and universities in the area and also worked with other entities with a marsh/wetland cultural-based community that is being threatened. We have learned from Grand Bayou, and our leadership has gone to Haiti, United Nations, Alaska, and Fiji to share, teach, and spread knowledge.

- Coastal communities are not docile communities but are intricately involved in learning, adapting, and teaching. They are incorporating knowledge and what they can do to preserve, protect, and continue the whole web of life. They are the teaching and learning laboratories. They have a huge value and can provide valuable input.
- An example is Grand Bayou. Not all communities want to relocate – some are digging into the marsh. They are the continual eye witnesses to a changing environment. Often the role is reactive to the storms or other changes and they are pushing to be proactive in responding to changes. Matt Bethel understands the need to continual dialog. All parties learn from it and are strengthened from it.

What is your knowledge of the sediment diversion projects and the community's view of those projects?

- If you talk to people in communities, they have not had a seat at the table or had their voices heard. When communities are not part of the process, it creates a one-dimensional, hostile environment, and there is huge push back from communities.
- There is much to be learned if there is more inclusion.
- Not just "check the box of public involvement," but connecting and having an ongoing dialogue with people who are recognized as knowledgeable experts in communities, and understanding what and who is going to be impacted.
- That is needed regardless of the restoration action.
- When communities do not know what is happening and decisions have not included local knowledge in developing plans and science, it is very contentious.
- The work we do includes people from communities we see as knowledge experts for different components. We include them for every aspect; they are involved so that they can be partners and not just adversarial or reactive.

What would an inclusionary process with these communities look like? [Provide the Missouri River Recovery Implementation Committee as an example.]

- Think the Missouri River example would be a good start.
- For the Isle de Jean Charles relocation effort, the community was involved in all aspects from land management to energy to building alternatives, health, etc. We included the ones that wanted to learn from the experience. The effort did not just include representatives, but infused knowledge and capacity-building in every aspect of the project. Some people were involved with grants, and some had knowledge of USACE regulations. It is very important to be conversant with the terminology with specialists in the field – need the language in which to converse. The folks need to learn the lexicon and then can converse on these subjects. Infusion and dialogue are necessary for a successful process.
- The Barataria-Terrebonne National Estuary Program (BTNEP) is a great program that works with stakeholders and builds consensus. Susan Bergeron (pronounces "bageron") is the director and I strongly encourage you to talk with her. They have worked with community outreach and science and have a management team with an extensive consensus approach. EPA has complemented them on their approach. They treat people with respect in deliberations and disagreements.

How are EJ communities impacted by land loss and sediment diversion projects?

- Currently, these communities are dealing with issues associated with financial health and well-being, health, safety, schools, housing, transportation, and spiritual and social implications.
- A report funded by Entergy (Kristina Peterson is sending us the report) documenting how small business are trying to implement innovative adaptation.
- If people lose their livelihoods, there are cascading effects throughout the community (less income and supporting services). When this happens, an area is lost, including social networks of continuity, churches, health services, etc.
- Health is huge – nuisance flooding is more prevalent with more water flow from any type of diversion. Tim Kerner, the mayor of Jean Lafitte, can speak to this. They deal with water from both directions, which affects local food production; and have to rely on fresh foods from other areas, which means more expense and more time. Heath impacts then occur. Tim has put in place farmers markets and other types of mitigation that provide for better sources of income – he is very innovative and creative, and tries to be proactive.
- Safety and schools. Areas where there is flooding means more school time lost. Some roads are not suited for high water levels. People have to move their cars to put them on high grounds, and this often requires other forms of transportation. This may cause greater risks during emergencies.
- When there are more high-water events, often the drinking water is not potable. There is an issue with septic tanks during increased water events, and no drain fields. In this case, septic tanks require pumping, which is another financial burden. If residents do not or cannot pump septic tanks, there is raw sewage mixing into the surface water causing both environmental and health impacts. Often, transportation is difficult with high water, causing isolations from social contact and barriers to connect with social networks, such as YMCA and churches.
- Currently, a substantial issue is the lack of connectivity. There is no statewide system so residents need their own personal hotspot or need to be connected in some other way. Wireless fidelity (WIFI) is extremely slow and cell phones are not reliable in the bayou. The place that folks rely on is public libraries. There is no access to libraries, and very little access to internet, documents, and printing services. It is not easy for these people to access documents online given these issues and considerations.
- Some of our work has been printing copies of plans and reports, and distributing the material so people can read it. People do not have access to data and information, and often do not have access to radio or announcements about meetings.
- Food production for these communities is very important – from growing Vietnamese traditional herbs and vegetables – to seafood – to trapping animals – to collecting eggs from birds. Food is used in social, traditional, medicinal, and celebratory occasions.
- The Friday before Easter, there are many crawfish boils, one of the many traditions the area has around food. There is an interview with Theresa Dardar on a radio show regarding food production. Think of food as giving: “The shrimp are giving,” and “cabbage is giving.” Gifting food – it is a different way of thinking about food, health, and well-being.
- Historically, these areas were known for cattle, poultry, and crops such as rice. There was an array of food production, including peach orchards in southern Plaquemines Parish. The communities are trying to protect feedstock and heirloom plants that are a part of their heritage; part medicinal but also for celebrations and ceremonies.
- As an example, Pointe-aux-Chien is building a greenhouse 12 feet above the ground as a science center to learn from the elders. The First Peoples’ Conservation Council – five tribes

connected with the Natural Resources Conservation Service – is looking at food management alternatives such as gardens in boxes that can be lifted with pulleys and other innovative ways so that when rising waters come in from various directions, food production facilities are protected. They know that the water levels are changing and are looking at adaptation alternatives. In doing this, conflicts can emerge in terms of who has the rights to which areas that can be leased for oysters or crabs when conditions change. Who will be able to farm oysters or crabs? Local communities need resources to perform pilot studies now before all of this comes to fruition. In talking to fishers, they have many ideas about how to adapt. Theresa and Donald Dardar are fighting to reclaim their food sovereignty (see: https://thelensnola.org/2017/02/09/reclaiming-native-ground-can-louisianas-tribes-restore-their-traditional-diets-as-waters-rise/).

- These communities are currently experiencing these difficulties with changes in rainfall patterns due to climate change. With more water from diversions, these impacts could worsen.
- Management of the pumps and levees has been changing because the rates pumpers are payed have decreased, which is leading to turnover resulting in a reduction in knowledge of hydrology, pump operations, and water support systems. If inexperienced people are working on these pumps and the smaller projects, there are concerns and perceptions that the larger structures (i.e., diversions) are not well-understood.
- Folks that live in low-lying areas see backwash from the levies and anticipate more flows coming in from the diversion. These communities are questioning what will happen because of the diverted water and sediment. There is a perceived lack of knowledge about these other issues. Need to include folks from communities and scientists with different dimensions – otherwise you are shooting blind.
- These projects are very complex and complicated with much uncertainty.
- If the state comes with money after the changes are made, it is too late. Residents need money to be proactive.

The state and the USACE need to think about mitigation in the National Environmental Policy Act process. The process is starting, and we will need some idea about the potential impacts so that appropriate mitigation is considered. The timing will need to be right.

Do you have any final thoughts for us?

- Here is an example of a man who was a pumper, who after having his pay cut, stopped working. He knows how water flows, hydrology, and different storm dynamics. He has worked with several entities to procure funds to plant cypress to promote land protection. He is trying to protect what is there until the time when CPRA can implement restoration actions. He has tried to be creative by protecting what is still intact. It makes sense to provide grant monies to continue to do these types of projects.
- Tim Kerner, Mayor of Jean Lafitte, is very creative in his ideas. He wants to get everyone elevated. There is such limited money that they are doing it on their own dime. A small amount of money can go a long way in coastal Louisiana.
- It is also important that people talk in the language that is being used within each discussion. Communities may have an incredible idea, but if they are not describing it with the lexicon of the regulatory entity, then the community is dismissed as "backwoods." Decision-makers need to listen more carefully to communities. Communities have contracted with Engineers

Without Borders to help put their ideas into the "engineering language." However, it takes money to hire specialists. The sad fact is that the burden of this work is put on the people in the area who are incurring the impacts, which should not be the case.

- Please reach out to Tim Kerner; he has educated himself on everything and it is very critical to talk with him. And Susan with BTNEP as well – please contact her.

Richie Blink, Plaquemines Parish District 8
Interview date: 1/29/2019

Abt attendees: Lisa McDonald, Holly Bender, and Olivia Griot

What is your background?

- I grew up in Plaquemines in a fishing community 25 miles south of where the structure will be located.
  - My father was a fisherman and I spent a much time with him on the boat when I was a child and saw how the delta provides for the community.
  - Land loss there was always a backdrop of my life – waterways provided for my family and watching land dissolve drove me to public service.
- I previously worked for grassroots environmental organizations – coastal restoration and planting trees to help with storm surge before the projections of sea level rise were so high. Now projections are two–four feet, which is conservative.
- I also worked at the National Wildlife Federation in Plaquemines Parish in outreach, working on getting this structure built.
  - I have taken an incredible social hit from supporting this project, but felt it was the right decision based on projections of continued land loss.
- I'm a councilmember in Plaquemines now – I went public with the decision about diversion and still won, despite my position being unpopular in a crowded field.
  - People are looking for someone to embrace the future and deal with it.
  - Legacy issues – timelines are longer than average people tend to think about.
  - Need to do something incredibly bold to counter the land loss – we are creating a new delta.
    - Do we sacrifice the entire place for a few subsets of the population?
  - The state should not build south of New Orleans. Should we be building these structures in New Orleans? Should we be focusing less on land building than on saving the culture in a new location?

What are the communities in District 8?

- District 8 is the most gerrymandered district in the parish.
- The entire fallout area of the diversion is within this district.
- This district includes one-third of Jesuit Bend
  - Bedroom community of New Orleans; several folks keep boats in Empire and live in Jesuit.

- Grand Bayou village – First Nations people
  - Trapping, fishing, living off of the land
  - Population of village skews older people – probably the last generation of folks living there. There are no children in the village
  - Have occupied the land for thousands of years.
- Port Sulphur
  - Oil and gas, fishing.
- Other communities include:
  - Homeplace
  - Marin
  - Empire.
- Northern end of Buras
  - Oil and gas
  - Fishing
  - People involved in shipping on the river
  - Support jobs – grocery, gas stations, government.
- Very diverse district
  - Large community of Cambodian fishermen
  - Croatian fishermen
  - McMansions outside of the levees.

Commercial fishing

- 85–90% is owner operated – larger boats in the Gulf and smaller boats in the Barataria Basin
  - Each boat represents a small business
  - Boats and fishing grounds (e.g., oyster leases) are passed down through generations.
- There is one large publically traded fishing company in Plaquemines (Daybrook fisheries, owned by Oceana)
  - Everything else is small operations.
- Oyster industry – smaller operations consolidated
  - Moratorium on oyster leases and limited productive areas mean a few lease holders own a large portion of the grounds – serfdom going on
    Subcontractors are forced to be in the water picking up oysters by hand purposefully to prevent any growth
    Could be dredging and building their own businesses.
- Shrimping – have not seen the same consolidation that is happening with oysters and red snapper
  - People are leaving the industry.

Communities that are tied to hunting and fishing

- Grand Bayou – they live right on the water
  - All other communities have to drive over the levee to get to the water.
- Everyone down there is tied to the water
  - Everyone depends on the estuary in one way or another
  - The MBSD is going to be the most transformative and traumatic project to the area

Going to be flooding in Myrtle Grove – mostly retired people
Transportation is going to be hindered – people will have to wade to cars to get to work
Trying to get things to be built into the project to deal with this to no avail
Grand Bayou will have a unique type of flooding; this is foreseen – we can tie a non-structural project with a restoration project if yards are going to be flooded.
Need some help in elevating houses
Need to make this project to do more than one thing at a time

- Impacts widespread and cascading
  - Traditional knowledge of fishing will be rendered obsolete overnight
  - Businesses are going to suffer
  - There is going to be a lot of stress such as higher suicide, substance abuse, and domestic abuse; this happened after Katrina and will happen again.
- Worried about the tax revenue after this project if businesses are feeling the pinch.
- Charter fishing and recreational fishing will be out of service for a minimum of three–six months
  - Fish will move to deeper, saltier water.
- Water access issues – diversion will fill in waterways and change access to fishing grounds.
- Needs to be an equitable transition for people who rely on the water for their livelihoods – has not seen any investment in this and it is disturbing
  - Project should have some mitigation that will help folks through the transition.

Challenges

Parish has major budgetary issues – balancing budget with one-time money
Plaquemines is a borderline welfare state
Was doing well with oil and gas for a while, and people are used to the government subsidizing things from that, but the parish can't afford it anymore.
Next tropical storm that makes landfall will drastically change the population mix.
People will start leaving their properties if the national flood insurance program is not changed.
Trying to keep culture intact and building resiliency
Louisiana was originally a state of flexible people – need to change and be like that again
People need to be able to adapt and handle that they live in a dynamic and wet place, and stop turning their backs on water and instead embrace it.
Economic growth – many large-scale industrial projects are getting built in harm's way
Need to think about building these projects cradle to grave – getting push back on this idea because it costs money to build levees around the building or to put it on stilts

Plaquemines has 11th largest port in the United States with Empire/Venice –we need to think beyond the election cycle
Bet his entire candidacy on long-term planning.

Would there be greater acceptance if mitigation was built into the project and there were more communication?

- Timing has come and gone for that – maybe it's too late
  - In the 1920s, people's land was appropriated and bulldozed in the name of saving New Orleans from flooding – history is repeating itself in the eyes of the people
  - There are many trust issues with CPRA.
- A robust community-driven planning process is needed and maybe it is too late for that
  - The opportunity has not been completely missed – there is still time for legitimate public input.

