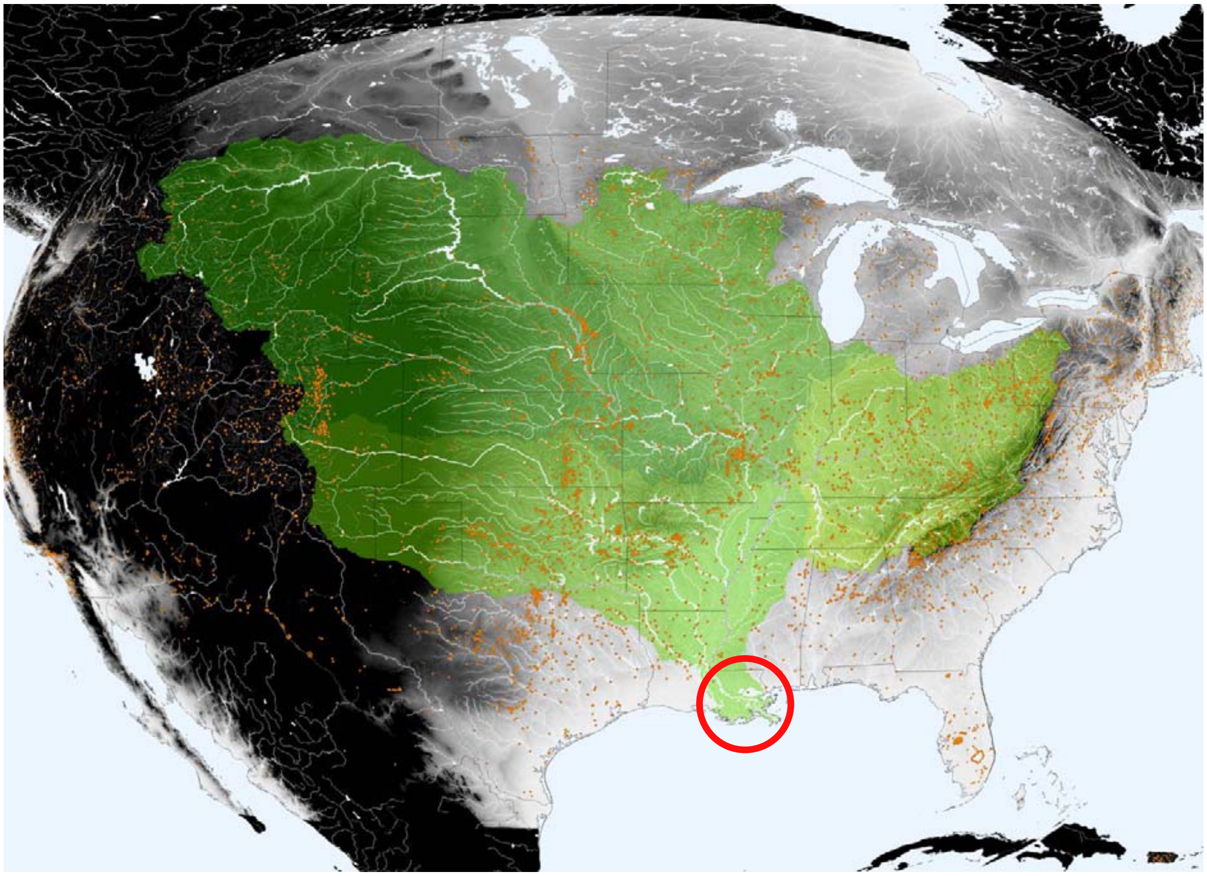
The Water Resources Development Act Title VII Louisiana Coastal Area



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EXECUTIVE SUMMARY

Title VII of the 2007 Water Resources Development Act (WRDA) authorizes the Army Corps of to address the problem of coastal land loss in the Louisiana Coastal Area (LCA). The LCA contains the largest swathe of coastal wetlands in the continental United States. The WRDA defines the LCA as the area between the Sabine and Pearl Rivers, spanning approximately 20,000 square miles.

