Mississippi Valley Division,
Regional Planning and Environment Division South

South Central Coast Louisiana Study

Hurricane Ike flooding in Delcambre, Louisiana 2008.

Appendix A-1 – Environmental Resources

May 2022

CONTENTS

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LIST OF FIGURES

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Section 1
Introduction

The US Army Corps of Engineers, Mississippi Valley Division, New Orleans District (CEMVN) inventoried the applicable social, economic, and environmental factors for the study area (St. Martin, Iberia, and St. Mary Parishes, as well as the affected area). The affected area, or area of analysis, includes the area outside the study area that may be directly or indirectly affected by the Federal action and not merely the immediate area involved in the action The study area and affected areas include an array of private, local, state, and federally-managed lands. CEMVN used applicable social, economic, and environmental factors as the foundation of the analysis, to evaluate and compare alternatives, and ultimately to select USACE Recommended Plan (RP). These factors establish a baseline to measure the project's impacts.

This appendix includes additional information referenced in the Main Report Section 2, Affected Environment such as maps and tables deemed too large for the main report. This appendix also includes a table outlining the CEMVN's risks specific to environmental planning throughout the planning process.

Section 2
Ecoregions of Louisiana

The Mississippi River watershed drains all or parts of 31 states, 2 Canadian provinces, and approximately 1,243,000 miles before the river finally reaches the Gulf of Mexico. The Mississippi Alluvial Plain is mostly a broad, flat, alluvial plain with river terraces, swales, and levees providing the main elements of relief. Soils are typically finer-textured and more poorly drained than the upland soils of adjacent ecoregions. The widespread loss of forest and wetland habitat; however, has impacted wildlife and reduced bird populations, although it is still a major bird migration corridor. The batture lands are hydrologically connected to the Mississippi River, are flood-prone, and contain remnant habitat for "big river" species (e.g., pallid sturgeon) as well as riverfront plant communities. The area of analysis has five sub-ecoregions to the Mississippi Alluvial Plain (Figure A1:2-1). This riverine ecoregion extends from southern Illinois, at the confluence of the Ohio River with the Mississippi River, south to the Gulf of Mexico.

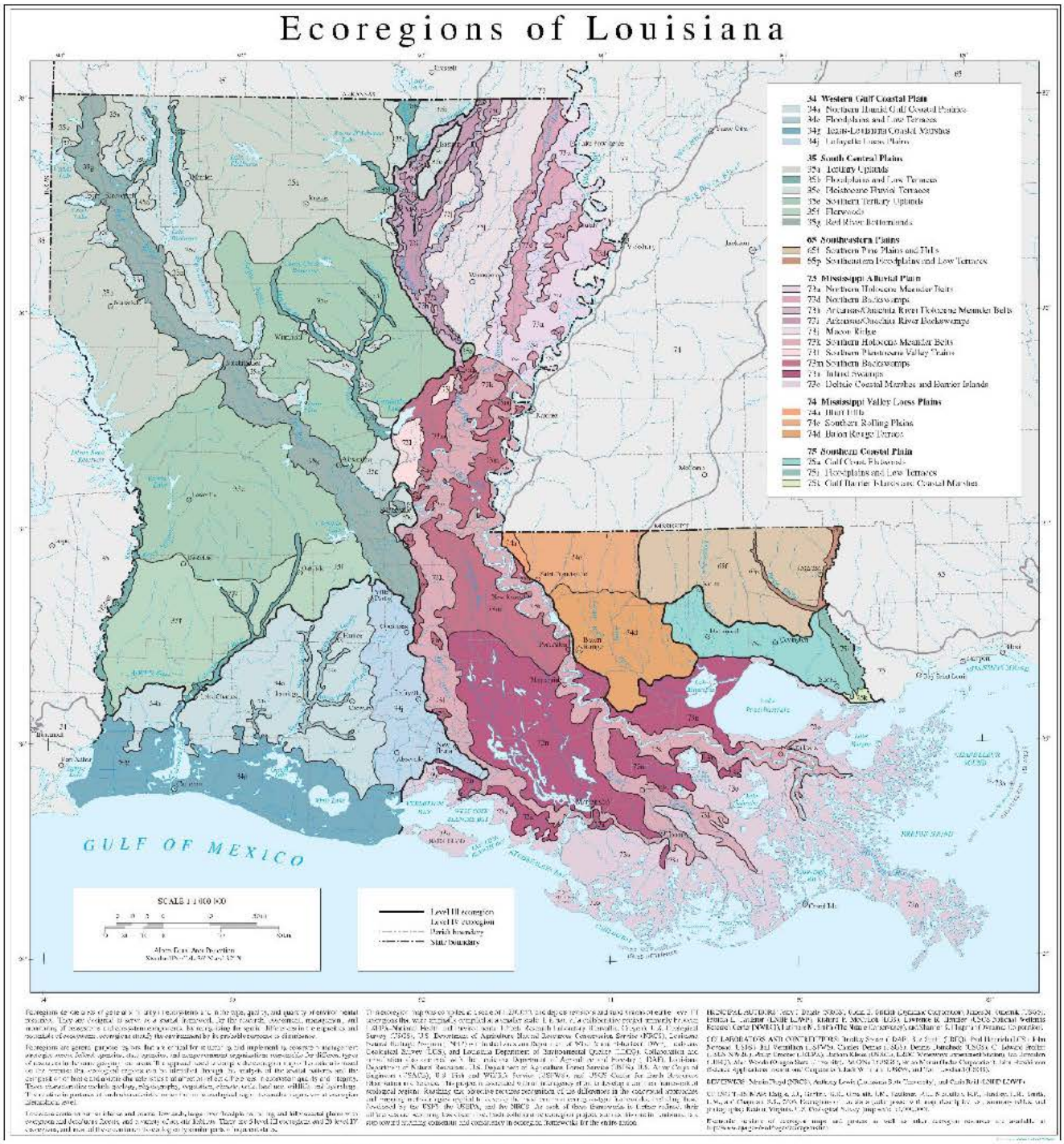

Figure A1:2-1. Ecoregions of Louisiana

The five sub-ecoregions to the Mississippi Alluvial Plain are:

1. ***Southern Holocene Meander Belts* ecoregion.** This stretches from just north of Natchez, Mississippi south to New Orleans, Louisiana. Similar to the Northern Holocene Meander Belts (73a), point bars, oxbows, natural levees, and abandoned channels occur. The Bayou Teche now runs through this former Mississippi River valley. The ecoregion contains minor species such as live oak, laurel oak, and Spanish moss that are generally not found in the more northerly regions. The bottomland forests have been cleared and the region has been extensively modified for agriculture, flood control, and navigation.
2. ***Southern Backswamps* ecoregion.** The soils within the ecoregion are mostly poorly drained, clayey Vertisols, rich in organic matter. Wetlands are common and flooding occurs frequently. Bottomland hardwood forests are more prevalent in this region than in the adjacent Southern Holocene Meander Belts (73k), where cropland is common. Channelization and flood control systems modified this region and impacted many of the wetland habitats.
3. ***Inland Swamps* ecoregion.** This ecoregion marks a transition, ranging from the fresh waters of the Southern Backswamps (73m) at the northern extent of the intratidal basins to the fresh, brackish, and saline waters of the deltaic marshes of Ecoregion 73o. Soils are mostly poorly or very poorly drained, clayey Entisols and Vertisols. Swamp forest communities are dominated by bald cypress and water tupelo, which are generally intolerant of brackish water except for short periods. In areas where freshwater flooding is more prolonged, the vegetative community is dominated by grasses, sedges, and rushes. This region contains one of the largest bottomland hardwood forest swamps in North America. Deposits include organic clays and peats up to 20 feet thick, and inter-bedded fresh- and brackish-water carbonaceous clays. The levees on either side of the Mississippi River have diverted much of the river flow from its natural tendency of flowing into the Atchafalaya Basin. Large concrete structures prevent diversion into the Atchafalaya River, and flow from the Red River is controlled. While this helps control flooding, it has also modified the region and contributed to the loss of wetland habitat.
4. ***Deltaic Coastal Marshes and Barrier Islands* ecoregion.** Dominated by brackish and saline marshes, the region supports vegetation tolerant of brackish or saline water including saltmarsh cordgrass, marshhay cordgrass, black needlerush, and coastal saltgrass. Black mangrove occurs in a few areas, and some live oak is found on Grand Isle and along old natural levees. Extensive organic deposits lie mainly below sea level in permanently flooded settings resulting in the development of mucky surfaced Histosols. Sediments of silts, clays, and peats contain large amounts of methane, oil, and hydrogen sulfide gas. Inorganic sediments found within the ecoregion are soft and have high water contents. They will shrink dramatically upon draining. The wetlands and marshes act as a buffer to help moderate flooding and tidal inundation during storm events. Lack of sediment input, delta erosion, land subsidence, and rising sea levels threaten the region.