Recommended contacts

- Rosina Phillipe
- Kindra Arnesen.

Mark Cognevich, Plaquemines Parish District 9
Interview date: 1/23/2019

Abt attendees: Lisa McDonald, Holly Bender, and Olivia Griot

Census data

- The Census data sound accurate for Plaquemines Parish.
- Main industries of employment
  - Commercial fishing, oil field
    Oil field slowed down so much that majority is likely commercial fishing
    Some might work for the parish and some are retired
    A significant amount participate in hunting, fishing, boating – it is an important activity
  - Significant challenges: low price for fish and high diesel prices
    Have to drive at least an hour to get to a grocery store since Katrina
    Services from before hurricane still have not come back
    Exodus of population since Katrina
    Oil spill has probably not pushed any people out.

Concerns about project

- CPRA brings people in so there is not enough room for the local people in meetings and they cannot ask questions once they do get in
  - Concerned because studies show the seafood industry is going to be killed off by the diversion

  - Many people think it is a money grab because a Congressman passed a law so they do not have to be concerned with the Marine Mammal Protection Act, and his dad's company is going to do some of the work
  - Concern that it is not going to work
    - Three canals are south of Venice, and if the diversions worked, there would be land down there, and there isn't
  - Low-income and minority communities are primarily concerned about the impacts to their livelihoods.

Issues facing parish

- Parish is broke
  - Since the oil industry dropped, money is not coming in as it did before
  - Trying to get more industries down there to get people jobs.
- More hurricanes will prevent people from moving back – the land is only a mile wild at the widest point; Plaquemines is 70 miles long.
  - People cannot afford flood insurance.

Final thoughts

- His father told him God put his hands on Plaquemines Parish because it was like no other place. Oil, seafood, and any natural resources that you wanted were here, and then man destroyed it
  - Family has lived there since 1700s
  - Grandmother's maiden name is Buras.

Monica Barra, University of South Carolina, School of the Earth, Ocean & Environment, Department of Anthropology
Interview date: 1/23/2019

Abt attendees: Lisa McDonald, Holly Bender, and Olivia Griot

Overview of work in Plaquemines Parish

- Cultural anthropologist working in Plaquemines Parish since 2014 doing field work on understanding the relationship between engineering projects and racial histories in the region
  - Focus a great deal on African American communities and mixed race Creole communities, as well as Native American communities in the diversion area.
- Archival and oral history research with a focus on race relations and how they link to former plantations from the 18th and 19th centuries, as well as looking at how diversion projects in the 20th century have impacted these communities
  - Reconstructing that history and understanding how the communities interpret those histories and look at it as part of today's decisions

    Engineering projects are part of the history of these people fighting to maintain access to land and water.
- Work looking at civil rights activism in the parish and how it is related to fisheries management issues and land and water issues.
- Spend much time attending meetings focused on diversion, including CPRA meetings and council meetings.

- Work is primarily qualitative – participant observation and longer form interviews
  - Extended one-on-one interviews with community leaders and residents to assess their primary concerns and to understand how this project is next in line of EJ issues

    There are many EJ conversations in these communities because of traditional EJ concerns with refineries and other polluting industries converging on their communities.

Communities

- Mainly on West and East Bank communities, from Phoenix to Bohemia.
- Communities around Ironton and Oakville.
- Working with political representatives, and folks from churches and libraries.
- Stay primarily in Plaquemines Parish but work a small amount with Grand Bayou as well.

Publications/papers

- Has dissertation – ethnography, so in more of a book form.
- Not much published yet.
- Recommends publications from expert panel on sediment diversion.
- The Coalition to Restore Coastal Louisiana has held focus groups for the "Shrimpers with Diversions" published report.
- Sandy Nguyen might have good quantitative data on subsistence fishing communities. Monica Barra suggested that we talk with her.

Economic impacts

- There is a lack of comprehensive inquiry into the socioeconomic impacts of diversion.
  - There has not been a sustained economic study – tricky because it is hard to account for subsistence fishing as well.
  - Much data are focused on commercial fisheries.
  - Clearly identified shortcoming with lack of data on which to understand the effects.
- Hard to assess economic impacts to EJ populations because it is a very small group of people.
- Not many people, not many jobs, not many resources to deal with changes to the estuaries that diversions are going to bring.
- Subsistence fishermen are not going out far, and have their spots they go to
  - Do not have extensive equipment, only small vessels.
  - Mostly in Phoenix Bay.
- Fishers rely on the relative stability of the estuary to supplement their income and food intake – important to understand but very difficult to get good data to quantify
  - Used to be able to support themselves independently by working the fisheries
  - Huge difference between these communities and large commercial outfits

    These populations are not the owners of commercial outfits, but can still do fine independently.

    After hurricanes and management changes, not able to independently fish for income – just able to supplement their income. Many remain unemployed, work for others, or out-migrated.

- There is much sharing of resources and food/catch – difficult to model and assign dollar values to.
- Many of these people have lived there for multiple generations and it is difficult to assess property ownership
  - Important to be able to live off land, have homes they can own, and live near families – this is why many of them still live there
    Many Black families struggle to have clear land titles and property titles – there were problems after Katrina applying for help from the Federal Emergency Management Agency.
  - Concerned about flood risk to these communities from diversion – worried they will not have financial or legal resources to do what needs to be done to protect their properties from being taken.
    Inherited properties
    Protection needed from levies, but also need financial and bureaucratic support for protection. The track record has not been good for these African American communities – see people with more access and money able to successfully apply for home elevation grants and financial support.
  - These communities are elderly, retired; there are not many 20–30-aged folks opting to stay and raise families in the region
    Can look at Census high school graduation data to see how many children are being raised in the area.

Main concerns with diversion project

- Flooding, which has to do with protection of homes and property.
- Fishery issues
  - Important to distinguish between commercial and subsistence fishing.
- Kristina Peterson would be a good person to talk to about the Grand Bayou community perspective
  - Grand Bayou now has very few year-round residents
    Elders in Tribe are full-time residents
    Others maintain houses there, but have houses elsewhere
    Matt could speak about this more.
- Concerns about safety issues during construction period
  - If there is another hurricane, how are we thinking about evacuation routes?
- Flood issues: current state of levies and how the USACE has decided which areas are being worked on first and last
  - Communities are saying there should not be a diversion until the levies are brought up to standard
    CPRA says there will be no diversion until the levies are up to standard, but the residents are distrustful because they have not seen any work being done and CPRA has not demonstrated they have the funds for this or for home elevation
    There is much uncertainty and no program is being started to assist with impacts to fisheries or homeowners, which is disconcerting to communities
    CPRA has been told this by many people at meetings.
- Plaquemines is losing residents with or without these projects after every hurricane

  - Hard to see this with Census data because people still maintain their properties in southern Plaquemines but live in another more northern location, and only visit their homes in southern Plaquemines Parish during fishing season or on weekends, etc.
  - The state knows what is going to happen with respect to the estuaries (biophysical data), but does not have a program in place for consequences to these communities in a way that is not going to exacerbate existing inequalities.
  - I do not think the state has a good understanding about the populations in these areas.
- Can diversions be done in a way that is more than just "do no harm?" Is there a way to ensure communities are in a more secure position after the project than they are now (e.g., infrastructure, jobs, legal and technical support)?
- Is the mitigation process being done before or after the fact? If the damage is done and you have to wait years for compensation, that is too late to help these communities.
  - Timing is very important for the mitigation
  - Recommend a way to do pre-emptive mitigation for communities that live there
  - People cannot afford to wait for mitigation – they are moving away and finding new jobs, so the incentive to return is harder.
  - This is a unique opportunity to think about mitigation differently from oil spills and storms and to plan for appropriate and proactive mitigation along with environmental restoration.

Community input

- Do not have much localized input or input from communities of color in the diversion project.
  - In the last CPRA master plan, there was a disappointing lack of input from communities; only spoke to the same few people to represent the entire coastal area
    - No residents from Plaquemines are on the advisory committees
    - Hard to see localized input being incorporated.
- Financially, investment in diversion makes sense because these communities do not have valuable land
  - They get cut out, so it is important to give them a voice. It is difficult because they are out there and you have to track them down.
- When people talk and think about sediment diversions, it is always about Caernarvon.
  - Residents understand what is happening because they know about the impacts from that project.
  - The state should spend more time with residents discussing flood risks and thinking about how to do mitigation in a way that people would be receptive to.
    - Explaining helps, but it does not make residents want the project more. When you have already made a decision to do a project, you need to give people a basic understanding as well as talk about what the community thinks should be done. People are familiar with the issues.
- The state is focused on building more land, but communities are focused on keeping their livelihood and not losing their families – historical and cultural ties of living close to families
  - The commercial fishing industry has decreased over the past decade
    - Other options for employment are coal processing plants, refineries, parish government, and school districts

  - Oil and gas fields are a not a big employer in Plaquemines and have not been for a few decades
  - Black and other minority communities have not gotten into recreational fishing and tourism services; Monica stated, "that is not what they do"
  - Some commute far to the west bank (Port Fouchon oil and gas jobs) and northern areas, others move away, and many stay who are unemployed or retired.

Additional contacts

- Sandy Nguyen – works with Vietnamese fishers
- Audrey Trufant-Salvant – outgoing council member, first Black councilwoman "Miss Audrey," works on EJ issues and with CPRA
- John Bartholemy – District 1 Council Member
- Darilyn Turner – School Board District 1
  - Works extensively with environmental groups and churches on the East Bank; also works with Zion Travelers Cooperative Center.

BTNEP Staff

Interview date: 2/21/2019

Abt attendees: Lisa McDonald and Holly Bender

BTNEP staff: Susan Testret-Bergeron, Director; Dean Blanchard – Deputy Director; Michael Massimi, Environmental Scientist and Invasive Species Coordinator

Please provide some background on BTNEP

- The BTNEP is 1 of 28 National Estuary Programs funded through EPA with a state match, whose primary mission is to protect and preserve the estuary.
- Our funding comes from the Clean Water Act, Section 320 funds, with a focus on protecting resources and water quality.
- We developed a Comprehensive Conservation and Management Plan (CCMP). There are 36 action plans that focus on community planning, ecological management, sustained recognition and citizen involvement, and economic growth. The action plans contain several elements, including objectives, background, description, lead agencies involved, timelines, ranges of costs and funding, and performance measures.
- Several action plans are related to the MBSD project, including river reintroductions, education, and culture. It is unusual to have so many elements in the CCMP.
- In this area, we are very much tied to the land and water, and we have a diverse set of objectives.
- At the BTNEP, we have a management conference and not a board of directors. The management conference includes 50 interests, including agriculture (sugar cane), fishermen, CPRA, and USACE. There are also academic and nonprofit organizations.

What are your perspectives on the impacts of diversions and specifically the MBSD?

- The information on the river reintroduction action plan is on our website.
- This action plan is part of the ecological management action plans (EM-2 river introduction).

- The objective is to use riverine resources of freshwater and sediment from the Mississippi and Atchafalaya rivers in order to decrease salinities and preserve and/or create marshes.
- In general, we support the diversions, although we have placed a number of caveats on that support because we believe there could be considerable impacts.
- BTNEP recognized that restoring the coast would be introducing freshwater and nutrients to the estuary. Over the years, the idea of a diversion has grown larger and larger, and we believe that the potential for impacts increases with the scale of the diversion. The first MBSD was the Myrtle Grove diversion at 15,000 cfs; in the 2017 Coastal Master Plan (CMP), the MBSD is proposed to be 75,000 cfs. It would be one of the largest diversions freshening the basin, impacting oysters from the salinity as well as shrimp, finfish, blue crab, and menhaden.
- Some of the largest potential impacts include:
  - *Impacts to induced flood risk.* Wind is a notable factor in this basin that affects flooding. Combined with water from the sediment diversion, especially during high-wind periods, would add additional flooding risks. Diversions should be designed with no adverse impacts from flooding.
  - *Impacts to commercial fisheries.* Of particular concern are impacts to oysters. The duration, seasonal timing, and degree of freshening will affect the breeding, growth, and harvesting of the eastern oyster in some areas. Meaningful engagement in terms of operations of the diversion is needed with those that have oyster beds near the diversion. Timings on the operation of the flow will be important to consider impacts to oysters. These are not just fishery impacts, but socioeconomic and subsistence effects. Fisheries maintain a way of life in the coastal region.
  - *Impacts to other living resources.* There will be impacts to the bottlenose dolphin because it does not readily relocate.
  - *Impacts to induced shoaling and shipping.* Siltation of the navigation channel could occur, requiring additional maintenance dredging of the channel. The West Bay diversion almost closed down the channel from induced shoaling – the channel becomes too shallow. No one claimed responsibility, and eventually restoration funds were used to dredge the channel. We also have steerage concerns around the diversions, especially for smaller boats. Water levels to support shipping must be considered, especially with multiple diversions operating or if the river is experiencing a drought or low-water period.
  - *Impacts from nutrients and contaminants.* We are concerned about freshwater from the river introducing invasive species. Nutrients will cause floating aquatic plants such as giant salvinia, water hyacinth, and hydrilla to bloom, with the potential for impacts such as clogging intakes, blocking navigation, and affecting drinking water; and aesthetic impacts. It could even destroy a boat launch and access would become an issue. There is also the potential for eutrophication and contaminants being introduced into the coastal bays.
  - *Impacts to EJ populations.* Communities such as the Native Americans in Grand Bayou, and the Vietnamese-American fishermen and low-income residents across Plaquemines Parish could be adversely affected by river reintroductions.
- Maintaining wetlands in brackish waters and introducing freshwater through diversions in an area where saltwater is intruding will affect the wetlands. Hurricanes bring in large amounts of saltwater, which will be toxic for wetlands created with freshwater. The plants are not

made to survive any salt. In general, there is a salinity gradient – plants are designed to survive. With a diversion of this size, freshwater go all the way to the Gulf. The green vegetation will die every summer from the storms bringing in the saltwater. CPRA recognized this and their models actually showed a die off of the freshwater marshes created by the diversions. In addition, when the river is low and there is no diverted water, the saltwater coming in would be toxic to these wetlands. This would cause severe impacts to project's ability to build new land. To solve the problem, CPRA now has a small amount of freshwater flowing through the diversion at all times – a minimum of 5,000 cfs. They found in the model that this will work and the saltwater will not destroy the freshwater wetlands.