The loss and degradation of coastal land reduces the capacity of the landscape to naturally buffer floods and storms, increasing the vulnerability of coastal populations. While this problem has persisted for decades, the devastation in the region caused by Hurricane Katrina brought the issue to center stage. Thus, the legislation aims to counteract land loss by and restoring coastal ecosystems to reestablish flood and storm protection for the coastal population. These goals will be accomplished through the Army Corps' Comprehensive Plan that combines restoration plans from previous WRDAs, as well as Louisiana state hurricane protection plans.

Coastal land loss in the LCA is occurring at a rapid rate. The equivalent of approximately one football field is lost every forty-five minutes. The causes of coastal land loss are both natural and anthropogenic. Natural causes of land loss include:

- *Natural Subsidence*: Natural subsidence, or land sinking, is the compaction of loosely consolidated soils along geological fault lines. Subsidence accounts for approximately thirty-five percent of all land loss in the LCA.

- *Sea Level Rise*: Sea level rise augments land loss due to subsidence, however, because rates of sea level rise are uncertain, its full contribution to land loss cannot be said for certain.

These natural causes of land loss and exacerbated by anthropogenic structures, such as of levees, dams and canals. The varied and complex ways in which these structures contribute to land loss include:

- *Saltwater Intrusion*: Canals provide a route for denser saltwater to intrude inland below the freshwater.

- *Marsh Conversion*: Marshes are characteristically transitional zones between wetlands and upland habitat. These unique zones are being lost because of spoil banks. Spoil banks are formed from the material excavated from the canals is placed on either side of the canal. Spoil banks prevent the flow of water across marsh land, disrupting not only sediment transport cycle, the hydrological flow of water over wetlands as well.

- *Reduced Sedimentation*: The sediments entering the LCA were historically deposited in the coastal Louisiana region when the Mississippi River's flood waters moved over wetlands. This movement is hindered by the levees, dams and reservoirs that have been built on the Mississippi and its tributaries in the last 200 years.

- *Change in Sediment Transport Cycle*: The natural cycle of sediment transport through water flow from the Mississippi River to the delta is important is an integral part of the natural hydrology. As more sediment is deposited, a delta begins to form. Currents and wave action distribute this sediment laterally to create beaches (barrier islands). This process continues until the river changes course and its channel is abandoned leaving behind a beach ridge. However, man-made structures have altered this natural cycle, preventing the formation of barrier islands.

These changes reduce the natural flood and storm protection of the landscape by stressing native vegetation and hindering the formation and replenishment of the natural features of the LCA landscape, especially barrier islands and wetlands. These natural features of the landscape serve as a source of friction to weaken storm surges and high winds.

In order to combat the processes contributing to coastal land loss the Army Corps has outlined four clear targets in both short-term projects and long-term planning. These targets include:

- Restoring natural wetlands
- Rebuilding barrier islands
- The deauthorization of obsolete canals
- Repairing outdated and damaged flood control structures

Both the science behind the problem and the proposed solutions are surrounded by degrees of uncertainty. Because of these uncertainties as well as differing political and social interests, many of the components of the Comprehensive Plan are controversial. However, the Army Corps has undertaken similar projects in the area that have proven successful in restoring coastal features.

Nevertheless, the success of the projects in the LCA will be difficult to measure and have not been attempted on such a large spatial scale. Some of the specific measures of success that will be evaluated are increased sedimentation, reformation of barrier islands, return of native vegetation, salinity conditions, wetland distribution and flood vulnerability. If the Army Corps proves successful in achieving their goals in the LCA, the solutions outlined within Title VII can be further applied to vulnerable coastal populations all over the world.

INTRODUCTION:

Title VII of the 2007 Water Resources Development Act (WRDA) addresses the problem of coastal land loss in the Louisiana Coastal Area (LCA). The LCA contains the largest swathe of coastal wetlands in the continental United States and is defined as the area between the Sabine and Pearl Rivers, including the Atchafalaya River basin, the Mississippi River Deltaic Plain and the Chenier Plain (WRDA, 2007). This area encompasses 20,000 square miles (USACE, 2006). Current land loss rates estimate that the LCA has lost over 1.2 million acres of land since 1930, 25 to 35 miles of land per year since 1990, and is expected to loose up to 430,000 additional acres by 2050 (USGS, 2005). Coastal land loss leads to increased vulnerability of the natural ecosystems and the coastal population. While this problem has persisted for decades, it came to the forefront of public attention after the devastating effects to the region by Hurricane Katrina.