5. ***Lafayette Loess Plains* ecoregion.** Historically the region had coastal prairie natural vegetation mostly tallgrass grasslands with gallery forests along streams. Little bluestem, big bluestem, yellow Indiangrass, brownseed paspalum, and switchgrass were dominant grasses, in a mixture with hundreds of other herbaceous species across these prairies. Almost all of the coastal prairies have been converted to cropland, pasture, crawfish aquaculture, or urban land uses. Some loblolly pines, and historically "islands" of longleaf pine, occur in the northern part of the region. Soils comprise a cap with a loess veneer associated with the Mississippi Valley. Well to poorly drained Alfisols and Mollisols with silt loam surface textures developed on the late Pleistocene-age terraces.

Section 3
Hydrologic Basins

The area of analysis intersects five hydrologic basins: Bayou Teche, Vermilion, Atchafalaya, Terrebonne, and Lower Grand. Bayou Teche and Vermilion can be considered two sub-basins in the combined Teche-Vermilion system. The Atchafalaya and Teche-Vermilion Basins contain the dominant hydrologic features while the western portions of the Lower Grand and Terrebonne Basins are peripherally relevant (Figure A1:3-1). Further details about these basins are provided in the subsections after the figure.

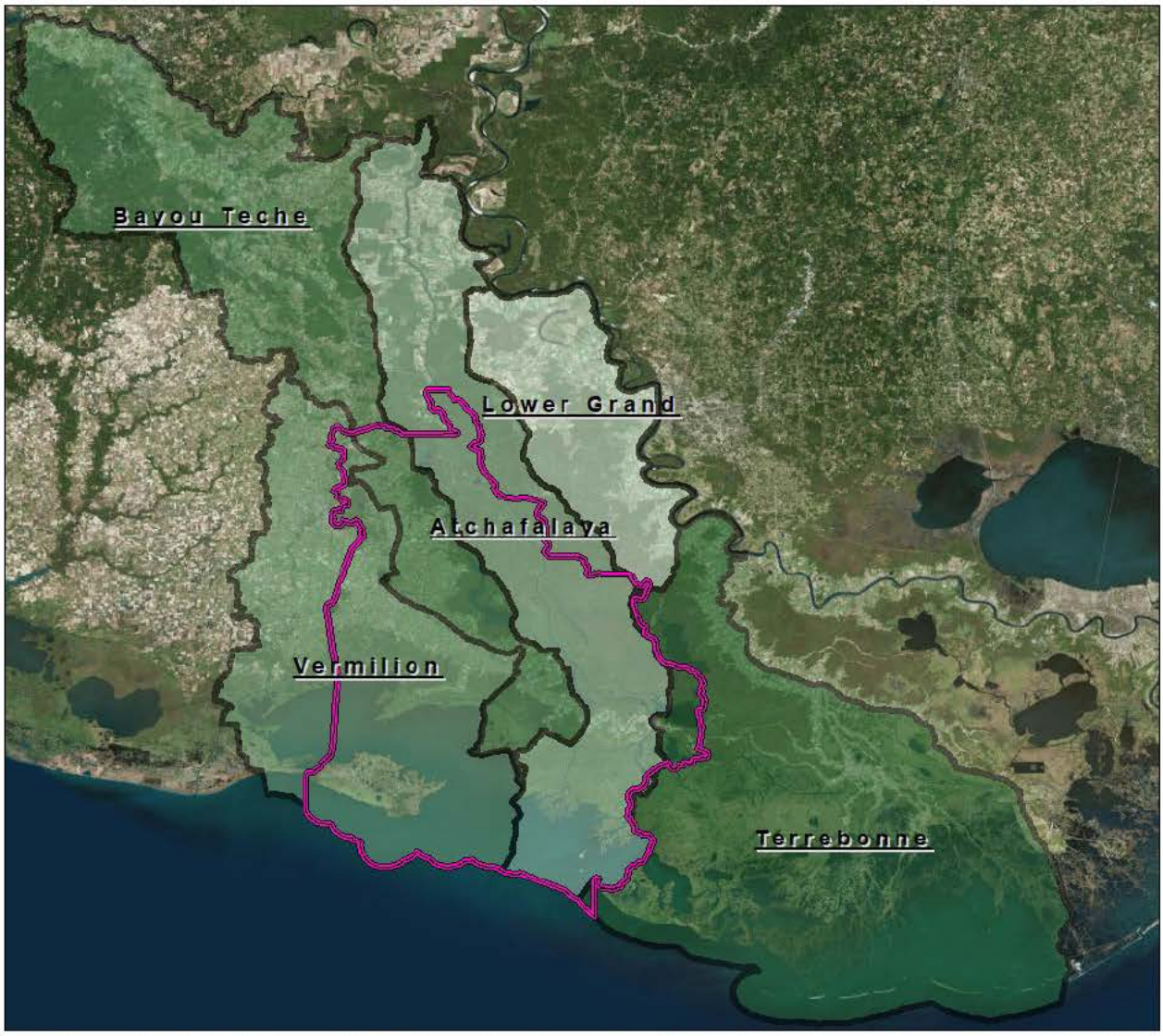

Figure A1:3-1. Schematic Delineating the Individual Basin Boundaries Overlaid with the Study Area

3.1.1 Teche-Vermilion Basin

The Teche-Vermilion Basin occupies over 50 percent of the study area. The Teche sub-basin has a drainage area of 2,200 square miles spanning from the west bank of the Red River to Cote Blanche Bay. Bayou Teche (125 miles long) begins in Port Barre and drains into the lower Atchafalaya. Because this is an ancient lobe of the Mississippi River, the banks are a natural ridge where many locals reside (Breaux Bridge, New Iberia, Franklin, etc.). Other inland features include Dauterive Lake and Lake Fausse Pointe, which are hydraulically connected to Bayou Teche via the Loreauville Canal. The coastal boundary of this sub-basin includes the Gulf Intracostal Waterway (GIWW) until the mouth of the

Charenton Drainage and Navigation Canal. The Vermilion sub-basin has a total area of 2,100 square miles, which includes the West Cote Blanche and Vermilion Bays, the Vermilion River, and Marsh Island. Much of the coastal area is made up of tidal wetlands transected by the GIWW. Unique to this sub-basin are exposed salt-dome deposits: Cote Blanche Island, Weeks Island, Avery Island, and partially Lake Peigneur.

3.1.2 Atchafalaya Basin

The Atchafalaya Basin contains the Atchafalaya River (137 miles long), a large freshwater feature that spans the entire study area (north to south). The basin begins at the Old River Control Structure located upstream of Simmesport, Louisiana and ultimately drains into the Gulf of Mexico. The Atchafalaya River receives 30 percent of the longitudinal flow from the Mississippi River, as well as the entire Red River, averaging 225,000 cfs. The floodway, bordered by large Federal river levees, directs flow south towards the Atchafalaya Bay near Morgan City or via the Wax Lake outlet between Centerville and Calumet.