  - We feel this is not a realistic assumption. Physically, you just cannot have 5,000 cfs coming through the river due to backflow during low periods. It is all about physics – you cannot move water through the diversions during low flows in the river because of backflow. They could build a pump station to move 5,000 cfs continuously through the diversion, but they have not accounted for this aspect in their costs. The model is predicting one set of outputs, where these features and costs are not included. They have used the wrong cost-benefit ratio.

How would it be best to operate the diversions to minimize adverse impacts?

- The operation regime is the most important and critical part of the project. There is a way to have it all, using the diversions for short periods during each year. You would still be able to have a fishery and oyster fishery if the timing of the discharges are right. If the discharges are stopped in May or June, you could still maintain a viable estuary and fishery.
- Natalie Peyronnin facilitated a meeting for a few months to talk about culture, salinity, and operations of sediment diversions. The document that resulted from this research and outreach on the sediment diversion operational regime can be found at https://www.researchgate.net/publication/317133216_Optimizing_Sediment_Diversion_Operations_Working_Group_Recommendations_for_Integrating_Complex_Ecological_and_Social_Landscape_Interactions.
  - They looked at the river hydrograph over the last 50 years; most years had two peaks. These peaks should be taken into account when determining when diversions are operating to maximize sediment delivery to minimize impacts to oysters and shrimp.
  - People are not aware of the Peyronnin document; this document does not resemble what is in the CMP.
- There should be an adaptive management framework, with flexibility in operations to make some adjustments to any impacts to fisheries and flooding.
- Stakeholders want to know who is in charge of the knobs; they want to be heard in terms of how they will be or are affected by the diversion.
- An advisory committee (see description below on the Davis Pond Advisory Community) would be perfect to guide operational parameters. The stakeholders know where they can grow oysters and know where shrimp will be. This could be a mitigation strategy in terms of providing advanced information so people understand the operations. The stakeholders will need to know and understand ongoing operations to assess whether they should continue living in their current locations or if they need to move their families.

Please give an overview of your project and how you are interacting with Tribal, low-income, and minority communities

- We have worked with some of the populations for a long time. We have met with Plaquemines Parish fishers and Native Americans. We have a working relationship with those communities, but not a deep relationship. We can give you names of people in the communities (see below).
- Native Americans have seen many of the impacts firsthand; they live the system and understand it. Their concern is that they are not being heard. When there is a public meeting, they have three minutes to talk. It is not a dialogue; there is no response from CPRA and no chance to discuss their issues.
- There is much fear and concern about the diversion. Farther down the river, there is greater fear and lack of engagement. There has been much engagement from the state but not a back-and-forth discussion. The people have been talking about their concerns for 10 years; many are deflated and fatigued. They have a number of concerns but plans for the diversions have grown to a larger and larger scale – the state is steamrolling ahead with its plans.
- A participatory engagement model that does work began in the late 1990s – an advisory panel on the Davis Pond diversion. All interests are included, including shrimpers, finfish fishers, etc. They meet annually so it is not too cumbersome in terms of a time commitment. They decide together how to manage the salinities. The stakeholders are being heard. This approach may be something to consider for MBSD to ensure there is an organized way for people to have input into the decisions. They are public servants and the public includes a variety of interests that need to be included. In terms of the Davis Pond advisory panel, we commend CPRA and USACE on their work there. We are a voting member.
- We support things that are consensus-driven – where everyone agrees. For the CCMP, we do not pursue strategies that do not have a full stakeholder buy-in. An example is the backfill canal when we had presentations on each side of the issue. We require consensus of our management council for decisions as well.
- For the EJ populations, we need to find the balance in terms of what these people need to live, including the Native Americans and Vietnamese. They do not feel that they are completely represented.
- Everyone is treated the same way in public outreach, but the Native Americans and Vietnamese communities do not communicate in the same way. We need to understand how they communicate and then decide on how we can communicate with them effectively.
- An advisory panel similar to Davis Pond with broad participation would go a long way to smooth over the resistance from communities. There is a long historical distrust by communities of these large projects.
- We are working with the Water Institute of the Gulf and we also had a meeting with the fishermen in Plaquemines Parish. They thought that it was a good meeting but noted that they had not been heard before. We need to find a way or find the right people to listen to and engage.
- The master plan is an ongoing process that would really lend itself to an operations or implementation advisory panel. CMP is an ongoing plan with implementation over many years; there are many issues to discuss.
- If you look at the CMP, marsh and ridge creation are an integral part of it. CPRA should be spending time talking about these projects.

Subsistence is really important to consider

- We are working with the Louisiana Department of Wildlife and Fisheries (LDWF) who is working with shrimp trawlers since subsistence is so important to shrimpers. LDWF is collecting data and information on subsistence activities since they do not have much information on this.
- In coastal Louisiana, subsistence is such an important activity; it is tied to culture, household sustenance, and supplemented food production or consumption. I think that subsistence permeates the coastal culture.
- Dr. Jack Isaacs with the LDWF is actively working on collecting information on subsistence.
- Louisiana Sea Grant is also working with the fishermen with funding from CPRA. The focus is to learn about their needs and adaption to diversion. I suggest that you speak with Rex Caffey (PhD economist) or Robert Twilley (Director). Their contact information is on the Sea Grant website.

Additional contacts:

- Jack Issacs, PhD, economist, Louisiana Department of Wildlife and Fisheries, Socioeconomic Research and Development, jisaacs@wlf.louisiana.gov, 225.765.2605.
- Rex Caffey, PhD, economist, Louisiana Sea Grant, Director of Marine Extension, Professor and Director for Natural Resource Economics and Policy, rcaffey@agcenter.lsu.edu, 225.578.2393.
- Robert Twilley, PhD, Executive Director, Sea Grant College Program, Professor – Oceanography and Coastal Sciences, rtwilley@lsu.edu, 225.578.6710.
- For contact information for Nichols State, email Susan Testret-Bergeron about the person at Nichols State (perhaps Diane Austin, who is with the University of Arizona).
- John Helmers, Director of Coastal Restoration, Plaquemines Parish Government, jhelmers@ppgov.net, 504.934.6297.
- Natalie Peyronnin, Environmental Defense Fund (she was a Senior Scientist with CPRA where she served as the Project Manager for the 2017 CMP).
- Sandy Winn (Lisa McDonald] noted she is already on our list to contact).
- Monica Barra (Lisa noted that we have already talked with Monica).
- Rosina Philippe, First Peoples' Conservation Council. Lisa noted that we have been working with EPA to coordinate these meetings. Susan will talk to Rosina next week to see if she can encourage her to talk with us.
- Audry Trufant-Salvant (Lisa noted that we have been trying to contact her, and Susan suggested that we ask John Helmerf about contacting Audry).
- Richie Blink (Lisa noted that we have already talked with Richie).

Arthur Johnson, Chief Executive Officer, Lower 9th Ward Center for Sustainable Engagement and Development

Interview date: 12/12/2018

Abt attendees: Lisa McDonald and Olivia Griot

What is your knowledge of sediment diversion projects in Louisiana?

- Arthur is very familiar with the diversion project.
  - Aware of the controversy, particularly in Plaquemines Parish.

A story about it appear online in the newspaper today.

- The project impacts an underserved community.
  There are questions about how much impact it will have on this community and if the community is truly objecting to the project,
  The parish President lost the election last week and is only there until the New Year.
- In general, these CMP projects have challenges in finding the compromises in order to benefit the whole.
  If the project is not done, there will be disastrous consequences. However, the project will have some smaller-scale negative impacts on fishermen and oystermen, but it will not destroy them and it will help the bigger scheme of things.
  Arthur is unsure if he is downplaying the impact on fishermen.
  This is one of those projects that is more worth doing than not doing.
- There is a question of how to deal with the challenges and impacts to underserved communities, including those who make their living on the water. Need to compensate or deal with these adverse impacts.
- In dealing with environmental issues, need to have some aspect of open-mindedness to deal with climate equity.
  This requires compromise – everyone is not going to be happy, but everyone should not be unhappy. Compromise might not be equal; equitable, but not equal.

Tell us about your work.

- It is a broad scope of work.
- Based in the Lower 9th ward and established after Hurricane Katrina.
  - Began as a community-based organization to assist the lower 9th ward, underserved populations in New Orleans, and a broader region to recover from Hurricane Katrina.
  - Recovery from Hurricane Katrina focused on environmental issues and the built environment.
    - Bringing things back to the way they were before Katrina does not address land loss, environment issues, etc. These issues that are impacting particular communities are urban and not coastal, so people did not think of these coastal issues as affecting the urban community. However, New Orleans is coastal. Water is big component of New Orleans as a city.
    - Community members need to be at the table, not just on the table when decisions are being made.
    - Education is also important – why these things are important and why community members need to be aware of them.
    - Advocacy is important – advocating for all communities to be considered in the legislative process, not just affluent communities. Underserved communities are usually the most impacted.
- On this project, had a meeting with CPRA and minority small businesses.
  - Minority small businesses trying to get involved in contracts.
  - Many entities are interested in CMP for more than one reason, not just the residents. Our organization is educating communities and business entities alike.
    - How to open up the discussion with these entities that are not being considered?
    - Small businesses are also residents in the community – have a vested interest in their quality of life, not just their business.

- Working with Zion Travelers Cooperative Center (a minority nonprofit) in Plaquemines Parish, which is on the water. [The reverend is Tyrone Edwards and the Executive Director is Lisa Darrelynn (spelling?)]. This nonprofit helped sponsor a youth summer camp and worked with the Greater New Orleans Foundation to talk about issues facing southeast Louisiana.
- There are organizations that work in these communities in addition to local and state governments and larger environmental nonprofits without being based there.

Craig Colten, Department of Geography and Anthropology, LSU
Interview date: 12/18/2018

Abt attendees: Lisa McDonald and Olivia Griot

Summary of work you have been doing as it relates to socioeconomic issues and EJ

- Does not do economics work at all, but sociocultural and much EJ work with marginalized populations
- Worked on a mini-atlas of Louisiana coastal populations for the Bureau of Ocean Energy Management that:
  - Was released in 2005 with 2000 Census data
  - Included St. Bernard and LaFourche Parish
  - Included Brownsville to the tip of Florida – the whole U.S. Gulf Coast
- Have done a number of projects looking at long-term impacts of diversions
  - Looking at how they impacted natural resource-based communities
  - Have no idea of when the forthcoming study might be published
- Been doing community resilience studies with his students for the past decade – how communities rebound from environmental change and major human-induced impacts to environmental settings
  - Quite a few of the studies have been published – can send us references
  - Did one with Scott Hemmerling on social justice and mobility
  - Did one with Jessica Sims on migration
- Work with Sandy Nguyen with Coastal Communities Consulting – represents Cambodian/Vietnamese fishermen
- Work with Reverend Tyrone Edwards (Zion Travelers Cooperative Center).

Scenario-building workshops

- Did two: Terrebonne/LaFourche and St. Bernard/Plaquemines
- Different levels of participation between the two groups
  - Never had an ideal balance between two parishes in each workshop
  - Had more representation from stakeholders – major players who can hire representatives (e.g., landowners, transportation industry, commercial fishermen)
    - Had poor representation in both cases from community-based groups
    - Did not have much representation from EJ groups: Reverend Tyrone Edwards was there for Plaquemines, although he's at every event
- Over the summer, traveled to Plaquemines and St. Bernard for informal meetings, which had better community group representation
  - Met with community groups to find out what questions they wanted to have academics answer

  - Sea Grant funding for this
  - Nothing published, but will have some presentations.

Opinion on how disadvantaged communities could be impacted by diversion?

- Communities have already been impacted – the diversion was announced without adequate participatory planning
  - Sends ripples through communities – creates distrust and democratic deficit
  - There has been confrontation
    - Ugly confrontation with past head of CPRA
  - This bad feeling and distrust will continue until communities are brought into the process
- In the past, there have been devastating impacts from diversions
  - In the 1920s, impacts nearly destroyed trapping by the intentional breach of Mississippi River levee
    - Trapping has really diminished today (some nutria trapping and gator hunting still occurs), so it is less of a concern; but it is reflective of the types of damage that can be caused by diversions
  - In the 1940s, oyster fishing in the Mississippi Sound was completely disrupted
  - Always major impacts to fisheries (shrimping and oyster), even if temporary
- When there are disruptions to natural resource-based economies, communities are hugely impacted
  - People do not pursue these economics
  - Inland migration causes social fragmentation and cultural erosion
    - Closure of businesses, schools, and communities centers, which fragment society
    - There is no effort to restore the community culture with these projects, just an effort to restore the coast
    - Land loss has also caused communities to be abandoned and retreat up the bayous
      (1) Mapping of closure of post offices in communities shows this (Scott did this mapping).
- Other impacts: displacement of risk from urban industrial areas to marginalized communities
  - Building levees reduce the risks within the city but displace communities along the lines of political weakness
    - Floating villages are all gone – the sediment that accumulates destroys fishery habitats
  - Prioritizing one segment of society forces some to make adaptations while protecting other people from making adaptations
    - With the diversion, asking the same people who have adapted multiple times to adapt again
      (1) Mitigating these significant impacts to marginalized communities has not been a part of the master planning process – it may be a minor part but it is not visible when looking at the budget.