Coastal land loss is the result of both natural and anthropogenic causes. Title VII authorizes the United States Army Corps of Engineers (Army Corps), the principal federal agency responsible for flood control, to take measures to restore coastal ecosystems and reestablish flood and storm surge protection for the local population. Although the exact rates of land loss are uncertain and the science behind the problem is not perfectly understood, many of the solutions proposed in Title VII can help restore the integrity of the natural landscape. This report provides insight into the complex problem behind coastal land loss, solutions to repair and prevent damage to the coastal ecosystem, as well as controversies surrounding Title VII and ways to monitor its progress.

1. BACKGROUND

1.1 Geography

To understand the problem of land loss in the LCA, it is important to consider the historic connection between this region and the larger Mississippi watershed. The Mississippi River watershed is divided into an upper and a lower basin. The lower basin flows out to the Mississippi delta, which is encompassed within the LCA.

The LCA is made up of nine distinct basins (Figure 1). Each basin is characterized by differing rates of land loss and varying vulnerability to flooding and storms. The greatest amount of land loss, approximately eighty percent, has occurred in the Barataria and Terrebonne Basins (losing 11.1 and 10.2 square miles of land per year respectively). These two basins fall within the larger region defined as the Deltaic Plain, which is formed at the mouth of the Mississippi River.

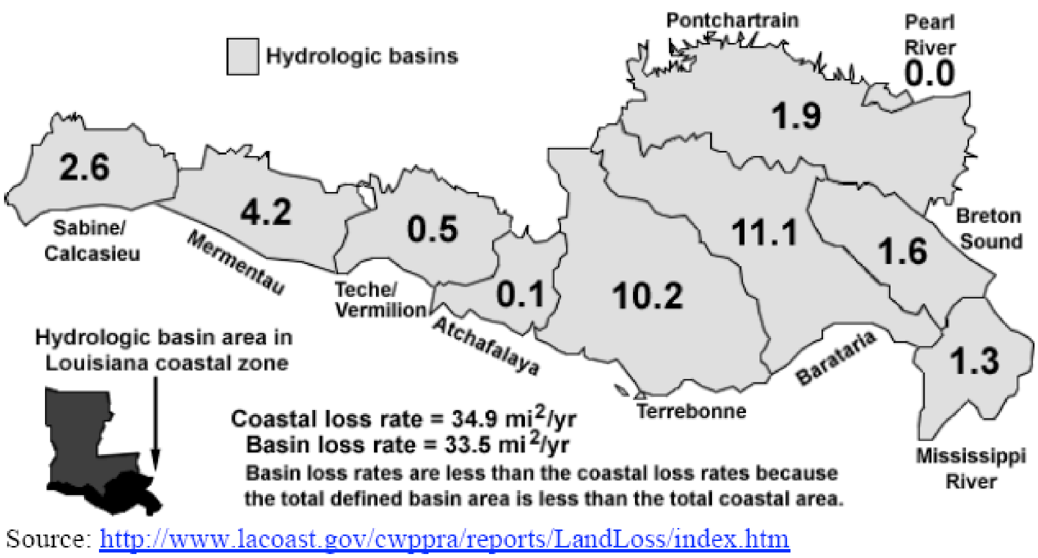


Figure 1: LCA basins and associated rates of land loss in square miles per year (Lacoast, 1994).

1.2 Historical Overview

1.2.1 Coastal Louisiana Context Pre-Human Development

Historically, the Mississippi River and its distributaries meandered and swept across the landscape. The meandering pattern dispersed sediments that literally built and shaped the landscape, forming marshlands, altering elevation of areas, and dispersing sediment into the ocean to create barrier islands. However, this natural cycle was disrupted with the onset of development both upstream and in the LCA.

1.2.2 Development and Flood Protection

As early as 1727, people began manipulating the natural cycle of the Mississippi for development purposes. The LCA, which encompasses the city of New Orleans, became a thriving shipping port and center of trade because of its access to the Mississippi River and the Gulf of Mexico. The Army Corps constructed canals and dams to facilitate the transport of goods and control the flow of the river (see Appendix IV, Old River Control Structure). The region was further developed for gas and oil extraction. The growing population, associated infrastructure and valuable economy necessitated protection from frequent flooding and storm events.