3.1.3 Terrebonne and Lower Grand

While the Terrebonne is a large basin, only the far western portion is considered in the authorization zone. The total area is 3,200 square miles and is made up of mainly tidal wetlands. These range from fresh near Bayou Lafourche to oligohaline towards the Gulf of Mexico. The Lower Grand Basin is contained between the east Atchafalaya levees and the west bank Mississippi levees. The main channels in this basin are the Port Allen Lock waterway and the Avoca Island cutoff. Much of the upper basin is alluvial and heavily used for agriculture. The main hydrologic contribution of this area is as a catchment area for rainfall.

Section 4
Storm Surge and Hurricane Events

Figure A1:4-1 shows the storm surge for the 25-year and 50-year storm events at critical infrastructure locations.

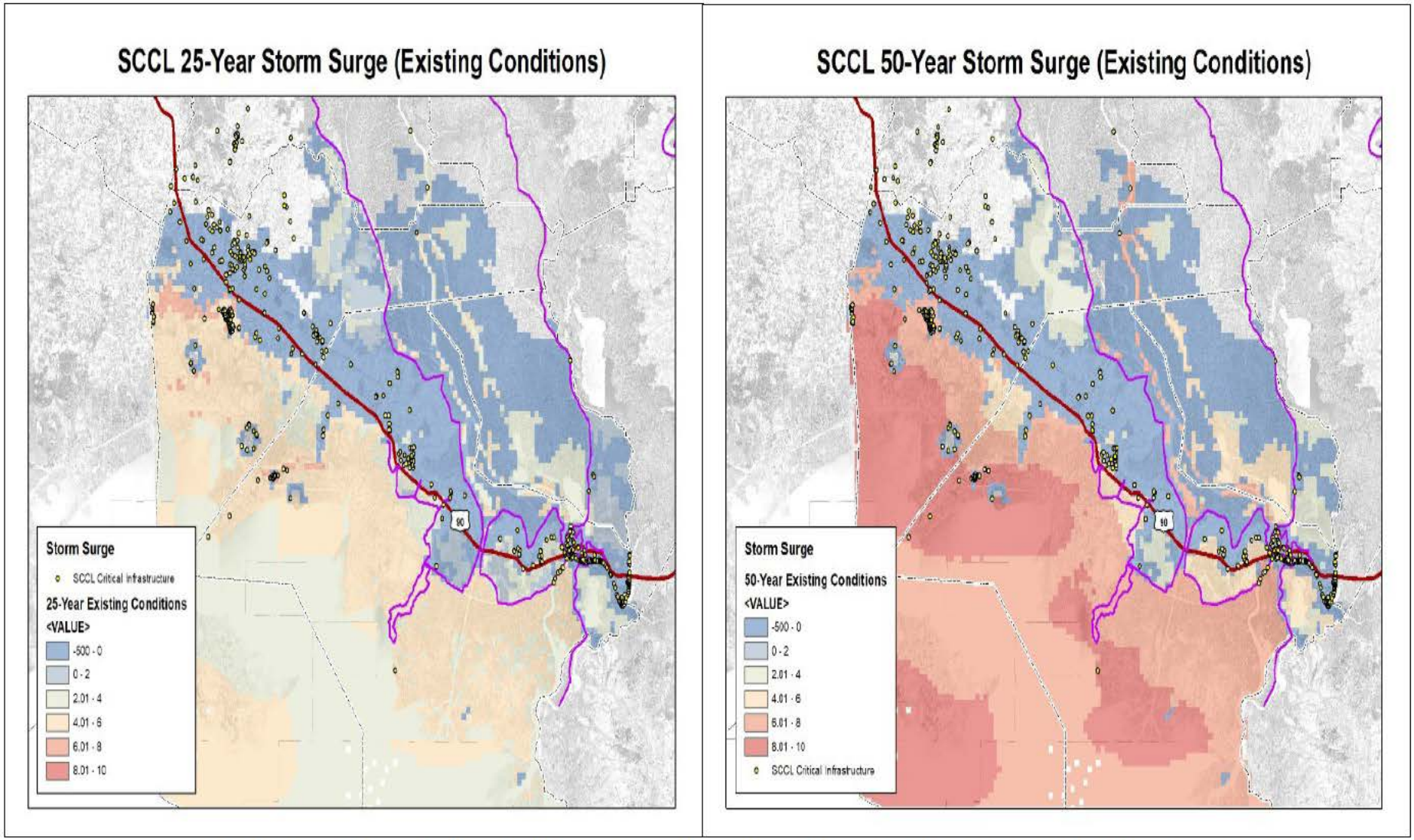

Figure A1:4-1. Storm Surge for the 25-Year and 50-Year Storm Surge Events at Critical Infrastructure Locations

Section 5
Storms of Record

5.1 HURRICANE AUDREY (JUNE 24-29, 1957)

Hurricane Audrey was one of the deadliest tropical cyclones in U.S. history, as well as the strongest June hurricane ever recorded in the Atlantic basin (tied with Hurricane Alex in 2010). The rapidly developing storm struck southwestern Louisiana as a powerful Category 3 hurricane, destroying coastal communities with a powerful storm surge that penetrated as far as 20 miles (32 km) inland. Audrey caused $147 million in damages and resulted in at least 431 fatalities.

5.2 HURRICANE LILI (SEPTEMBER 23-OCTOBER 3, 2002)

Originally a Category 4 hurricane, Hurricane Lili first made landfall near Marsh Island in Iberia Parish with maximum sustained winds of 92 mph. Highest recorded rainfall amount was about 9 inches in some parts of Louisiana. The highest storm surge was over 11 feet in St. Mary Parish.

5.3 HURRICANE RITA (SEPTEMBER 24-26, 2005)

Reaching its peak intensity southeast of the mouth of the Mississippi River as a Category 5, Hurricane Rita first made landfall just west of Johnson's Bayou and east of Sabine Pass at the Texas-Louisiana border as a Category 3 hurricane. Sensors recorded storm-surge water levels over 14 feet above North American Vertical Datum of 1988 (NAVD 88) at Constance Beach (LC11), Creole (LA12), and Grand Chenier (LA11), Louisiana, about 20 miles, 48 miles, and 54 miles, respectively, east of Sabine Pass, Texas. In general, storm-surge water levels increased eastward from the Sabine River into southwest Louisiana. The magnitude of the storm surge was greatest near the coast and decreased inland through the approximate latitude of I-10, about 35 miles inland from the coast.

5.4 HURRICANE ANDREW (AUGUST 16-29, 1992)

Hurricane Andrew was a powerful and destructive Category 5 Atlantic hurricane that struck the Bahamas, Florida, and Louisiana. Andrew caused major damage in the Bahamas and Louisiana, but the greatest impact was felt in South Florida. Prior to making landfall in Louisiana on August 26, Andrew caused extensive damage to oil platforms in the Gulf of Mexico, leading to $500 million in losses for oil companies. It produced hurricane-force winds along its path through Louisiana, damaging large stretches of power lines that left about 230,000 people without electricity. Over 80 percent of trees in the Atchafalaya River Basin were downed and the agriculture there was devastated. Throughout the basin and Bayou Lafourche, 187 million freshwater fish were killed in the hurricane. With 23,000 houses damaged, 985 others destroyed, and 1,951 mobile homes demolished, property losses in Louisiana exceeded $1.5 billion. The hurricane caused the deaths of 17 people in

the state, 6 of whom drowned offshore. Andrew spawned at least 28 tornadoes along the Gulf Coast, especially in Alabama, Georgia, and Mississippi. In total, Andrew left 65 dead and caused $27.3 billion in damage. It is currently the seventh-costliest Atlantic hurricane to hit the United States.