What would be useful for these adaptations?

- Full participatory planning at the outset would help identify the adaptations that *need* to be made

  - Getting all the experts together, not just those with technical expertise. Getting experts who work in the bays and the waters together with engineers and biologists to figure out the impacts and the best adaptations, and what can be done to provide viable opportunities for these communities.

Work with tribal entities

- Have not done much work in this area – have attended meetings but have not been directly involved.

Useful contacts

- Sandy Nguyen
- Reverend Edwards
- Will give us some additional names.

Other notes

- Commercial fishermen have been dealing with all types of disruptions with changing shrimping laws, and oystermen advocating for diversions and then not liking the impacts and filing lawsuits
  - This is seen as something outside of their control
  - They just want these diversions to be managed so they can continue their operations
  - Oystermen are farmers with leases in fixed locations who cannot just pick up and move to another location and have the same crop the next year
    - They claim that oil companies have many leases to ensure they do not get into trouble with oystermen – not sure if this is true
    - There needs to be accommodation in this process for the relocation of leases
  - Consideration needs to be given not just to commercial operations but to subsistence as well – this applies to Native Americans
  - With storm surge and flooding, these communities have adapted repeatedly
    - Putting homes on stilts, moving inland
    - "Disposable homes," when flooded, gut and rebuild the homes
    - Every time there is a disruptive event, see an erosion of people with them departing
    - Migration is a survival strategy but there is a resistance to it
      (1) Need to recast it as transplanting communities or calling it managed advanced (toward safety) rather than managed retreat
        (a) There needs to be assistance for moving inland in the budget for these types of projects
          (i) There is an investment for the diversion, but there is nothing comparable for a planned investment in humane solutions for people who live on the coast
        (b) Even fishers can move 30–40 miles inland as long as the roads are maintained; to sustain a coastal livelihood, you do not need to live on the coast
- Two–three years of sediment being dumped in the bays is going to have a sustained impact on culture and society.

Matt Bethel, Associate Executive Director of Research, Louisiana Sea Grant, LSU
Interview date: 12/17/2018

Abt attendees: Lisa McDonald, Heather Hosterman, and Olivia Griot

Summary of what Matt has been working on:

- Background in geographic information system (GIS), remote sensing, mapping
- PhD in applied environmental sciences and engineering
- A partnership with social sciences introduced him to communities in Louisiana
  - Worked with Native American community in Plaquemines Parish to talk about issues they face – land loss was a big issue
    - Listening to their concerns and priorities on how to live sustainably in that environment
    - First project with Grand Bayou – mapping land loss in hot spots around their village and their priorities for restoration
      (1) Mapped areas most likely to be lost and overlaid that with community priorities
      (2) Trying to give the state an idea of restoration priorities in the area – CPRA liked the results and funded the partnership to expand beyond the Grand Bayou study area to Barataria Basin in general
- Started working at Sea Grant at LSU in 2013
  - Has many administrative duties as the Research Director, but still maintains a research component of the position by continuing to work with Grand Bayou and other Barataria Basin communities
  - Through Sea Grant, worked and did outreach with communities across Louisiana, which introduced him to similar communities in Terrebonne Parish
  - Most recently, community work has focused on helping hazard mitigation planning, so helping tribes with planning for land loss and sea level rise
  - Working on NOAA's Integrated Ecosystem Assessment work group for the region on the social science advisory team for the MBSD
    - Advisory team has calls every few weeks to discuss everyone's perspective on socioeconomic impacts and implications of the diversion
    - Developing a conceptual model that is specific to socioeconomic issues and impacts, which will blend with ecosystem indicators developed by the larger Integrated Ecosystem Assessment team
    - Matt will facilitate connection between this team and our team.

Information about his papers

- Subsequent paper in 2014 leveraged experience with Grand Bayou and expanded to be applicable to a number of other communities
  - Mapped location factors for shoreline protection, freshwater introduction prioritization, etc.
    - Results from data and interviews, and transcribed information from communities.

Fishing perspective on diversion

- People are apprehensive about anticipated salinity changes from the MBSD, primarily fisheries impacts

  - People that Matt works with are primarily fishermen
    - Worried about short-term impacts of salinity on fishing that they get their livelihoods from
      (1) Will they have to travel farther distances to get the same fish? Will they have support for transitioning their boats and gear? How will they deal with increased fuel costs with bigger boats and traveling further distances??
      (2) Will they have access through oyster/fishery leases? What are the legal ramifications if they have to move beyond leased area into federal waters?

Tribal perspective on diversion

- Tribes are primarily concerned about land loss and see the diversion as a way to stop this loss in the long-term. However, at the same time, the Grand Bayou community has observed the Siphon project since the 1990s, which was designed to introduce freshwater to marshes. The community has had to adapt to marsh changes from this diversion.
  - Used to trap muskrat and mink but switched to nutria due to the changing marsh type
  - Liked seeing traditional plants coming back and more nutrient diversity around the Siphon area, but in all those years they did not see much land being built, so the Tribes have a misconception about diversions
    - Provided information to the Tribes that the siphon project introduced freshwater and not sediment to correct that misconception
  - They had a positive reaction to sediment pumping and their perception is that the best way to build land is to pump sediment and freshwater
    - See the diversion as beneficial if it is nourishing pumped sediment projects – they understand that this new sediment will erode if nothing is done to nourish it
- The Grand Bayou community is dependent on fishing for their livelihood
  - Variety of fishing includes shrimping and oysters; in the offseason trap nutria
  - Concerned about short-term impacts to fisheries as well
    - Wonder about the impacts on oyster leases
    - Small-scale fishing operations (single shrimping boat)
- Rate of change through past few decades has been exponential – hard for the community to keep up with adaptation capacity, which is why they are increasingly reaching out to outsiders for assistance
- Tension and distrust of the state due to poor responses in the past
  - Past diversion project (Caernarvon diversion) had negative impacts on fisheries that were never addressed by the state
  - Are open to LSU because there is a more positive association with academia.

Information on other minority communities

- Matt has not directly worked with African American communities, but Sea Grant has funded some work recently
  - Monica Barra: project with African-American fishermen community in east bank of Plaquemines Parish
    - Oral history study on Sea Grant website
- Huge Vietnamese fishing fleet in coastal Louisiana
  - In Plaquemines Parish but mainly offshore, so were not included in Matt's study

- Geographical scope of the study included fishermen in estuary (inside), not offshore (outside)
- Large boats are far offshore.

Closing thoughts

- Fishers are holistic thinkers – see the pros and cons and are used to being adaptive
- As long as populations feel they have meaningful input into process (especially in terms of the diversion operations), that is half the battle for getting communities on board
  - Engaging in a way so that locals are part of the process will go a long way, otherwise will be years of pushback and litigation that will slow the operation of the diversion.

Khai Nguyen, Mary Queen of Vietnam Community Development Corporation
Interview date: 12/21/2018

Abt attendee: Lisa McDonald

Abt provided the following introductory statement: We are working for CPRA, pulling information on EJ to help with the Environmental Impact Statement analysis. EPA provided your contact information. We are also talking to quite a few community leaders and others involved with these communities.

Summary of what Khai has been working on

I work with many other organizations that are also involved with these communities. Part of the coalition is working with community groups and constituents to inform them more about the diversion projects. It would be helpful for you to contact other groups as well. (Khai will email a list of names and organizations for us to contact.) Coastal Communities Consulting, which is led by Sandy Nguyen, works with Vietnamese, Cambodian, and Spanish speaking fishermen.

What is your knowledge of diversions projects in the area?

I worked with Mary Queen of Vietnam for a time since the oil spill. We work with the Vietnamese community in the fishing industry. After the spill, had many people come through our office. Got involved with community coalitions that are trying to learn about, influence, and provide input into the Master Plan. We are a part of the community coalitions – we provide education and information to communities about diversion projects as well as all of the other restoration projects. We need to obtain community input for these projects. I attended many information meetings held by CPRA and understand the projects and what they aim to do. I have been aware of this sediment diversion project for the last few years.

We are not directly working with groups in Plaquemines Parish; other groups work more with those communities. Many of the individuals our organization works with are living in east New Orleans but some work (i.e., fish) in the Barataria Basin. The Vietnamese population has been in this area since the 1970s when they migrated after the Vietnam War. There is a higher concentration of Vietnamese in New Orleans, with smaller concentrations in Plaquemines Parish. There are still some folks who are living in Plaquemines Parish, as it is more accessible for the boats.

I cannot talk about the communities in the coastal parishes. I spend less time in the parishes but am sure that Sandy Nguyen would know more. The Vietnamese community has been in New

Orleans since the Vietnam War when they came here as refugees, and have always fished in the Gulf. I am not sure of the specifics of how they spend their time (i.e., if they live in New Orleans and fish in the lower parishes).

Have you talked to folks in the communities about potential impacts of the sediment diversion project on the Vietnamese community?

I attend meetings and other events, and the community's main concern is that the freshwater diversion would push shrimping farther out or impact where the shrimp are located, which would affect fuel costs. The community is worried that this would directly impact both shrimping and the oyster industry.

Is the Vietnamese community doing oystering?

Yes. The leases are not owned, but some community members are oyster shuckers or have oyster processing jobs, so they would be affected if the oysters were impacted.

Has the Vietnamese community been previously affected by freshwater diversion projects?

I am not sure about that.

Please summarize – what do you see as major obstacles or challenges that the Vietnamese communities are facing over next five years, not just with the diversion, but in general?

Disasters are a constant challenge and even before the oil spill, the fishing industry in this region had competition from imports. A large portion of seafood is imported. The oil spill had a big impact. Land loss, which the diversion project trying to mitigate, and climate change are bringing challenges. With fishermen, the prices for shrimp are lower than they have been and fuel costs are important to them. Fishermen have had a rough time in the last few years.

There are many cumulative impacts – natural and manmade pressures – and things outside of the Vietnamese community's control. A big consolidation in the shrimping market in the region. Yes, 85% of shrimp comes from overseas. Are people getting out of the industry?

I do think younger Vietnamese folks are less involved in the fishing industry and seafood. As with other immigrant communities, they tend to want the younger generation to have more white collar jobs and the younger generation to take advantage of school and attend universities.

Please talk about land loss and climate change. How are they being affected by land loss?

Land loss has been going on for 100 years now. In this region, we lose so much land every day – a size of a football field every hour and a half from oil and gas building to canals with saltwater intrusion that kills vegetation. This land loss increases flooding and higher storm surge. If you look at a map of Louisiana years ago, it is very different from current maps. The land loss affects the ability to buy insurance and live in the southern parishes. Our group is an advocate for non-structural projects, which includes flood-proofing and elevating homes. All people need to be doing this because of land loss. Community members have had to deal with this their entire lives.

I traveled to southern Plaquemines Parish last month and saw the amount of land loss in this region. Compared to years ago when land in the region was 10–20 feet above the water level, only the road is still above the water level.

Do you think people in the community are concerned more with short-term impacts or do they understand the long-term benefits for a project like this? Is there uncertainty? What are their views and tradeoffs?

They have concerns and are worried about the short-term future. Most residents understand why projects are needed and why land needs to be built. The communities want to be more informed by the state and to have more research done by the state in terms of how communities will be affected. They would like to learn more about the impacts that are associated with the projects.

These projects are so complex, with models, and communicating this to the public is a challenge.

These communities want to be part of the process as well. They have been dealing with coastal issues and land loss for many years and they have expertise in these matters. There should be input from these communities.

Is language a barrier to understanding these projects and communications?

With the public process and meetings, language is definitely a barrier for community members to be able to provide their input and understand the process and communications. Trying to help these communities understand is part of our job.

It is very important that you are reaching out and collecting community input, and it is very appreciated.

Scott Hemmerling, Director of Human Dimensions, The Water Institute of the Gulf
Interview date: 12/17/2018

Abt attendees: Lisa McDonald and Olivia Griot

What is your background/biography?

- Director of Human Dimensions at the Water Institute since 2013
- Before that I was with U.S. Geological Survey
  - Co-located with the Department of Natural Resources, which eventually become CPRA
    - Worked on the cultural heritage section and GIS for the CMP
    - Worked on the social vulnerability index for the 2017 master plan
- Cultural geographer by training
- My PhD was funded by the Bureau of Ocean Energy Management to perform EJ assessments for the federal government
- Went to the Water Institute because there was not much opportunity to perform socioeconomic research at the U.S. Geological Survey
  - Still do work on geospatial components
- Currently work on EJ from a historical perspective – looking at growth of the oil and gas industry from 1950 to 2010 to correlate with EJ population impacts and tropical storms
- Also working with diversion modeling team and fishermen to redesign models with traditional ecological knowledge from fishermen.

Scenario-building workshops

- Holding scenario-building workshops that focus on diversions
  - If diversions are implemented, we estimate what is going to happen using a decision tree

  - Working on home elevation scenarios
  - Show what community members see as the impacts of diversion projects
  - When communities were informed that the funding came from CPRA, they essentially shut the project down
    - Fishermen refused to help with coming up with alternative scenarios of not doing the diversion because did not want their words to be used against them by the state (1) Talked about other alternatives to the diversion
  - In Plaquemines and St. Bernard parishes, the diversions gave them something to attack rather than the land loss issue
    - Because the community has seen negative impacts with other diversion projects, they think the same thing is going to happen with the MBSD
- Scenario building is useful because it does not allow for knee-jerk reactions – if this happens, then what happens next?
  - In case of home elevations, the knee-jerk reaction might be that if we do not elevate, we have to leave. But with the scenario-building process, we can determine the tipping point if we do not leave right away.