By the early 20th century, the Army Corps began building levees in the region to protect the most heavily populated areas and development centers from flooding. Levees provided a sense of security in the region, further supporting increased development and population growth (Wohl, 2000). In 1929, in part because of a massive levee failure in 1927, Congress passed additional legislation authorizing the Army Corps to build new levees in the area. As a result, the number of levees built along the Mississippi River steadily increased through the 20th century.

The implications of the large scale manipulation did not go unnoticed. By the 1970's, scientists realized that human activities were leading to adverse effects on the natural landscape, namely coastal land loss. In 2005, Hurricanes Katrina and Rita highlighted how the altered hydrology of the natural ecosystem resulted not only in the destruction of the landscape but also in decreased flood protection. Coastal land loss has thus been seen as a vital threat to regional and national security. The Army Corps, under Title VII, is now undertaking efforts to reverse the damage and restore the natural landscape to increase flood and storm protection in the LCA. Local, state and national leaders have urgently called for a comprehensive plan to stabilize, restore and protect coastal Louisiana.

2. THE LEGISLATION

2.1 Legislative History

Water Resources Development Acts (WRDA) are drafted to provide the Army Corps with direction on water resource projects undertaken throughout the United States. The first WRDA was passed in 1974. Prior to this, the U.S. Congress would authorize the Army Corps' flood control and navigation projects under different titles, such as the River and Harbor or the Flood Control Acts. In 1986, Congress passed a new WRDA that packaged several measures together into one bill. This is commonly referred to as an "omnibus act."

The last WRDA was passed in 2000, despite Congressional intent to pass a new one every other year. Previous versions of the WRDA have addressed the coastal Louisiana region, primarily for flood control projects and limited ecosystem restoration planning. However, after Hurricanes Katrina and Rita hit the Gulf Coast in 2005, the need for an updated WRDA that authorized more specific ecosystem restoration planning and storm protection was apparent.

A new WRDA was introduced on March 13, 2007. The 2007 WRDA is a comprehensive law, with multiple titles that addresses specific regions and initiatives. Included in the 2007 WRDA was Title VII, which focused on addressing hurricane damage, storm protection and ecosystem restoration in the Louisiana Coastal Area to counteract coastal land loss.

The entire WRDA authorizes $23 billion in projects nationwide. President George W. Bush vetoed the bill on November 2, 2007, calling it fiscally irresponsible overall (ENS, 2007), however Congress overrode the veto on November 8, 2007, making WRDA 2007 law. As of August 2008, funding has yet to be appropriated.

2.2 Title VII – Louisiana Coastal Area

The goals of Title VII are to reduce hurricane, storm and flood damage, protect coastal communities, and protect, preserve and restore coastal ecosystems to improve storm protection in the Louisiana Coastal Area. It authorizes $1 billion for projects to restore wetlands, many of which are ready to be implemented by 2010. It also authorizes additional funding for structural projects to protect human populations in the coastal Louisiana area.

Title VII authorizes the Army Corps to develop a Comprehensive Plan to implement the legislation's goals. The plan will be consistent with an existing coastal restoration plans from the 2005 WRDA as well as the Hurricane Protection Study and Louisiana State Master Plan, both from 2006. Figure 2 delineates the structure of Title VII and its components.