5.5 HURRICANE GUSTAV (AUGUST 25-SEPTEMBER 4, 2008)

Hurricane Gustav made landfall near Cocodrie, Louisiana on September 1, 2008, as a strong category 2 (based on 110 mph sustained winds) and continued to move northwest, spreading hurricane force wind gusts across portions of Southeast and South Central Louisiana (http://www.srh.noaa.gov/lix/?n=gustavsummary; accessed January 26, 2016). Due to the storm-making landfall east of the study area, storm surge values were only 4-5 feet across St. Mary, Iberia, and Vermilion Parishes

5.6 HURRICANE IKE (SEPTEMBER 1-14, 2008)

Hurricane Ike first made landfall near Galveston, Texas on September 13, 2008, as a Category 2 hurricane with maximum sustained winds of 110 mph. Ike was a large hurricane with tropical-storm-force and hurricane-force winds associated at the time of its landfall extending approximately 275 miles and 120 miles from the storm center, respectively. In Louisiana, estimated wind speeds ranged from 80 mph near the Texas-Louisiana border to 50 mph in Vermilion Parish. Storm surge caused flooding in Cameron, Vermilion, and many parishes to the east, with over 9-foot stillwater levels estimated for Lake Charles.

5.7 HURRICANE BARRY (JULY 4, 2019)

Hurricane Barry was an unusually asymmetrical tropical cyclone that made landfall in Louisiana in July 2019, causing $600 million in damages. Barry was also the fourth recorded storm to make landfall at hurricane strength on the state of Louisiana in the month of July. Barry made landfall on Marsh Island and Intracoastal City, Louisiana as a Category 1 hurricane, subsequently weakening to tropical storm status. While Barry was in its formative stages, it dropped 6 to 9 inches (150 to 230 mm) of rainfall across the study area, causing flooding. Particularly hard-hit was St. Mary Parish, where hurricane-force winds and storm surge flooding damaged buildings, toppled trees, and inundated roads in and around Morgan City.

Section 6
Floodplain Terminology Definitions

Flood Insurance Rate Map Zones (FIRM) are depicted in Table A1:6-1. Figure A1:6-1 shows the floodplain mapping for each of the three parishes.

Table A1:6-1. Floodplain Terminology

Terms	Measured Flood Event	Common Name	FIRM Zones
HIGH RISK AREAS Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.	1% chance flood	100-year flood	Zone A
The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs instead of A1-A30 Zones.	0.2% chance flood	500-year flood	Zone AE
HIGH RISK COASTAL AREAS Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.			Zone VE
Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.			Zone AH
River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.			Zone AO

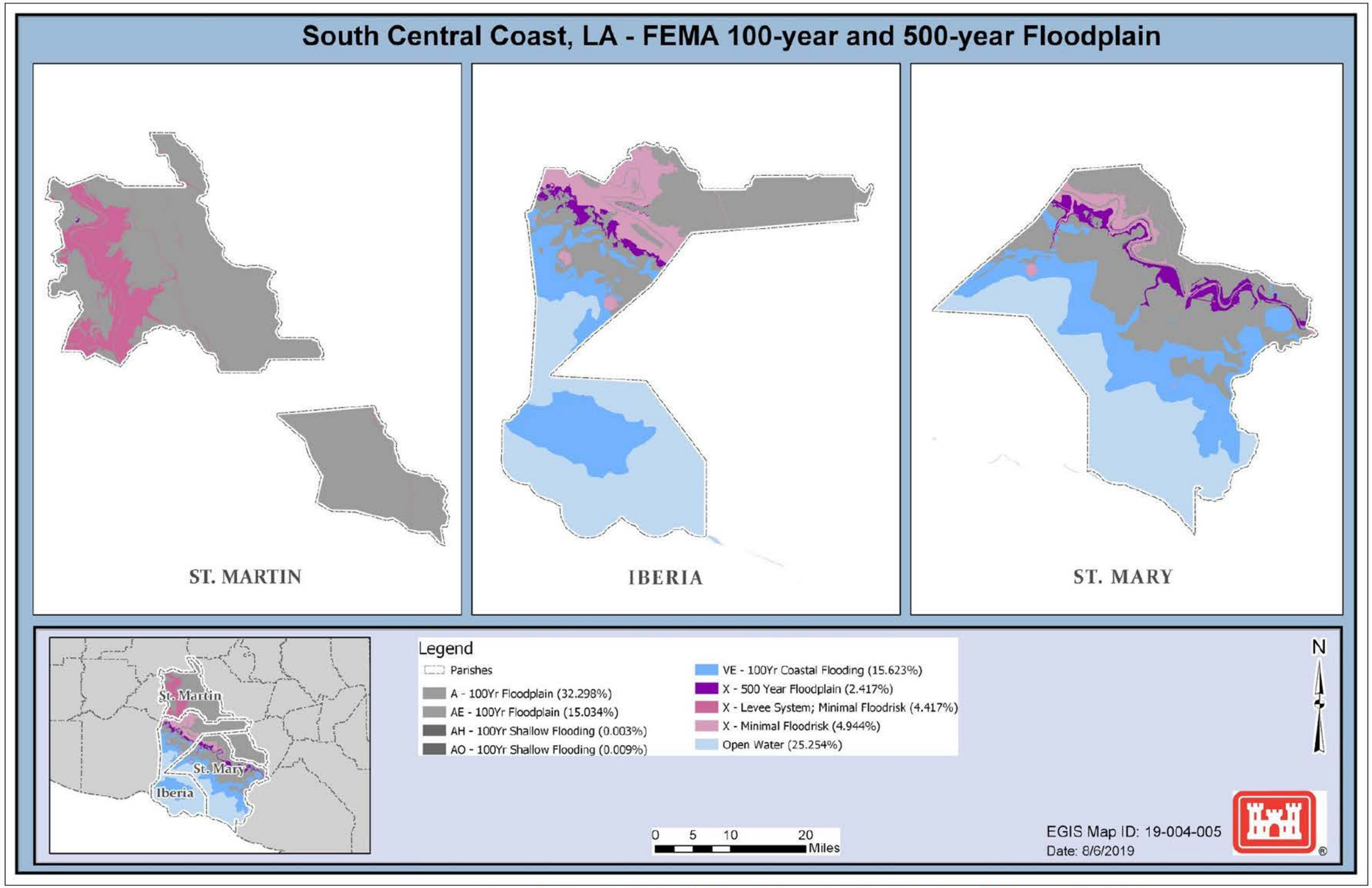

Figure A1:6-1. South Central Coast, LA – FEMA 100-year and 500-year Floodplains

Section 7
Land Use and Land Use Plans

Figure A1:7-1 shows the land cover classification for the study area.