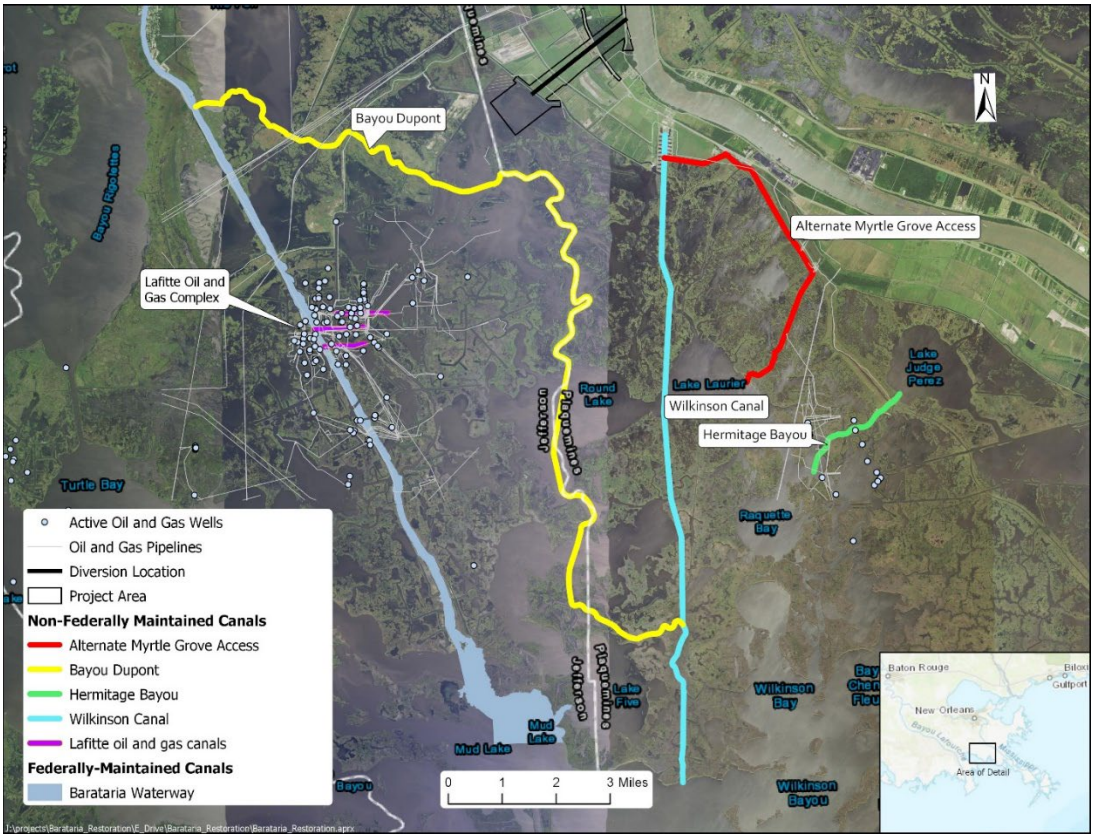
Communities

- Monica Barra is very involved with the community in Plaquemines Parish
  - Going to many public meetings in Ironton
  - Works at the University of South Carolina
  - She will be protective of this community because she does not want to be seen as helping the enemy
- People are part of this system and are affected by these decisions.

Appendix C: Evaluation of Non-Federally Maintained Channels and Canals

This discussion in this Appendix evaluates the operational impacts of the project alternatives on the non-federally maintained channels and canals located on the Basin side of the Project. Specifically, the evaluation considered impacts from changes in sedimentation of non-federally maintained channels and canals as a result of operation of the Project. CPRA identified a representative sample of non-federally maintained channels that may be important to the recreational fishing industry within the area of potential impact, including those channels that provide access to the Myrtle Grove Marina (Figure 2-6). In addition, three canals that service oil and gas operations were evaluated for potential impacts.

Figure C-1 Non-Federally Maintained Channels and Canals Evaluated



Abt used the results of the Delft V3 Basinwide Model production runs performed as part of the MBSD EIS to evaluate potential sedimentation caused by the project alternatives to select non-federal maintained channels. Due to the number of variables that will affect future sedimentation, as well as the fact that the Delft model has not been validated to predict changes in channel sedimentation, the actual degree of sedimentation during Project operations is likely to range from -50% to +100% compared to the numeric values projected by the production runs. As such, Abt prepared a semi-quantitative analysis to provide a relative measure of potential impacts of the project alternatives as compared to No Action. While the results provide relative

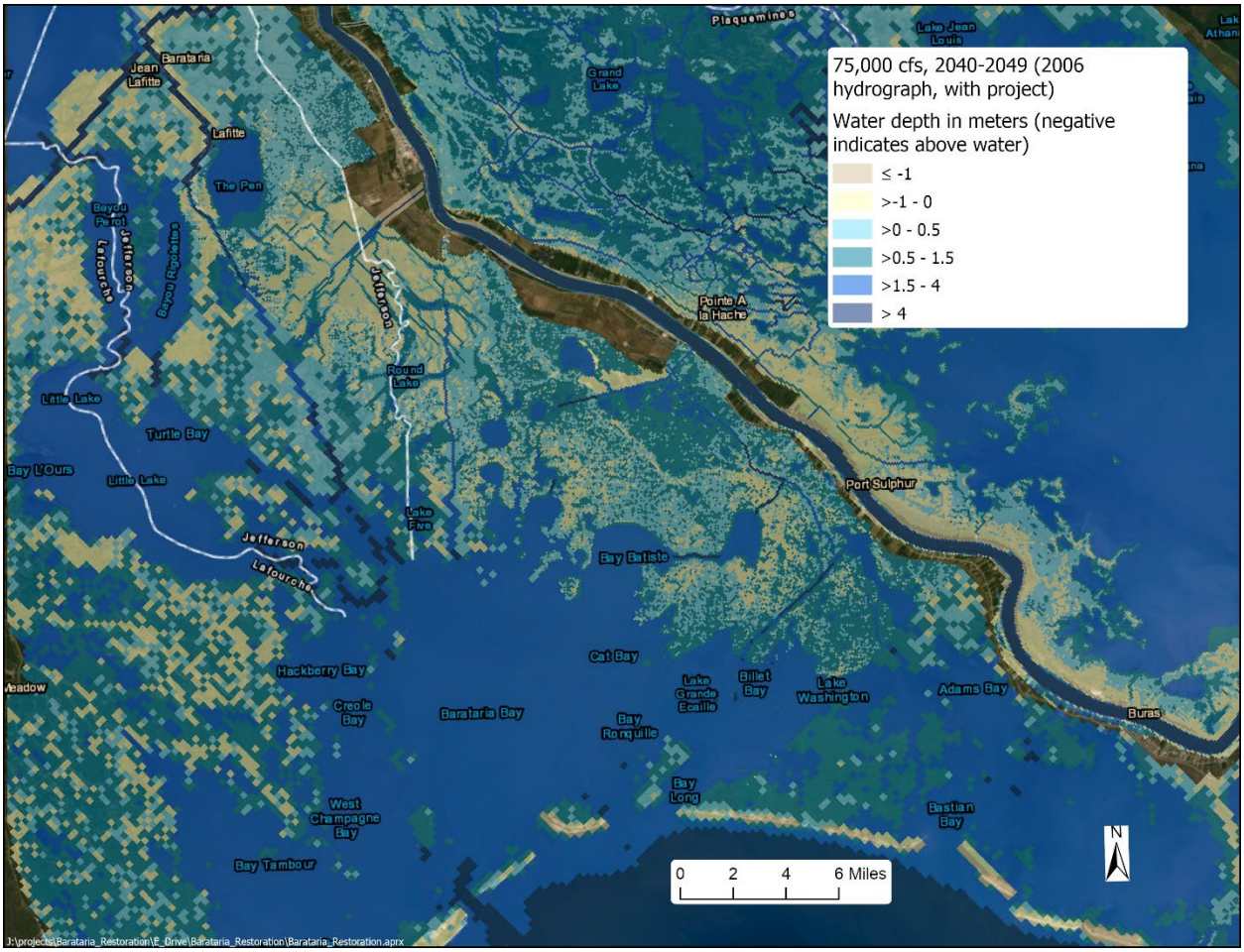
measures, they are not appropriate to use to estimate absolute measures of changes in sedimentation or the costs of potential mitigation.

Changes in sedimentation were evaluated using the following steps.

- Step 1 - projected water depths relative to the mean daily low water level were derived (i.e., mean low tide) under the various project alternatives and model years (2020-2029, 2040-2049. 2060-2069) using a combination of time series water level data (relative to the NAVD88 vertical datum) at 16 monitoring stations and the change in bed elevation height (relative to the NAVD88 vertical datum) using the gridded polygon data of bed elevations (

-
- **Figure C-2**). The analysis used the low hydrograph year (2006) to simulate worse case conditions.
- Step 2 - for each of the 16 monitoring stations, the average minimum daily water levels were calculated from time series water level data provided by The Water Institute.
- Step 3 - a gridded surface of average minimum daily water levels was generated over the extent of the modeling domain (gridded polygon data) through interpolation of the station water levels derived in Step 1.
- Step 4 - water surface polygons were overlaid with the bed elevation polygons for each decade for each project alternative.
- Step 5 - water depth (water level – bed elevation) was then calculated for each project alternative. Note that a negative depth would indicate a water level above the mean annual minimum daily level.
- Step 6 - the resulting water depth data was overlaid with canal locations to calculate changes in sedimentation to the canals.

Figure C-2. Evaluation of Average Depth Bins for Preferred Alternative



No Action Alternative

Depths for the four non-federally maintained channels under the different decades are summarized in **Error! Reference source not found.** and oil and gas canals are summarized in Table C-2 for the No Action Alternative. For the non-federally maintained channels, depths on average are increasing over time, with increases in the 2–6 foot and greater than six foot depth bins. This is most notable in Bayou Dupont, which shows the length of the channel increasing in the greater than six-foot depth by approximately ten miles. While the results for the oil and gas canals also show an increase in depths, the increases are not as significant as those in non-federally maintained channels. Note that the modeling results show some lengths of the channels and canals that are above ground under the NAA. This may be due to discrepancies in the Geographic Information System (GIS) and Delft modeling that may not represent actual on the ground conditions. Also, the hydrograph used for the analysis was 2006 and represents a low water year.

Table C-1. No Action Alternative – Estimated Length of Channels within Each Average Depth Bin

Decade	Wilkinson Canal				Hermitage Bayou				Alternative Myrtle Grove Access				Bayou Dupont			
	Depth Bins				Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	700	1,900	2,200	14,900	500	1,300	2,100	-	3,500	5,100	700	100	2,200	5,000	26,700	100
2040-2049	400	800	2,600	15,800	400	1,000	2,400	-	700	5,300	3,300	100	1,600	2,700	27,200	2,500
2060-2069	300	200	2,300	16,800	-	600	2,700	500	100	2,500	6,700	100	100	1,600	16,600	15,800

Table C-2. No Action Alternative – Estimated Length of Oil and Gas Canals within Each Average Depth Bin

Decade	Oil and Gas Canal #1				Oil and Gas Canal #2				Oil and Gas Canal #3			
	Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	-	-	1,300	200	-	500	400	400	-	700	900	-
2040-2049	-	-	1,300	200	-	-	900	400	-	100	1,400	-
2060-2069	-	-	1,300	200	-	-	600	700	-	-	1,300	300

Applicant's Preferred Alternative

The estimated lengths by average depth bins for the non-federally maintained channels and oil and gas canals under the Applicant's Preferred Alternative are summarized in Table C-3 andTable C-4, respectively. Table C-5 and Table C-6 show the difference in channel and canal lengths by average depth bin as a result of the Applicant's PA. The modeling projects that the Wilkinson Canal will see a reduction in the length in the greater than six foot average depth bin in every decade. However, a significant portion of the channel (67% of its length) will remain in this depth bin through the end of the study period. The Alternative Myrtle Grove Access channel (see Figure C-1) will also experience increases in sedimentation over the study period as a result of the Applicant's Preferred Alternative. The modeling results show decreases in the 2-6 foot and greater than 6 foot average depth bins while the 0-foot and 0-2 foot average depth bins are showing increases. The Hermitage Bayou would also experience some sedimentation but impacts are expected to be negligible.

To understand the potential magnitude of dredging costs that may be required to offset increases in canal sedimentation under the project alternatives, a semi-quantitative assessment was conducted using the results of the channel depth analysis. Because of the uncertainties associated with the Delft 3D Basinwide Model and GIS modeling results and the number of variables needed to estimate costs of dredging, this estimate was only developed for the Wilkenson Canal. This semi-qualitative result is used for the purposes of comparing project alternatives and should not be considered representative of actual dredging costs to offset impacts.

Table C-7 summarizes the estimated dredging costs for sections of the Wilkinson Canal that would fall in the zero to two-foot average depth bin as a result of the Applicant's Preferred Alternative. Column 2 shows the length of the channel that would fall in this depth bin under each decade. It was assumed that the channel would need to be dredged to a target depth of three feet, based on depth requirements for some fishing boats. All lengths of the channel, in the 0 to 2 average depth bin are assumed to be at zero depth (conservative assumption) prior to dredging. Using an average channel width of 240 feet, the amount of material that would need to be removed through dredging was estimated in column 5. The material requirements were then multiplied by an average unit dredging cost of $4[83] per cubic yard to estimate expected dredging costs for the channel lengths that fall in this average depth bin. Given the uncertainty associated with the modeling results and the number of factors that would be needed to accurately estimate a unit cost of dredging in this area, a range of costs are shown in Table C-7. The costs shown in Table C-7 represents a one-time cost in each decade and do not account for the frequency that dredging would need to occur in order to keep these lengths of the channel at a three-foot depth.