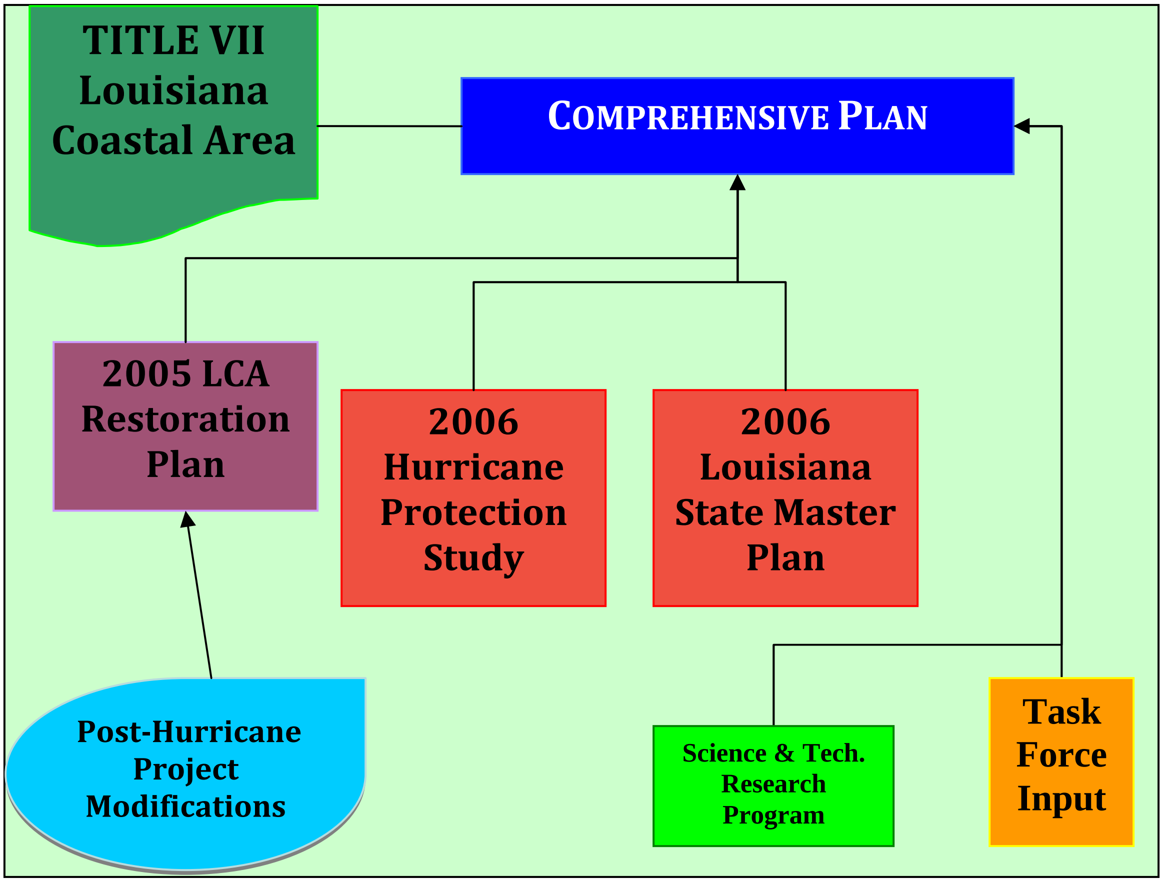


Figure 2: Flowchart representation of Title VII.

The major components of Title VII are:

- Authorization of an Army Corps coastal ecosystem restoration program that is based on their 2005 Louisiana Coastal Area restoration plan (Fig. 2, purple box).
- Creation of the Coastal Louisiana Ecosystem Protection and Restoration Task Force that will include representatives from federal government agencies, Louisiana government agencies and the United States Coast Guard. The Task Force will make recommendations on the development of the Comprehensive Plan (Fig. 2, orange box).
- Review of all water resources projects in progress in the coastal Louisiana ecosystem in order to determine any related project modifications (Fig. 2, blue oval).
- Funding of $100 million (pending appropriation) for a science and technology research program to identify uncertainty and improve knowledge relating to the scientific and cultural baseline conditions in the region (Fig. 2, green box).
- Creation of the Louisiana Water Resources Council to serve as an exclusive peer review panel for all Corps activities in major disaster areas as designated by the State of Louisiana in 2005.
- Implementation of projects to increase flood and storm production by raising levees, installing pumps, modifying drainage canals and restoring surrounding wetlands.

- Deauthorization of the Mississippi River-Gulf Outlet[1] for navigation purposes and also directs the Army Corps to determine the best method for its closure and ecosystem restoration.

Title VII clearly sets ambitious goals for preventing land loss in addition to restoring ecosystems and rebuilding flood and storm protection. The legislation addresses these complexities by calling for additional research and interagency collaboration. The first step in counteracting land loss is understanding the science behind the problem.