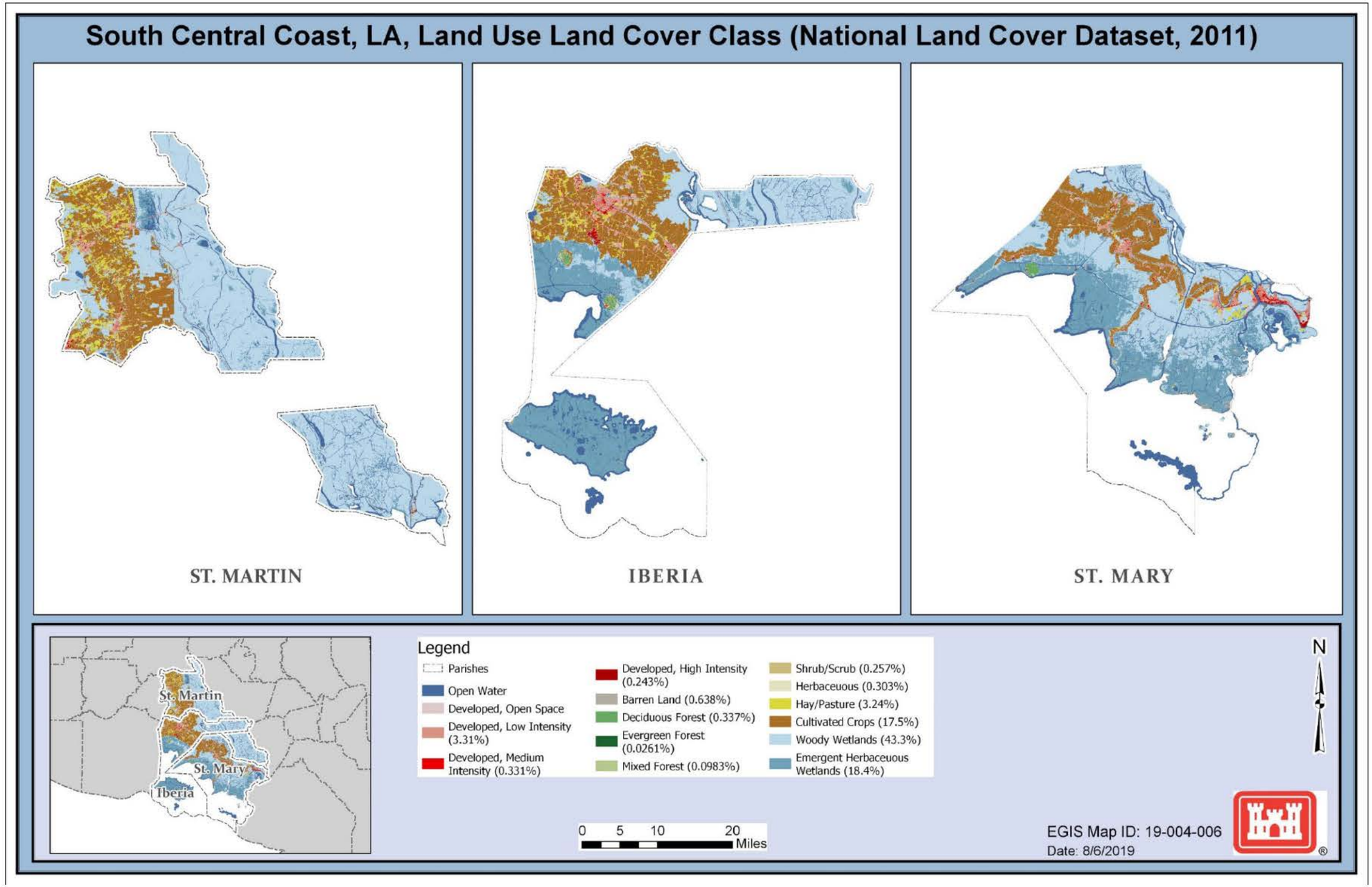

Figure A1:7-1. South Central Coast, LA, Land Use Land Cover Class (National Land Cover Dataset, 2011)

7.1 LAND USE PLANS AND EMERGENCY OPERATION PLANS FOR EACH PARISH

Table A-1:7-1 details the various master plans being carried out in the study area.

Table A1:7-1. Master Plans in the Study Area

Title	Owner	Date	Purpose
Louisiana's Comprehensive Master Plan	Coastal Protection and Restoration Authority of Louisiana.	2017	Following Hurricanes Katrina and Rita in 2005, the Louisiana Legislature created the CPRAB and tasked it with coordinating the local, state, and Federal efforts to achieve comprehensive coastal protection and restoration. To accomplish these goals, CPRAB was charged with developing a master plan to guide our work toward a sustainable coast.
Breaux Bridge Comprehensive Long-Range Resiliency Plan	Breaux Bridge, LA	2012	A plan to use infill development in targeted areas to manage growth and ensure long-term resilience
Restoring the Mississippi River Delta	Restore the Mississippi River Delta	2018	Recommendations for Coastal Restoration Projects and Programs in Louisiana
Iberia Parish Hurricane Protection Master Plan	Iberia Parish	2012	Comprehensive plan to provide protection from flooding, saltwater intrusion, tidal and storm surges associated with tropical storms and hurricanes for the lands and residents of Iberia Parish.
St. Mary Levee District Master Plan	St. Mary Parish	2010	The plan identifies parish hurricane protection, backwater flooding, and related needs such as saltwater intrusion.

7.1.1 Iberia Parish Emergency Management Plan

Iberia Parish has an emergency management plan that aims to reduce the loss of life, suffering, and property damage from emergencies and/or disasters. All Federal and state regulations, authorities, and other directives have been taken into account when creating the emergency operations plan (EOP). The EOP is intended to be broad enough to cover any disaster while also maintaining specific instructions for each individual disaster possibility. The 2019 EOP for Iberia Parish is located at http://iberiaparishgovernment.com/forms/dept-911-EOP.pdf.

Table A1:7-2 contains a list of possible disasters with accompanying probability, risks, and priorities for Iberia Parish.

Table A1:7-2. Iberia Parish Storm Risk Matrix

Hazard	Probability	Risks	Priority
Flood & Storm Surge	Highly Likely	Lives, Property, Utilities, Etc.	High
Hurricanes, Tropical Weather	Likely	Lives, Property, Comm, Etc.	High
Severe Weather	Highly Likely	Lives, Property, Etc.	High
Levee Failure	Possible	Lives, Property, Etc.	High

Iberia Parish states three levels of evacuation; shelter in place, recommended evacuation, and mandatory evacuation. To shelter in place means that it is recommended one hunker down in their own residence, place of work/business, or if outside to find a safe structure to hold up in for a period of hours to days. When a moderate risk is present to citizens, Iberia Parish may declare a recommended evacuation. The Iberia Parish government will describe the areas affected and include the location of shelters. In the event of a mandatory evacuation, the same procedures for the recommended evacuation will occur, in addition to transportation being provided to shelters, if resources are available.

Communications during an emergency are varied and range from the use of the State of Louisiana standard 700 MHz interoperable radio system to several methods of public alert notifications distributed by means of local media, social media, OnSolve, and IPAWS. In the event that Iberia Parish 911 is disconnected, all incoming calls will be transferred to St. Martin Parish's 911 center.

During the recovery and restoration phase, emergency management response activities will continue as long as they are needed. As soon as possible after an emergency or disaster, all agencies involved will conduct damage assessment activities. Damage assessments will be used to define the need for resources and strategies needed for recovery. The Disaster Recover Manual will be used to guide all damage assessment, analysis, documentation and report of damages. The Office of Homeland Security and Emergency Preparedness (OHSEP) Director will work with local and parish government agencies, private individuals, and organizations in all recovery and restoration efforts.

7.1.2 St. Martin Parish Emergency Management

The mission of the St. Martin Parish OHSEP is listed as to coordinate response to natural and man-made disasters, including acts of terrorism; to plan and prepare responsible programs for the protection of life and property; to direct, mobilize, coordinate, and determine utilization of resources; and to coordinate and direct restoration and recovery operations in the disaster area.

St. Martin Parish is determined to be a "High Risk" parish and as such is not suitable for sheltering. When disaster conditions present themselves, shelters will not be opened to the public. However, if conditions allow, the parish emergency management office will arrange for public emergency shelters according to any potential threats. St. Martin Parish follows the plan established by the Louisiana Shelter Task Force and works in conjunction with the Acadiana Chapter of the American Red Cross.

If in need of an evacuation, St. Martin recommends having an emergency car kit, travel kit, and to leave your place of residence as early as possible. Evacuation plans are set forth with predetermined routes and Emergency Shelter Information Points along these routes are listed within the Storm Survival Guide.