1. [83] CPRA provided an average cost of $4 per cubic yard based on experience in the Barataria Basin (Joffrion, 2019). The actual cost would likely vary from this estimate given a number of variables such as size of the project, mobilization and demobilization costs, and dredging method.

Table C-3. Approximate Length of Non-federally Maintained Channels within Each Average Depth Bin – Applicant's Preferred Alternative

Decade	Wilkinson Canal				Hermitage Bayou				Alternative Myrtle Grove Access				Bayou Dupont			
	Depth Bins				Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	1,200	1,800	2,300	14,400	500	1,300	2,000	-	3,900	5,200	300	-	4,200	11,500	18,400	100
2040-2049	1,500	1,900	2,600	13,700	500	900	2,400	-	1,400	6,300	1,700	-	8,600	5,200	20,000	300
2060-2069	1,300	1,500	3,700	13,100	100	900	2,800	-	200	6,400	2,600	100	6,300	5,600	18,600	3,600

Table C-4. Approximate Length of Oil and Gas Canals within Each Average Depth Bin – Applicant's Preferred Alternative

Decade	Oil and Gas Canal #1				Oil and Gas Canal #2				Oil and Gas Canal #3			
	Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	-	1,100	300	200	-	500	400	400	400	800	500	-
2040-2049	200	1,000	300	-	-	500	700	-	500	700	400	-
2060-2069	-	1,200	200	200	-	-	1,200	-	-	1,500	100	-

Table C-5. Difference in Approximate Length of Non-federally Maintained Channels within Each Average Depth Bin – Applicant's Preferred Alternative – No Action Alternative

Decade	Wilkinson Canal				Hermitage Bayou				Alternative Myrtle Grove Access				Bayou Dupont			
	Depth Bins				Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	500	(100)	100	(500)	-	-	(100)	-	400	100	(400)	(100)	2,000	6,500	(8,300)	-
2040-2049	1,100	1,100	-	(2,100)	100	(100)	-	-	700	1,000	(1,600)	(100)	7,000	2,500	(7,200)	(2,200)
2060-2069	1,000	1,300	1,400	(3,700)	100	300	100	(500)	100	3,900	(4,100)	-	6,200	4,000	2,000	(12,200)

Table C-6. Difference in Approximate Length of Oil and Gas Canals within Each Average Depth Bin – Applicant's Preferred Alternative – No Action Alternative

Decade	Oil and Gas Canal #1				Oil and Gas Canal #2				Oil and Gas Canal #3			
	Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	-	1,100	(1,000)	-	-	-	-	-	400	100	(400)	-
2040-2049	200	1,000	(1,000)	(200)	-	500	(200)	(400)	500	600	(1,000)	-
2060-2069	-	1,200	(1,100)	-	-	-	600	(700)	-	1,500	(1,200)	(300)

Table C-7. Estimated Dredging Cost Range for the Wilkinson Canal (0-2 Foot Average Depth Bin)

Decade	Change Length of Canal in 0-2 Feet Depth Bin (APP-NAA) (meters)	Original Depth (feet)	Dredging Depth (feet)	Dredging Needs (cubic yards)[a]	Range of Estimated Dredging Costs[b,c]
(1)	(2)	(3)	(4)	(5)	(6)
2020-2029	500	0	3	43,121	$86,000 to $345,000
2040-2049	1,100	0	3	94,866	$190.000 to $750,000
2060-2069	1,300	0	3	112,114	$224,000 to $897,000

[a] Assumes Wilkinson Channel is 240 feet wide based on GIS analysis.
[b] Estimated with a unit dredging cost of $4 cubic yard (Joffrion, 2019).
[c] Range of costs estimated with assumed error bounds of -50% to +100%

Table C-8 summarizes a similar evaluation of dredging costs for the Wilkinson Channel for the channel length that would fall in the two to six-foot average depth bin. Here it was assumed that the channel depth would start at two feet deep (conservative estimate) with the implementation of the Applicant's Preferred Alternative. Dredging requirements were then based on the assumption that the channel lengths in this bin would be dredged to an average depth of three feet. Dredging material requirements and a range of costs are estimated in column five and six.

Table C-8. Estimated Dredging Cost Range for the Wilkinson Canal (2-4 Foot Average Depth Bin)

Decade	Change Length of Canal in 2-6 Feet Depth Bin (APP-NAA) (meters)	Original Depth (feet)	Dredging Depth (feet)	Dredging Needs (cubic yards)[a]	Range of Estimated Dredging Costs[b,c]
(1)	(2)	(3)	(4)	(5)	(6)
2020-2029	100	2	3	5,749	$11,000 to $46,000
2040-2049	0	2	3	0	$0
2060-2069	1,400	2	3	80,492	$161,000 to $644,000

[a] Assumes Wilkinson Channel is 240 feet wide based on GIS analysis.
[b] Estimated with a unit dredging cost of $4 cubic yard (Joffrion, 2019).
[c] Range of costs estimated with assumed error bounds of -50% to +100%

Other Alternatives

Impacts of the other five project alternatives on the non-federally maintained channels and oil and gas canals were also evaluated using the same approach as with the Applicant's Preferred Alternative. Table C-9 shows the difference in length of the channels by depth bin between the 50,000 cfs Alternative and the NAA for the non-federally maintained channels. Table C-10 shows the difference between the 50,000 cfs Alternative and NAA for the oil and gas canals. The modeling shows that the 50,000 cfs Alternative would also result in sedimentation to three of the four non-federally maintained channels evaluated with no additional sedimentation in Hermitage Bayou. In general the amount of sedimentation under the 50,000 cfs Alternative is less than what is expected under the Applicant's Preferred Alternative. Changes in sedimentation in the oil and gas canals would be similar or slightly less than what is predicted under the Applicant's Preferred Alternative.

For the 150,000 cfs Alternative, the modeling shows an increase in sedimentation over the study period to all the non-federally maintained channels (**Table C-11**) and oil and gas canals (

Table **C-12**) and the level of sedimentation would be slightly higher than what is predicted under the Applicant's Preferred Alternative.

While small boat traffic is not expected to be affected in the channels accessing Myrtle Grove, larger fishing vessels may not be able to access canals if water depths are less than three feet and may require additional maintenance dredging of certain parts of the channels and canals, or other marine infrastructure as a result of the increases in sedimentation. For boats that utilize Bayou Dupont, alternative waterway or canals could be utilized to access the Barataria Bay to avoid areas where the canal is experiencing increases in sedimentation.

Table C-9. Difference in Length of Non-federally Maintained Channels within Each Average Depth Bin – 50,000 cfs Alternative – No Action Alternative

Decade	Wilkinson Canal				Hermitage Bayou				Alternative Myrtle Grove Access				Bayou Dupont			
	Depth Bins				Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	(100)	-	(500)	600	-	-	-	-	(300)	(100)	300	100	(1,900)	(6,100)	8,000	-
2040-2049	900	1,500	(200)	(2,200)	-	-	-	-	300	300	(600)	-	7,100	3,100	(7,800)	(2,300)
2060-2069	1,100	2,300	(300)	(3,200)	-	-	-	-	-	1,300	(1,300)	-	8,900	4,000	(3,700)	(9,000)

Table C-10. Difference in Length of Oil and Gas Canals within Each Average Depth Bin – 50,000 cfs Alternative – No Action Alternative

Decade	Oil and Gas Canal #1				Oil and Gas Canal #2				Oil and Gas Canal #3			
	Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	-	1,000	(1,000)	-	-	-	-	-	100	200	(400)	-
2040-2049	200	1,000	(1,000)	(200)	-	500	(100)	(400)	700	400	(1,100)	-
2060-2069	200	1,000	(1,000)	(200)	-	500	200	(700)	900	600	(1,400)	-

Table C-11. Difference in Length of Non-federally Maintained Channels within Average Each Depth Bin – 150,000 cfs Alternative – No Action Alternative

Decade	Wilkinson Canal				Hermitage Bayou				Alternative Myrtle Grove Access				Bayou Dupont			
	Depth Bins				Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029																
2040-2049																
2060-2069																

Table C-12. Difference in Length of Oil and Gas Canals within Each Average Depth Bin – 150,000 cfs Alternative – No Action Alternative

Decade	Oil and Gas Canal #1				Oil and Gas Canal #2				Oil and Gas Canal #3			
	Depth Bins				Depth Bins				Depth Bins			
	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft	O Ft	0-2 Ft	2-6 Ft	> 6 Ft
2020-2029	-	500	(500)	-	-	-	-	-	400	200	(600)	-
2040-2049	-	600	(400)	(200)	-	500	(100)	(400)	700	600	(1,300)	-
2060-2069	-	1,200	(1,000)	(200)	-	-	700	(700)	1,000	500	(1,400)	(100)

Appendix D: Economic Impact of the Design and Construction of the Mid-Barataria Sediment Diversion Project

Methods and Assumptions

This appendix describes the methodology used to estimate the economic benefits associated with the design and construction of the Mid-Barataria Sediment Diversion (MBSD) project.

D.1.1 Input-Output Analysis and IMPLAN®

Abt Associates (Abt) used IMPLAN® (2019) to estimate the regional economic impact of the design and construction of the MBSD project. The IMPLAN® software and data constitute an input-output (I/O) model specified for a region that can be used to estimate the impacts of changes in regional economic activity. I/O models measure the interdependence among industries in the regional economy, which provides an estimate of multiplier effects, or how a change in one industry can ripple across other industries and create larger total economic effects. These models can describe the demand and supply of products and services among industries, households, and governments to create a quantitative description of an economy within a specified area. IMPLAN® is an industry-standard I/O model used to estimate economic impacts.

IMPLAN® customizes regional I/O models to provide estimates of output (sales), employment, income, and gross regional product effects in a specified location. The model has the capability to analyze 536 industry sectors, providing a detailed examination of economic effects on specific industries. The types of impacts that can be estimated using this model are summarized in Table D.1.

Table D.1. Economic impact definitions

Type of impact	Definition
Direct	The revenues or expenditures received by the industry experiencing the economic change (e.g., the construction industry would be one of the directly affected industries).
Indirect	The backward-linked industry suppliers for any goods and services used by the directly affected industries.
Induced	The results of local spending of employees' wages and salaries for both employees of the directly affected industry and employees of the indirectly affected industries.

IMPLAN® software and data include a doubly constrained gravity model to estimate trade flows among regions using estimates of commodity demand and supply. In general terms, the import and export flows between regions are thought to be proportional to the mass, attractiveness, or size of an economy; and are inversely proportional to the distance or cost of moving goods and services among them. In most cases, IMPLAN®'s trade-flow ratios (from 0 to 1) are used to estimate the portion of the regional production value that can be used to satisfy local demand. These ratios are described in IMPLAN® as regional purchase coefficients (RPCs); RPCs are applied to intermediate purchases to estimate economic leakages for indirect and induced effects. Local purchase percentages (LPPs), ranging from 0 to 1, are applied to direct effects to estimate how much of the locally demanded direct stimulus can be met with local industry or suppliers.

D.1.2 Study Area

IMPLAN® datasets are available from the ZIP Code level to the national level, and regional data can be combined to create representative geographic regions for calculating economic impacts.

The proportion of construction spending that is captured within a study area depends on the size of that study area. In an IMPLAN® analysis, purchases of products or labor that fall outside the study area are considered imports. Therefore, the determination of a study area is an important part of the evaluation because it affects assumptions surrounding economic leakages.

At a minimum, the study area should contain the region where the project will be constructed. In addition, the study area should also include proximate locations from which workers will travel to the project site. According to construction experts, the construction workforce for most of this project will originate from within the State of Louisiana (90%), with a high concentration from the New Orleans metropolitan region. The State of Louisiana was chosen to be the study area to capture a broad array of impacts related to the design and construction of the MBSD. Although the state study area was chosen, most of the direct and multiplier effects will be experienced in the broader New Orleans region due to the high concentration of activity in that area.

D.1.3 Cost Estimates for the Alternatives

The project team used cost estimates from the Preparation of Engineering and Design Basis of Design Report, Appendix F, Construction Cost Estimates, prepared by AECOM Technical Services (2018) for the Coastal Protection and Restoration Authority, as inputs to the IMPLAN® model. Specifically, the Basis of Design (BOD) Class 3 Cost Estimates, 15% Design, were used from this appendix (starting on p. 118 of the document) for the Preferred Alternative. Cost estimates for the 50,000 cfs and 150,000 cfs diversion structures, Alternatives 3 and 5, respectively, were obtained from AECOM cost memoranda (AECOM Design Team, 2018, 2019). Alternatives 2, 4, and 6 add $1.3 million to Alternatives 1, 3, and 5, respectively, for the terrace features of the project. All MBSD cost estimates used in this evaluation are reported in 2018 dollars. Construction cost estimates used in this evaluation do not include any escalation costs as reported in the BOD. In addition, construction costs associated with feature options (e.g., T-wall intake option) for each alternative were not included in the analysis. Table D.2 summarizes the construction cost estimates used in the evaluation.