[1] The Mississippi River-Gulf Outlet (MRGO) is a 76 mile long man-made navigation channel connecting the Inner Harbor Navigation Canal near New Orleans to the Gulf of Mexico. It was originally authorized by the U.S. Congress in the 1950's to provide a safer, shorter route between the Port of New Orleans and the Gulf of Mexico for deep-draft navigation (15 feet or deeper).

3. COASTAL LAND LOSS

While Title VII of the WRDA encompasses a wide range of specific goals to protect and restore the coastal Louisiana region, the underlying problem driving the need for the restoration is coastal land loss. The legislation addresses both natural and anthropogenic factors of loss. The natural forces at work are land subsidence (land sinking) and sea level rise. This natural land loss is exacerbated by anthropogenic forces impacts within the Mississippi Delta region. As noted earlier, the isolation of the Mississippi River from the Delta Plain, via flood control and navigation structures built by the Army Corps of Engineers has lead to an imbalance in the sediment transport cycle. The processes outlined below demonstrate the impact of engineering projects that alter local hydrology and, ultimately, further destroy coastal wetlands.

3.1 Natural Causes of Coastal Land Loss

3.1.1 Land Subsidence

Subsidence, or land sinking, is the combined effect of geological movement along faults (fractures in the Earth's crust) and the compaction of poorly consolidated sediments. Compaction is related to the type and thickness of sediment that has accumulated on top of weathered surface (Coast 2050, 1998). In the Mississippi Delta, sedimentary deposits (sand, silts, clays, peats and shell beds) were not well compacted and had a high water content at the time of deposition. As sediments were deposited and the delta formed over hundreds of years, these poorly compacted sediments have compressed, leading to ongoing subsidence. The areas with the thickest deposition of these sediment types have the highest subsidence rates.

The geological fault pattern along the Louisiana's coast is extensive and complex. Many faults occur along zones which define irregularly shaped blocks that are subsiding within Louisiana's coastal zone. The area with the most extensive faulting occurs within the Deltaic Plain. Sixty percent or more of the total land loss for the entire coastal zone has occurred within the fault-bounded triangle in the Deltaic Plain (Penland et al. 1989; Gagliano and Van Beek 1993; Kuecher 1994). Figures 3 and 4 show the location of the Deltaic Plain and the extensive fault lines that make the area extremely susceptible to natural subsidence.

Figure 3: The coastal Louisiana area with the current deltaic plain circled. (Northest-Midwest Institute, 2003)

Figure 4: Fault-bounded area within the deltaic plain (Adapted from Coast 2050, 1998).

3.1.2 Sea Level Rise

Climatic change has led to rising sea levels which exacerbate land loss in the Louisiana coastal area. Based on sequential land surveying measurements, the rate of land loss in the fault-bounded triangle of the Deltaic Plain (As shown in Figure 4 above) is more than 3.0 feet per century due to the combined effects of subsidence and sea level rise. For instance, models predict that Southeast Louisiana could experience up to a 44 inch sea-level increase when factoring in subsidence over the next 100 years (Twilley 2007). However, future rates of sea level rise are uncertain as they depend on rates of climate change.

3.2 Anthropogenic Causes of Coastal Land Loss

Anthropogenic-driven land loss occurs as a result of the building of structures that alter the natural hydrology of the Louisiana coastal area. Disruption of the hydrological cycle subsequently damages the ecosystem and reduces flood and storm protection. Anthropogenic forces are mainly associated with man-made structures such as canals, levees and dams.

3.2.1 Canals and Spoil Banks

Canals and spoil banks permit saltwater intrusion, which causes marsh conversion in the Louisiana coastal area. Saltwater intrusion is the process by which saltwater sinks below freshwater (due to density differences) and enters into freshwater environments. Marsh conversion describes the process of marsh becoming open water through wetland plant death.