St. Martin utilizes the Emergency Alert System (EAS) on all licensed broadcast stations in order to best disseminate information to the public immediately before, during, and after an emergency has occurred. The EAS radio stations will provide information on weather reports, road conditions, shelter locations, and re-entry information. As the storm comes closer to landfall, information will be distributed every 2 hours.

The St. Martin Parish Emergency Operations website is http://www.stmartinohsep.org/. The 2009 St. Martin Storm Survival Guide is located at http://www.stmartinohsep.org/uploads/TRAC_ST_MARTIN_FINAL.pdf.

7.1.3 St. Mary Parish Emergency Management

The mission of the St. Mary Parish Government Office of Emergency Management is to maintain the highest possible level of preparedness to protect the lives and property of the citizens of St. Mary Parish before, during, and after a natural or manmade disaster. The St. Mary Parish Government Office of Emergency Preparedness works with all emergency responders, public and private agencies, business communities, and volunteer organizations to meet this mission.

St. Mary Parish Hurricane Guides are located in the lobby of the St. Mary Parish Courthouse Building. St. Mary Parish will open shelters for storms up to Category 2 strength; however, for any storm that is Category 3 or greater, St. Mary Parish will close all shelters and encourage its residents to evacuate.

When a local evacuation order is called, parish officials, will notify residents primarily using local media and the Emergency Alert System (EAS). All emergency information, including shelter openings, evacuation routes, and weather conditions will be given through the media. In case of an evacuation order, St. Mary has the following pick-up points listed

Morgan City Jr. High
(985-384-5922)
(29'4218.93N/91'1212.06W)
911 Marguerite St.
Morgan City, LA

Franklin Senior High
(337-828-0143)
(29'4815.91N/91'3002.80W)
1401 Cynthia St.
Franklin, LA

The St. Mary Parish Emergency operations website is http://stmaryohsep.org. The State of Louisiana Emergency Preparedness Guide is located at http://gohsep.la.gov/Portals/0/Documents/Prevent/2016EmergencyGuide_English.pdf.

Section 8
State Wildlife Management Areas and Federal Wildlife Refuges

8.1 ATCHAFALAYA DELTA WILDLIFE MANAGEMENT AREA

Located at the mouths of the Atchafalaya River and the Wax Lake Outlet, Atchafalaya Delta Wildlife Management Areas (WMA) mostly consists of open water in Atchafalaya Bay. Within the bay, two deltas (Main Delta and Wax Lake Delta) have formed from the accretion of sediments from the Atchafalaya River and from dredged material deposited by USACE. Main Delta has about 15,000 acres of marsh and scrubby habitat and Wax Lake Delta has about 12,000 acres of marsh.

8.2 ATTAKAPAS ISLAND WILDLIFE MANAGEMENT AREA

The state acquired Attakapas Island WMA in 1976. USACE also owns several tracts of land, including Shatters Bayou, which are managed as part of this WMA.

This WMA's terrain is characterized by flat swampland subject to periodic flooding and silt from the Atchafalaya River. Areas adjacent to the river and spoil banks from dredging activities provide upland habitat and refuge areas during periods of high water. Many areas within the WMA have silted in; siltation will continue to increase the land-to-water ratio.

8.3 MARSH ISLAND WILDLIFE REFUGE

The Marsh Island Wildlife Refuge, operated by the Louisiana Department of Wildlife and Fisheries (LDWF), is located at the edge of the Gulf of Mexico, in Iberia Parish. Marsh Island Wildlife Refuge is located between Vermilion Bay and the Gulf of Mexico. When originally deeded to the state in 1920 by Mrs. Margaret Sage, the island was 76,664 acres. Today, Marsh Island is closer to 71,000 acres, primarily due to erosion and past storm damage. Marsh Island currently measures approximately 20 miles east to west and 11 miles north to south. Habitat on this refuge is mainly brackish to intermediate marsh and flat, with very few remaining trees.

Marsh Island is an extremely important refuge as it supports a wide array of animal species throughout the year. The island serves as crucial wintering habitat to numerous waterfowl, wading and shorebirds, and birds of prey. This refuge also serves as essential habitat for commercially important fish species, as well as alligators and furbearers. In the Vermilion Bay area, much of the recreational and commercial harvests of shrimp and blue crab depend on the nursery habitats provided by Marsh Island.

8.4 CYPREMORT POINT STATE PARK

Between Grand Isle and Cameron, Cypremort Point is one of the very few locations near the Gulf of Mexico that can be reached by car. The Louisiana Department of Natural Resources (LDNR) manages the park, which is located in both Iberia and St. Mary Parishes. A half-mile stretch of a man-made beach provides a delightful area for relaxing, picnicking, and enjoying the water in this 185-acre park. It also affords an opportunity for fishing, crabbing, water skiing, windsurfing and, sailing.

In addition to excellent sailing and swimming facilities, the park also holds a special attraction for nature enthusiasts. Located in the heart of a Louisiana marsh, the site contains an abundance of wildlife. The quiet observer may happen upon nutria, muskrat, alligator, or a number of bird species native to the state. Deer, black bear, rabbits, opossum, and red fox also make their home in this area

8.5 MARSH ISLAND/RAINEY UNIT LA-05P

The study area has one Coastal Barrier Resources Act (CBRA) unit, the John H. Chafee Coastal Barrier Resources System Marsh Island/Rainey Unit LA-05P. The CBRA of 1982 and subsequent amendments designated relatively undeveloped coastal barriers along the Atlantic, Gulf of Mexico, Great Lakes, U.S. Virgin Islands, and Puerto Rico coasts as part of the John H. Chafee Coastal Barrier Resources System (CBRS), and made these areas ineligible for most new Federal expenditures and financial assistance. The CBRA encourages the conservation of hurricane prone, biologically rich coastal barriers by restricting Federal expenditures that encourage development, such as Federal flood insurance. Areas within the CBRS can be developed if private developers or other non-Federal parties bear the full cost. The USFWS administers the CBRA program.

This area is located on the west end of Marsh Island in Iberia Parish. The seaward side of the CBRS unit includes the entire sand-sharing system, including the beach and nearshore area. The sand-sharing system of coastal barriers is normally defined by the 30-feet bathymetric contour. In large coastal embayments and the Great Lakes, the sand-sharing system is defined by the 20-feet bathymetric contour or a line approximately 1 mile seaward of the shoreline, whichever is nearer the coastal barrier.

8.6 BAYOU TECHE NATIONAL WILDLIFE REFUGE

The Bayou Teche National Wildlife Refuge (NWR) is located within St. Mary Parish. Bayou Teche NWR is a 9,028-acre refuge situated along and on either side of Bayou Teche, an ancient channel of the Mississippi River. The refuge consists of six non-contiguous management units, ranging in size from 81 acres to 3,619 acres.

The refuge consists mostly of back-swamp land located off the natural levees of the bayou. Habitats on the refuge include bottomland hardwood forests, cypress-tupelo swamps, bayous, and freshwater marshes. The refuge's primary objective is to restore and manage bottomland hardwood forests, cypress-tupelo swamps, and marshes in order to provide high quality and diverse habitat to support the Louisiana black bear.

8.7 SHELL KEYS NATIONAL WILDLIFE REFUGE

Shell Keys NWR was established by Executive Order on July 9, 1855, as a lighthouse reservation and subsequently as Shell Keys Reservation, and a breeding ground for native birds as established by Executive Order 682 on August 17, 1907. Shell Keys NWR is one of the oldest refuges in the Refuge System. Its boundary was and still is rather loosely described as "...a small group of unsurveyed islets located in the Gulf of Mexico about 3.5 miles south of Marsh Island, Louisiana..."

For a number of years, there has only been one islet at the location. This islet is composed almost entirely of shell fragments. It is extremely dynamic and builds or recedes with passing storms. Vegetation is almost entirely lacking.