Table D.2. Construction costs of alternatives (BOD 15%, 2018$)

Alternative feature	Alternative 1 – 75,000 cfs	Alternative 3 – 50,000 cfs	Alternative 5 – 150,000 cfs
Open cut U-frame intake	$245,010,743	$220,793,767	$327,000,145
Gated diversion structure	$61,031,245	$52,442,842	$101,816,911
Transitions and wingwalls	$53,244,418	$51,499,881	$60,403,944
Railroad bridge	$44,388,923	$42,540,056	$48,100,502
Highway 23 roadway and bridge	$53,249,158	$50,243,558	$60,542,158
Channel and levee	$258,752,377	$266,594,979	$412,575,376
Interior drainage	$28,073,199	$26,746,290	$33,391,151
Secondary site features	$4,574,804	$4,574,804	$4,574,804
Utility relocations	$32,955,000	$32,684,600	$41,784,600
Temporary construction features	$30,215,510	$30,215,510	$30,215,510
Beneficial use material	$997,500	$973,665	$1,947,330
Allowance for flood of cofferdam during construction	$2,000,000	$1,500,000	$4,000,000
Mobilization and demobilization	$24,434,786	$23,424,299	$33,790,573
Insurance	$8,473,169	$8,042,343	$11,601,430
Performance bond	$8,473,169	$8,122,766	$11,717,444
Total (not including escalation costs)	**$855,874,001**	**$820,399,360**	**$1,183,461,878**

Sources: AECOM Design Team (2018, 2019); AECOM Technical Services (2018, p. 118).

D.1.4 Data Inputs, Spending Profiles, and LPPs

Construction expenditures were mapped to appropriate sectors in the IMPLAN® model, whenever possible. In addition, information from the U.S. Army Corps of Engineer (USACE) Regional Economic System (RECONS)[84] was used to develop cost allocations to appropriate IMPLAN® sectors for a number of the alternative features. RECONS categorizes USACE spending based on "work activities" for the type of project activity occurring and associated with each expenditure (e.g., lock construction, erosion control, earthwork). Each work activity has an associated "spending profile" that allocates the total cost of the work activity to multiple IMPLAN® sectors. For example, many construction work activities include cost categories such as labor, indirect contractor costs, equipment, and materials.

A number of construction work activities in RECONS have used USACE Micro-Computer Aided Cost Estimating System cost factors in developing the spending profiles. The cost factors were updated in 2013 by the USACE Cost Engineering Center of Expertise, located at the Walla Walla District; and include reviews of hundreds of cost estimates. The cost factors include an allocation of project costs among construction labor, indirect contractors, equipment, and materials. In many cases in RECONS, the work activity spending profile also includes USACE project management, engineering, and planning costs; for this analysis these expenditures were removed and normalized to focus on construction expenditures. Indirect contractor costs include items that are not unitized to the project but are typically incurred by the contractor. Examples include contractor overhead (e.g., office costs), job site overhead (e.g., vehicles, trailers), and

[84]. RECONS is an online regional economic software that uses IMPLAN's data and multipliers to estimate the jobs, income, gross regional product, and sales associated with USACE Civil Works spending, including construction, operations and maintenance, and investigation spending.

contractor profit. For the spending profiles that use RECONS work activities, the materials identified in the cost estimates in AECOM Technical Services (2018) were mapped to specific industries that produce those materials.

Abt customized the LPPs for the construction sectors, indirect contractor costs, and construction labor to be 90% within the state; in general, most of the workforce is expected to originate from within the state, with only 10% of highly skilled workers coming from locations outside the state (Crowe, 2019). The equipment and materials sectors used IMPLAN®'s RPCs to estimate the proportion of expenditures that can be met with local (i.e., state) sources.

D.1.5 Design, Engineering, Project Management, and Permitting

Engineering and design cost estimates were mapped to Architectural, Engineering, and Related Services (Sector 449) in the model. Design costs were $118.5 million and were assumed to be in 2018 dollars (CPRA, 2019). Costs incurred by the Coastal Protection and Restoration Authority for project management, engineering, and permitting total approximately $119 million. These costs were run through Other State Government (Sector 523) in the model.

D.1.6 Project Construction

Intake Structure, Gated Monolith, and Transition and Wingwalls

The spending profile for the intake structure, gated monolith, and transition and wingwalls used the RECONS work activity "lock construction of onsite features" because of the similarity in the type of structure. The gate itself was treated as a separate feature (described in the following section). The lock construction work activity is described in USACE IWR (2019):

> Lock construction of onsite features entails new construction and major rehabilitation of locks such as foundation work, drainage, guide walls, guard walls, approach walls, and construction of monoliths, access roads, and bridges. Such projects include onsite modifications with materials fabricated offsite, such as operations machinery, piping, power and lighting systems, and milling machines. During this type of work, a concrete batch plant is sometimes erected onsite and materials and equipment are sourced at the local, regional, and national level.

Based on the RECONS lock construction work activity, the spending profile was allocated as follows:

- Construction labor: 31%
- Indirect contractor costs: 36%
- Construction equipment: 5%
- Materials: 28%.

Materials expenditures were mapped to multiple sectors in IMPLAN® based on a review of the costs identified in AECOM Technical Services (2018, pp. 120–124); and were weighted based on their prevalence in the cost estimates. The LPPs for construction labor and indirect contractor costs were assumed to be 90%, while costs for construction equipment and materials used IMPLAN®'s RPCs[85] to estimate the LPPs for this expenditure category.

[85]. IMPLAN derives RPCs for various industries from the regional trade flows included in the model.

Gates

The allocation of costs for the gate components used the RECONS work activity "lock or dam gate fabrication and installation." The steel gate manufacturing represents the bulk of these costs. The gate fabrication itself is a highly specialized steel manufacturing process undertaken by only a few companies in the United States. IMPLAN®'s RPCs were used for the steel product manufacturing, with 19% of the expenditure captured within the state. This is consistent with discussions with engineering and construction experts, who noted that the gates would likely be fabricated in Missouri (Crowe, 2019). The spending profile was allocated as follows:

- Gate fabrication: 90%
- Installation labor: 10%.

The LPP for installation labor was assumed to be 90%, while the gate fabrication [Fabricated Structural Metal Manufacturing (Sector 238)] used IMPLAN®'s RPCs to estimate the LPPs; for Sector 238, the RPC is 19%.

Highway 23 Roadway and Bridge and Railroad Bridge

These costs were applied to the Highway, Streets, and Bridges Construction sector (Sector 56); and the Other New Nonresidential Construction sector (Sector 58)in IMPLAN® was based on costs identified in AECOM Technical Services (2018, pp. 125–126). The Other New Nonresidential Construction sector (Sector 58) includes transit construction. Again, the LPPs for these construction sectors were set to 90%, based on the assumption that most of this work would be completed by companies and a workforce originating within the state.

Channel and Levee

The spending profile for the channel and levee work used the RECONS work activity "construction, repair, and major rehabilitation of earth, concrete, and steel channels and canals" because of the similarity in the project component (USACE IWR, 2019). Based on the RECONS channels and canals construction work activity, the spending profile was allocated as follows:

- Construction labor: 24%
- Indirect contractor costs: 35%
- Construction equipment: 5%
- Materials: 35%.

Materials expenditures were mapped to multiple sectors in IMPLAN® based on a review of costs identified in AECOM Technical Services (2018, p. 127), and were weighted based on their prevalence in the cost estimates. The LPPs for construction labor and indirect contractor costs were assumed to be 90%, while costs for construction equipment and materials used IMPLAN®'s RPCs to estimate the LPPs.

Interior Drainage

The component of interior drainage included a siphon, earthwork for ditches, a pump station upgrade, and a release valve. Spending profiles for siphon expenditures were based on the RECONS work activity "lock construction of onsite features" due to the similarity in the types of construction activities. The spending profile is the same as the one reported above in the intake structure, gated monolith, and transition and wingwalls section. Expenditures for the earthwork for ditches were all allocated to the Other New Nonresidential Construction sector (Sector 58) in IMPLAN® because of the consistency with this type of activity. The spending profile for the pump station upgrade was based on the RECONS work activity "construction or major rehab of

pumping station." Materials components were customized and weighted based on material items in construction cost estimates for this feature. The spending profile for the pump station construction expenditures was allocated as follows:

- Construction labor: 21%
- Indirect contractor costs: 36%
- Construction equipment: 4%
- Materials: 40%.

Release valve expenditures were mapped to the appropriate valve manufacturing sector in IMPLAN®. The LPPs for construction labor and indirect contractor costs were assumed to be 90%, while costs for construction equipment and materials used IMPLAN®'s RPCs to estimate the LPPs.

Secondary Site Features, Temporary Construction Features, and Beneficial Use Material

Secondary site features, temporary construction features, and beneficial use material expenditures were all mapped to appropriate construction sectors within IMPLAN® because of the similarity to these construction activities. IMPLAN® sectors that were used for these expenditures include Construction of Power and Communication Structures (Sector 54), Construction of New Highways and Streets (Sector 56), and Construction of Other New Non-Residential Construction (Sector 58). Construction cost estimates in AECOM Technical Services (2018, pp. 129–130) were used to identify the amounts mapped to various types of construction sectors in IMPLAN®. LPPs for these sectors were all set to 90%, based on the assumption that most of this construction work would be contracted to companies and a workforce within the state (Crowe, 2019).

Additional Items

Additional items include mobilization and demobilization, insurance and bond payments, and allowance for construction during a hurricane. Insurance and bond expenditures were mapped to the Insurance Carriers (Sector 437) in IMPLAN®, while mobilization/demobilization expenditures were allocated to Construction of Other New Non-Residential Construction (Sector 58). Additional costs in the event of a hurricane were not evaluated in the impact analysis as they may not occur during construction. The LPP for Sector 58 was set to 90%, based on the assumption that most of this construction work would be supplied by companies and a workforce within the state (Crowe, 2019); while the LPP for Sector 437 used IMPLAN®'s RPCs to estimate the LPP.

Terraces

Alternatives 2, 4, and 6 include terrace features. In each case, terraces are added to one of the capacity alternatives, Alternatives 1, 3, and 5. For example, Alternative 2 includes a 75,000 cfs diversion structure with terraces, Alternative 4 include a 50,000 cfs diversion structure with terraces, and Alternative 6 includes a 150,000 cfs diversion structure with terraces.
Alternatives 2, 4, and 6 include construction of marsh terrace features intended to expedite the near-term benefits of the project. A dredging work activity in RECONS was used to map expenditures ($1.3 million in 2018 dollars) to relevant sectors in IMPLAN®. The expenditures in the spending profile include dredge labor, fuel, repairs, equipment, and consumable operating expenses. The LPP for the dredge labor was set to 90%, consistent with the assumption that the bulk of the construction workforce would be from the State of Louisiana.

D.1.7 Margins

Margins represent the difference between producer and purchaser prices. Margins distribute expenditures among industry sectors that manufacture the products, retail and wholesale trade industries that sell the products, and industries that transport the products, including the truck, rail, waterborne, and pipeline sectors. For this analysis, margins were applied to most of the materials sectors; IMPLAN®'s margins allocate the cost expenditures among the relevant sectors.

D.2 Economic Impact Results

This section describes the results of the economic impact analysis, including the project's design and construction phases.

D.2.1 Design, Project Management, and Permitting

Economic benefits associated with the design, project management, and permitting of the project would be the same for all alternatives. The vast majority of these benefits would occur over a three- to five-year period. Because IMPLAN® is an annual model, all engineering and design expenditures were run through IMPLAN® as if they occurred in a one-year period. Table D.3 summarizes the total impacts of these costs over all years (top half of Table D.3). A total of $256 million in economic output would be supported by the engineering and design expenditures across all years. These total impacts were then averaged to get an understanding of annual impacts that would occur during the design phase (shown in the lower half of Table D.3). If the design phase were to last over a 4-year period, 422 jobs would be supported on average, with an average annual labor income, gross regional product, and sales of $30.2 million, $36.4 million, and $64.0 million, respectively.

Table D.3. Economic benefits of the design phase for each alternative (2018$)

Impact type	Employment	Labor income	Gross regional product	Economic output (sales)
Total economic impacts for all engineering and design costs				
Direct effect	729	$76,763,000	$73,135,000	$130,276,000
Indirect effect	392	$20,676,000	$28,929,000	$49,587,000
Induced effect	569	$23,375,000	$43,718,000	$76,272,000
Total effect	1,690	$120,814,000	$145,782,000	$256,135,000
Average annual impacts over a four year time period				
Direct effect	182	$19,191,000	$18,284,000	$32,569,000
Indirect effect	98	$5,169,000	$7,232,000	$12,397,000
Induced effect	142	$5,844,000	$10,930,000	$19,068,000
Total effect	422	$30,204,000	$36,446,000	$64,034,000

Notes: Employment includes full-time and part-time jobs. IMPLAN® is an annual model; in the first part of the table, all engineering and design costs were run in IMPLAN® through one year.

D.2.2 Construction

Alternative 1 – 75,000 cfs Diversion Structure – Preferred Alternative

The construction of the MBSD project is anticipated to occur over a three- to five-year period. Because IMPLAN® is an annual model, all construction expenditures were run through IMPLAN® as if they occurred in a one-year period. Table D.4 summarizes the total economic impacts for all construction expenditures as well as the average annual impacts if construction

were to occur over a four-year period. A total of $1.2 billion in economic output or sales would be supported by construction expenditures across all years. During the 5-year period, approximately 2,000 jobs would be supported, with an average annual labor income, gross regional product, and economic output or sales of $103.8 million, $141.1 million, and $236.2.2 million, respectively. On average over a 5-year period, there would be a construction workforce of approximately 1,300 workers (direct effect).[86]

Table D.4. Economic benefits of the construction of Alternative 1, the preferred alternative (2018$)

Impact type	Employment	Labor income	Gross regional product	Economic output (sales)
Economic impacts for all construction expenditures				
Direct effect	6,500	$365,641,000	$430,734,000	$683,676,000
Indirect effect	1,000	$52,181,000	$95,235,000	$183,438,000
Induced effect	2,400	$96,085,000	$179,691,000	$313,817,000
Total effect	9,900	$513,907,000	$705,661,000	$1,180,931,000
Average annual impacts over a five year time period				
Direct effect	1,300	$73,128,000	$86,147,000	$136,735,000
Indirect effect	200	$10,436,000	$19,047,000	$36,688,000
Induced effect	500	$19,217,000	$35,938,000	$62,763,000
Total effect	2,000	$102,781,000	$141,132,000	$236,186,000

Notes:
Totals may not sum due to rounding.
Employment includes full- and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® for one year. Therefore, the employment column represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, commercial and industrial machinery, and equipment rental and leasing.