Canals have been dredged through marshes, converting wetlands into open water and altering the natural hydrology of the area (Baustian and Turner, 2006). Over 15,000 km of canals, covering 46,000 ha, have been dug since the 1930’s (Day et al. 2007). The majority of these canals were dug for oil and gas development, but were also created for navigation, drainage and logging. Deep water canals such as the Mississippi River Gulf Outlet (MRGO), a 12-by-300m canal dredged through the Breton Sound Basin, permit saltwater to intrude into wetland ecosystems. Because the MRGO is deeper than natural bayous and channels, the denser saltwater is able to intrude farther into the canal under the freshwater, illustrated in Figure 5. This effect is exacerbated by the pumping of oil, which lowers the water table and creates a vacuum, further drawing saltwater to the surface where it mixes with freshwater, thereby changing the composition of the water and stressing marsh vegetation (Baustian and Turner, 2006). This has resulted in the death of thousands of hectares of freshwater cypress forests (Day et al. 2000).

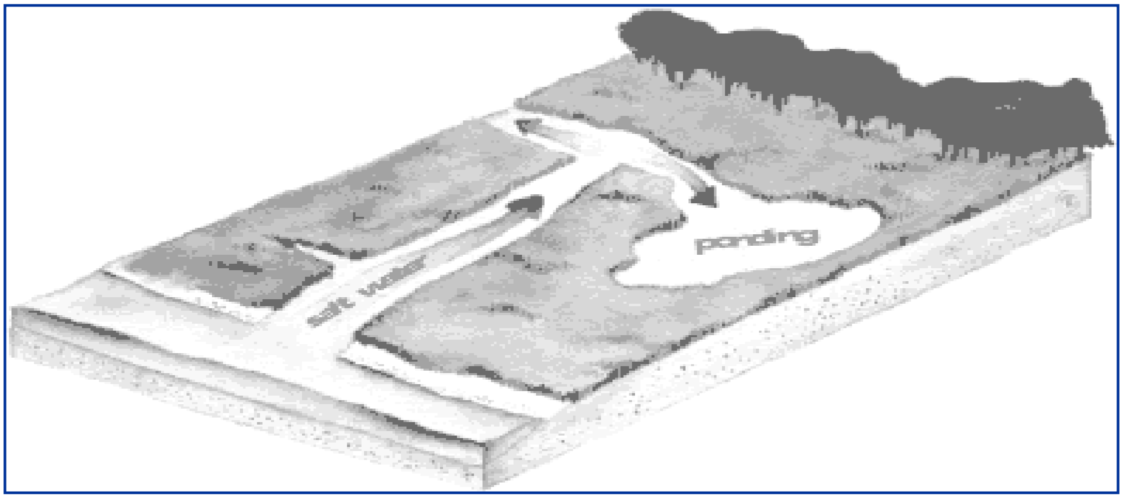


Figure 5: Saltwater intrusion (Mission 2010, 2008)

Spoil banks also disrupt the natural hydrological cycle of wetlands. Spoil banks are created by placing the material dredged to excavate the canals on either side of the canal. Spoil banks prevent the flow of water across marsh land disrupting not only sediment transport, but the hydrological flow of water over wetlands as well (Swenson and Turner, 1987). Water trapped by the spoil banks flood certain areas continually, creating pools of open water and, in effect, "drowning" marsh vegetation (Baustian and Turner, 2006). On the uphill side of spoil banks, water flow is blocked, transforming wetland environments to upland habitat.

3.2.2 Levees and Dams

Levees and Dams also alter the hydrology of the Louisiana coastal area by disrupting sediment deposition and transport cycles. Coast 2050, a coastal restoration plan undertaken approved by federal agencies and the state of Louisiana, found that the average annual suspended sediment load of the Mississippi River reaching the Gulf of Mexico is about 78 million cubic yards and estimates that this is only half of the suspended sediment load of the 1950's - before the extensive networks of dams and channel control mechanisms were in place (1998). Figure 6 compares historical and existing floodable areas where sedimentation can occur.

Natural processes of sediment deposition and transport serve two primary functions. First, sediment counteracts natural subsidence and the relative sea-level rise to prevent the disappearance of coastal wetlands (Reed, 1995). During a flood event, when a river rises over its banks, the flood waters flow over wetlands and deposit sediment and nutrients. However, the levees, dams and reservoirs on the Mississippi and its tributaries, prevent water flow into surrounding wetlands, therefore reducing sediment deposition and rendering these areas unable to counteract natural subsidence and sea-level rise (Day et al., 2000 and Penland et al., 1988). Reduced sedimentation also robs wetland vegetation of a foundation and essential nutrients, leading to a decline in vegetation. Figure 7 illustrates how dams and levees block sediment deposition.