Shell Keys NWR is managed as part of the Southwest Louisiana NWR Complex.

Section 9
Aquatic Resources and Wetlands

9.1 GULF COASTAL SHORELINES

Between 1932 and 2016, while other basins in Louisiana were losing land, the Atchafalaya Basin gained over 6 square miles (4,000 acres) of wetlands. The Atchafalaya River is the last major tributary of the Mississippi River. The Atchafalaya receives, on average, 30 percent of the combined flow of the Mississippi and Red Rivers, or around 300,000 cubic feet of water per second.

In 1942, CEMVN dredged a channel from the Atchafalaya River to the Gulf of Mexico to decrease water levels moving past Morgan City; thus, splitting the flow of water and sediment between the Atchafalaya River and the Wax Lake Outlet. Over time, sediment filled in the Wax Lake, and the Wax Lake Delta emerged. The Atchafalaya River delta has also grown with an increase of sediment settling out at the river reaches the Gulf of Mexico. This new land pushing out into the Gulf of Mexico has continued over the years, despite challenges affecting many areas of Louisiana's coast including land subsidence, sea level rise, and hurricanes. The land built and sustained by the Wax Lake Outlet is swamp and marsh habitat that is teeming with life, and the Wax Lake Delta is a picture of a living, thriving delta.

However, in most areas along the Louisiana coast, shorelines are vanishing at an alarming rate. Shorelines on either side of the Atchafalaya Basin are being lost (Figure A1:9-1). Since the 1930s, about 2,000 square miles of land have turned into open water – an area nearly the size of the State of Delaware. Between 1932 and 2016, the Terrebonne Basin lost more than 500 square miles (30,000 acres) of wetlands. This basin is the remnants of an old delta complex formed when the main flow of the Mississippi River drained into this area 500-2,500 years ago.

Gulf coastal shorelines, located along the northern rim of the Gulf of Mexico, provide essential and critical shelter, nesting, feeding, roosting, cover, nursery, and other habitats and life requirements for fish and wildlife. They function as the boundary between marine and estuarine ecosystems and provide protection to the estuarine wetlands, bays, and other inland habitats. Coastal shorelines, as well as other coastal landscape features such as shoals, coastal marshes, and forested wetlands, can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes. Rapid deterioration of the barrier coast is resulting in a transformation of low-energy, semi-protected bays into high-energy, open marine environments (Stone et al., 2005).

9.2 VEGETATION AND ESTUARY RESOURCES

The study area consists of open water ponds and lakes, Gulf shorelines, and freshwater, intermediate, brackish, and saline marsh (Figures A1:9-2 and A1:9-3).

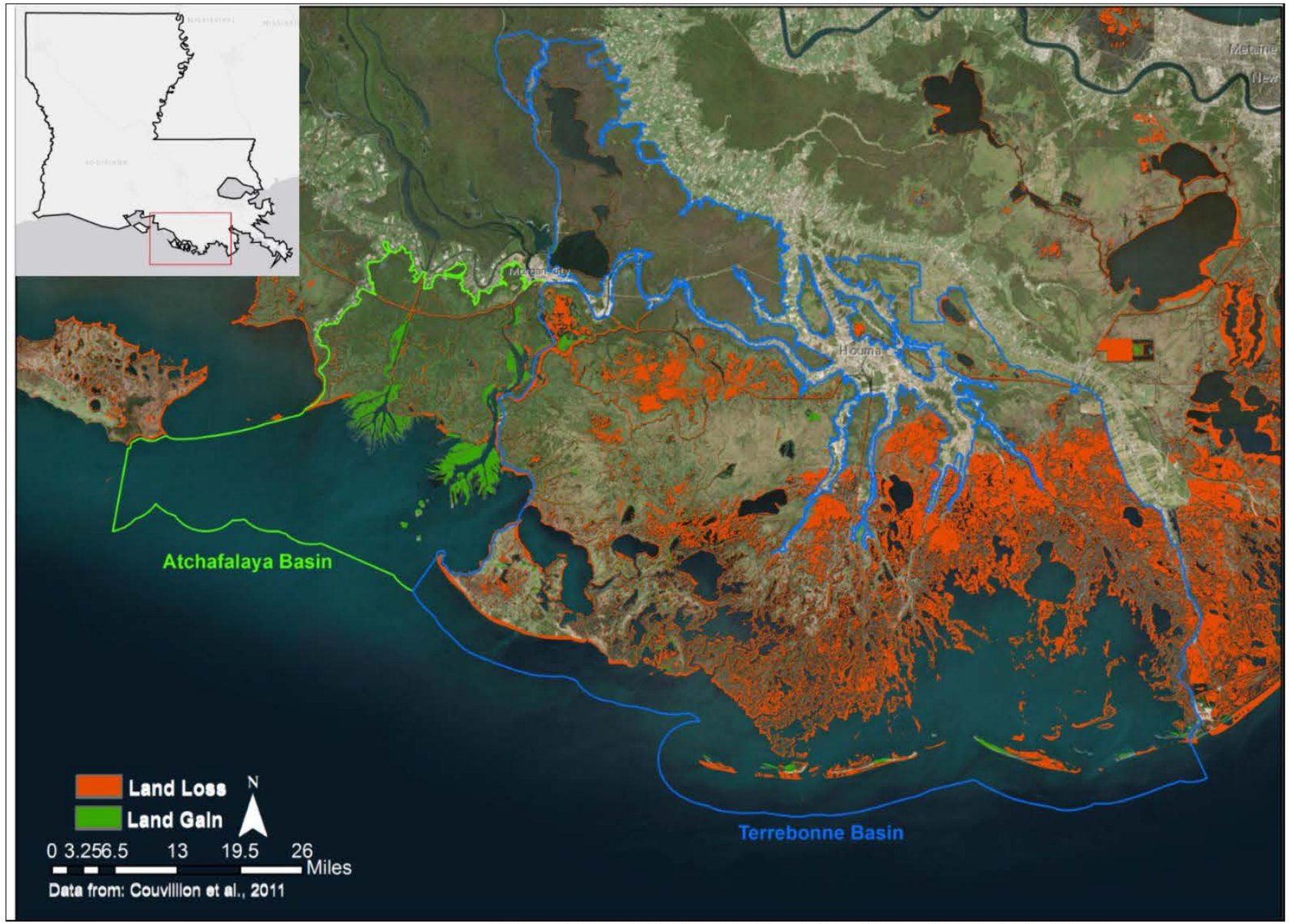

Figure A1:9-1. Gulf Shore and Land Area Change in Coastal Louisiana (Photo courtesy of USGS)