Alternative 2 – 75,000 cfs Diversion Structure with Terraces

The economic impact of constructing the marsh terraces would support approximately 8 direct and a total of 12 jobs. Total labor income, gross regional production, and economic output or sales for this construction activity would support $649,000, $996,000, and $1.7 million, respectively. These economic impacts would be in addition to those described under Alternative 1.

[86]. The employment estimate is an average annual number and represents the number of workers that would be working onsite throughout the entire year. We estimated annual employment impacts as those associated with total construction costs averaged across a four-year construction period.

Alternative 3 – 50,000 cfs Diversion Structure

Table D.5 summarizes the total economic impacts for all construction expenditures as well as the average annual impacts if construction were to occur over a four-year period. During the 5-year period, an average of 1,900 jobs would be supported, with an average annual labor income, gross regional product, and economic output or sales of $99.7 million, $137.8 million, and $229.3 million, respectively. On average over a 5-year period, there would be a construction workforce of approximately 1,300 workers (direct effect). A total of $1.1 billion in economic output or sales would be supported by the construction expenditures across all years.

Table D.5. Economic benefits of the construction of Alternative 3 (2018$)

Impact type	Employment	Labor income	Gross regional product	Economic output (sales)
Economic impacts for all construction expenditures				
Direct effect	6,300	$352,099,000	$418,673,000	$655,625,000
Indirect effect	900	$50,130,000	$91,445,000	$176,085,000
Induced effect	2,300	$92,553,000	$173,085,000	$302,283,000
Total effect	9,500	$494,782,000	$683,203,000	$1,133,994,000
Average annual impacts over a five year time period				
Direct effect	1,300	$70,866,000	$84,324,000	$132,556,000
Indirect effect	200	$10,142,000	$18,499,000	$35,689,000
Induced effect	500	$18,712,000	$34,994,000	$61,060,000
Total effect	1,900	$99,720,000	$137,817,000	$229,304,000

Notes:
Totals may not sum due to rounding.
Employment includes full- and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® for one year. Therefore, the employment column represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, commercial and industrial machinery, and equipment rental and leasing.

Alternative 4 – 50,000 cfs Diversion Structure with Terraces

The construction economic benefits for the marsh terraces would be the same as those described under Alternative 2. These economic impacts would be in addition to those described under Alternative 3.

Alternative 5 – 150,000 cfs Diversion Structure

Table D.6 summarizes the total economic impact for all construction expenditures as well as the average annual impacts if construction were to occur over a four-year period. A total of $1.6 billion in economic output or sales would be supported by construction expenditures across all years under Alternative 5. During the 5-year period, approximately 2,700 jobs would be supported, with an average annual labor income, gross regional product, and economic output or sales of $142.3 million, $196.1 million, and $332.4 million, respectively. On average over a

5-year period, there would be a construction workforce of approximately 1,800 workers (direct effect).

Table D.6. Economic benefits of the construction of Alternative 5 (2018$)

Impact type	Employment	Labor income	Gross regional product	Economic output (sales)
Economic impacts for all construction expenditures				
Direct effect	9,200	$508,608,000	$604,652,000	$933,784,000
Indirect effect	1,300	$69,855,000	$127,160,000	$244,068,000
Induced effect	3,300	$132,865,000	$248,472,000	$433,949,000
Total effect	13,800	$711,328,000	$980,283,000	$1,611,801,000
Average annual impacts over a five year time period				
Direct effect	1,800	$101,722,000	$120,930,000	$186,757,000
Indirect effect	300	$13,971,000	$25,432,000	$48,814,000
Induced effect	700	$26,573,000	$49,694,000	$86,790,000
Total effect	2,700	$142,266,000	$196,057,000	$322,360,000

Notes:
Totals may not sum due to rounding.
Employment includes full- and part-time jobs.
IMPLAN® is an annual model; in the first part of the table, all construction costs were run in IMPLAN® for one year. Therefore, the employment column represents annual jobs if the construction activity occurred in one year.

The top 10 employing industries include construction, truck transportation, wholesale trade, restaurants, real estate, hospitals, commercial and industrial machinery, and equipment rental and leasing.

Alternative 6 – 150,000 cfs Diversion Structure with Terraces

The construction economic benefits for the marsh terraces would be the same as those described under Alternative 2. These economic impacts would be in addition to those described under Alternative 5.

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H2: Addendum and Final EIS Data Update

APPENDIX H2: ADDENDUM AND FINAL EIS DATA UPDATE

The Socioeconomics Technical Report in Appendix H1 includes 2013-2017 American Communities Survey (ACS) data and 2010 Decennial Census data. Subsequent to the development of the Socioeconomics Technical Report, the U.S. Census Bureau released more recent data than was included in that report. Updated data has been incorporated below and in the Final EIS. The table below provides updated demographic data, including 2014-2018 ACS data as well as 2020 Decennial Census data. See also Tables 3.15-6 and 4.15-1 of the Final EIS. The table below also includes data for Hermitage, Happy Jack, Suzie Bayou and West Pointe à la Hache that were not included in the Socioeconomics Technical Report, Table 2-4, as denoted by footnote c.

Table H.2-1. Environmental Justice Characteristics Associated with Communities in Plaquemines, Jefferson, and Lafourche Parishes Potentially Affected by the MBSD

Parish	Community	CDP or Census Blocks (2020)	Population[a]	Percent Minority[a]	Below Poverty Level (%)[a]
Plaquemines Parish (36% minority; 20% living below poverty level)	Belle Chasse	CDP	13,490	19%	11%
	Live Oak	Census Tract 504, Block Group: 2	2,575	26%	17%
	Ironton[b]	Census Tract 504, Block Group 1, Block: 1031, 1033, 1034, 1278, 1279	125-153	89-90%	18%[e]
	Myrtle Grove[b,f]	Census Tract 504, Block Group 1, Block: 1030, 1032, 1076, 1084, 1085	108-136	11-29%	18%[e]
	Grand Bayou	Census Tract 504, Block Group 1, Block: 1140, 1142, 1210, 1272, 1273	25	72%	18%[e]
	Hermitage[c]	Census Tract 504, Block Group 1, Block: 1099, 1100, 1101, 1108, 1116, 1122	62	63%	18%[e]
	Happy Jack[c]	Census Tract 504, Block Group 1, Block: 1127, 1128, 1202, 1209, 1210	16	25%	18%[e]
	Suzie Bayou[b,c]	Census Tract 504, Block Group 1, Block: 1038, 1073, 1075, 1076, 1082, 1099	40-157	22-35%	18%[e]
	Port Sulphur	CDP	2,175	83%	53%
	Empire	CDP	1,060	61%	40%
	Buras	CDP	907	24%	23%
	Triumph	CDP	493	26%	17%
	Boothville	CDP	626	53%	34%
	Venice	CDP	245	4%	11%
	Braithwaite	Census Tract 501, Block Group 2, Block: 2001, 2004, 2013, 2015, 2014, 2017	191	50%	51%[e]
	Scarsdale	Census Tract 501, Block Group 2, Block: 2014, 2015, 2017	41	12%	51%[e]
	Woodlawn	Census Tract 501, Block Group 2, Block: 2021, 2026	107	42%	51%[e]
	Wills Point	Census Tract 501, Block Group 2, Block: 2028, 2033	23	26%	51%[e]

Parish	Community	CDP or Census Blocks (2020)	Population[a]	Percent Minority[a]	Below Poverty Level (%)[a]
	Phoenix	Census Tract 501, Block Group 1, Block: 1055, 1057, 1258, 1259, 1260, 1261, 1464, 1465	253	99%	51%[e]
	Davant	Census Tract 501, Block Group 1, Block: 1251, 1253, 1254, 1255, 1256	777	82%	51%[e]
	West Pointe à la Hache[c]	Census Tract 504, Block Group 1, Block: 1048, 1049, 1050	32	75%	18%[e]
	Pointe à la Hache	CDP	217	100%	78%
	Bohemia	Census Tract 501, Block Group 1, Block: 1218	22	100%	51%[e]
Jefferson Parish (60% minority; 19% living below poverty level)	Estelle	CDP	17,099	44%	12%
	Woodmere	CDP	10,458	85%	22%
	Harvey	CDP	20,712	57%	17%
	Timberlane	CDP	10,192	54%	8%
	Crown Point	Census Tract 280, Block Group 1, Block: 1047, 1048, 1049, 1050, 1051	781	32%	10%[e]
	Jean Lafitte (town)	CDP	1,971	11%	16%
	Barataria	CDP	979	18%	5%
	Lafitte	CDP	990	4%	34%
	Grand Isle	CDP	757	1%	22%
Lafourche Parish (21% minority; 15% living below poverty level)	Thibodaux City	CDP	14,515	36%	19%
	St. Charles	Census Tract 209, Block Group 1, Block: 1005, 1006, 1007, 1008, 1009 Census Tract 219.02, Block Group 2, Block: 2000, 3015	337	18%	18%[e]
	Raceland	CDP	10,686	36%	17%
	Des Allemands	CDP	1,597	6%	15%
	Gheens	Census Tract 210, Block Group 2, Block: 2016, 2019, 2020, 2027, 2028, 2030, 2031, 2055	877	5%	19%[e]
	Mathews	CDP	2,649	4%	6%
	Lockport	CDP	2,489	7%	15%
	Larose	CDP	7,529	15%	15%
	Cut Off	CDP	5,897	22%	11%
	Galliano	CDP	7,131	26%	17%
	Golden Meadow	CDP	2,023	16%	21%
	Leeville[d]	Census Tract 211.01, Block Group 1, Block: 1136, 1138, 1149, 1152, 1160 Census Tract 212, Block Group 1, Block: 1034, 1046, 1047, 1048, 1052, 1053, 1054, 1055, 1056, 1057, 1058, 1060, 1062, 1065, 1068, 1202, 1203, 1204, 1209, 1210, 1290	58	22%	18%[e]
	Port Fourchon	Census Tract 211.01, Block Group 1, Block: 1154, 1184, 1186, 1190, 1197, 1200, 1202, 1204, 1205	42	33%	28%[e]

[a] Data sources: For parish, incorporated place, CDP, and block group level data, the source is American Community Survey (ACS) 5-Year Estimates, 2014-2018 (Census Bureau 2020). While 2020 ACS data was recently released, some data quality concerns exist regarding these data, which continue to be released as of this Final EIS (e.g., See U.S. Census Bureau 2021a). For block level data, which is used here to report demographics of very small communities, the source is U.S. Census Bureau Decennial Census 2020. The Draft EIS reported 2010 Decennial Census data for block level data, which has been updated in the Final EIS to 2020 Decennial Census data. Poverty data are unavailable at block level. Because Census and ACS data collection methods differ, data issues related to COVID-19 have a more limited impact on the Decennial Census (U.S. Census Bureau 2021b). However, the adoption of differential privacy measures in data reporting for the 2020 Census introduces new uncertainties related to data reported at smaller geographic scales than existed in the 2010 Decennial Census (U.S. Census Bureau 2021c). Because these communities are important to the EIS evaluation, were the subject of public comments on the Draft EIS, and the updated data represent much more recent data, the block level Decennial Census data have been updated in the FEIS.

[b] For the 2020 Census, portions of both Ironton and Myrtle Grove fall within Census Block 1031 (Block Group 1, Census Tract 504, Plaquemines Parish). Consequently, exact population totals, including minority populations, for Ironton and Myrtle Grove cannot be determined. To account for uncertainty, the lower bound estimate for Ironton excludes all populations counted in Block 1031, while the upper bound estimate includes all populations counted in Block 1031. Similarly, the lower bound estimate for Myrtle Grove excludes all populations counted in Block 1031, while the upper bound estimate includes all populations counted in Block 1031. In addition, portions of Suzie Bayou and Myrtle Grove fall within Census Block 1076 and portions of Suzie Bayou and Hermitage fall within Census Block 1099 (Block Group 1, Census Tract 504, Plaquemines Parish). The lower bound estimate for Suzie Bayou excludes all of the populations in the two blocks, while the upper bound includes all populations in the two blocks.

[c] This community was not included in the Socioeconomics Technical Report communities table, but is included in the Final EIS communities table (Table 4.15-1) and as such has been added here.

[d] There are multiple census blocks that intersect Leeville that did not have any population identified in 2020 Decennial Census estimates. These census blocks are not listed in the table.

[e] Unlike racial demographic data, poverty data are not available at the block level from the ACS. Poverty data for communities in non-incorporated, non-CDP areas are taken from the corresponding census tract. For Ironton, Myrtle Grove, Grand Bayou, Hermitage, Happy Jack, and West Pointe à La Hache, poverty data are presented for Census Tract 504, Plaquemines Parish; for Crown Point: Tract 280, Jefferson Parish; for Leeville: Tract 212, Lafourche Parish; and for Port Fourchon: Tract 211.01, Lafourche Parish.

[f] The community of Woodpark is included in a census block that overlaps Myrtle Grove and as such is combined with Myrtle Grove in this table, Census Block 1076 (Block Group 1, Census Tract 504, Plaquemines Parish).