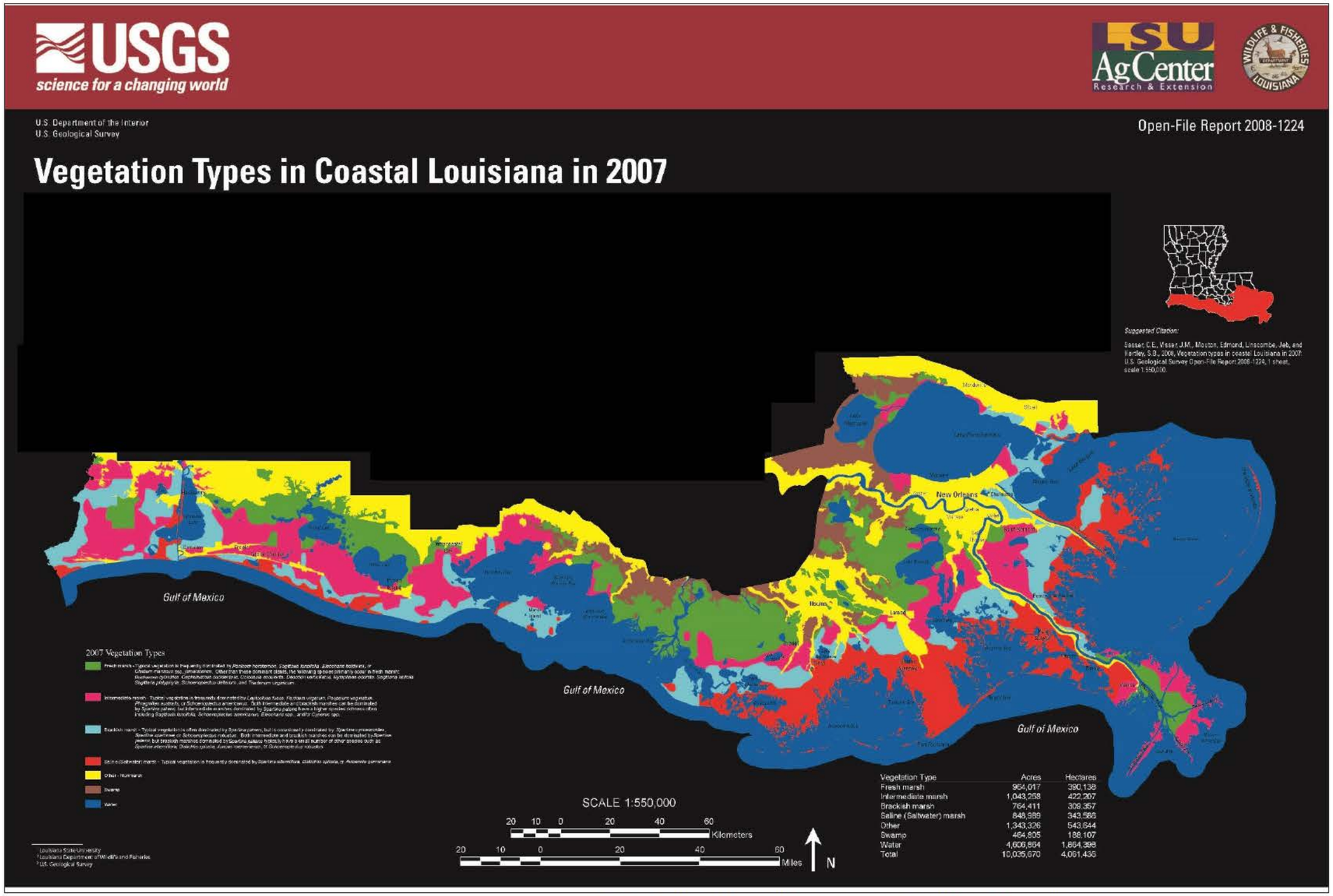

Figure A1:9-2. Vegetation Types on Coastal Louisiana in 2007

Section 10
Fish and Wildlife Resources

Oysters and mussels from the epibenthic community provide commercial and recreational fisheries throughout the Gulf of Mexico and the study area (Figure A1:11-1, LDWF, 2018). They also create oyster reef habitats used by many marine and estuarine organisms.

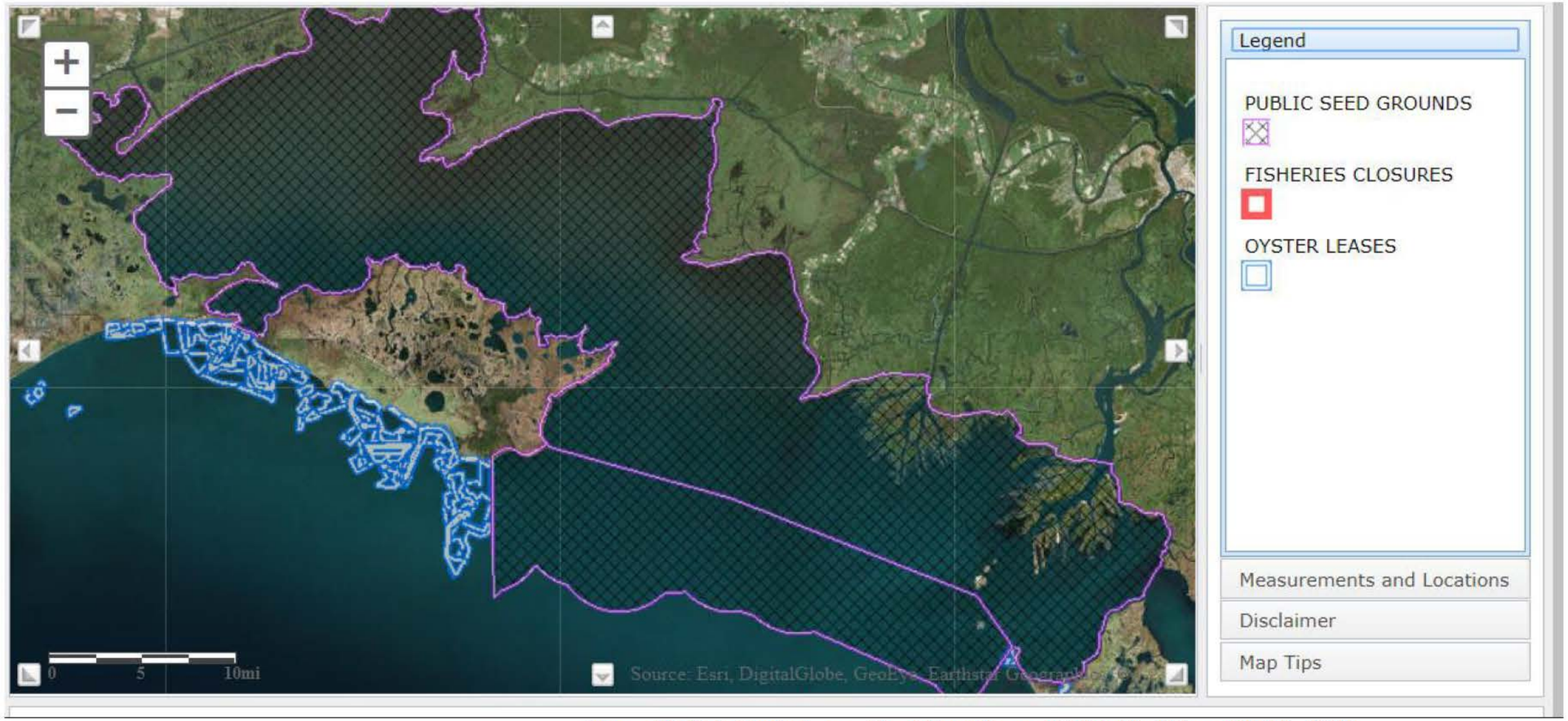

Figure A1:11-1. Oyster Lease, Seed Grounds, and Cultch Plant Maps (LDWF, 2018)

Section 11
Wetland Mitigation Costs

Early in the planning process the SCCL PDT investigated several FRM structural measures. These ranged from building a large levee across the planning area to upgrading existing levee systems. In order to determine cost benefit ratios for each measure and/or a combination of measures, the PDT included environmental mitigation costs from either filling wetlands or using wetlands as a source of levee material.

Wetland mitigation costs vary depending on the type of wetland impacted. The PDT made the following assumptions based on past project costs.

1. Forested wetland mitigation costs = $232,000 /acre;
2. Wetland costs are based on a 1:1 replacement. This underestimated the total wetland loss.
3. Non-forested wetland costs = $84,000/acre
4. No borrow site or future lifts impacts were included in this assessment.
5. New levee construction would require a 300-foot width for construction and final footprint.

Appendix B: Engineering includes the final costs associated with all the proposed project measures used to complete the cost benefit ratios. The nonstructural alternative did not have any wetland mitigation costs since the residential and nonresidential structures would not have any wetland or coastal zone impacts.