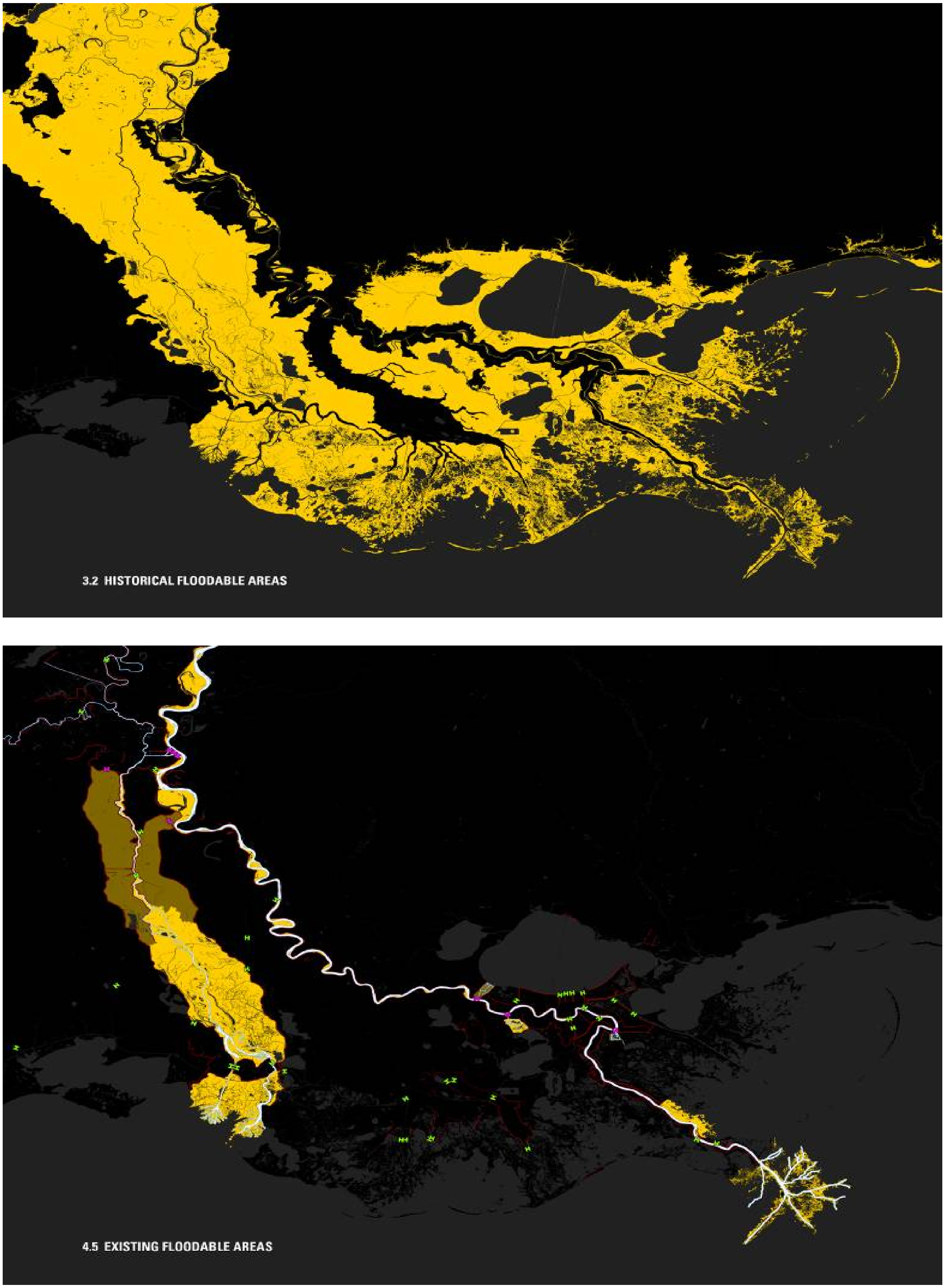


Figure 6: Reduced Sedimentation (Rosenzweig, 2007)

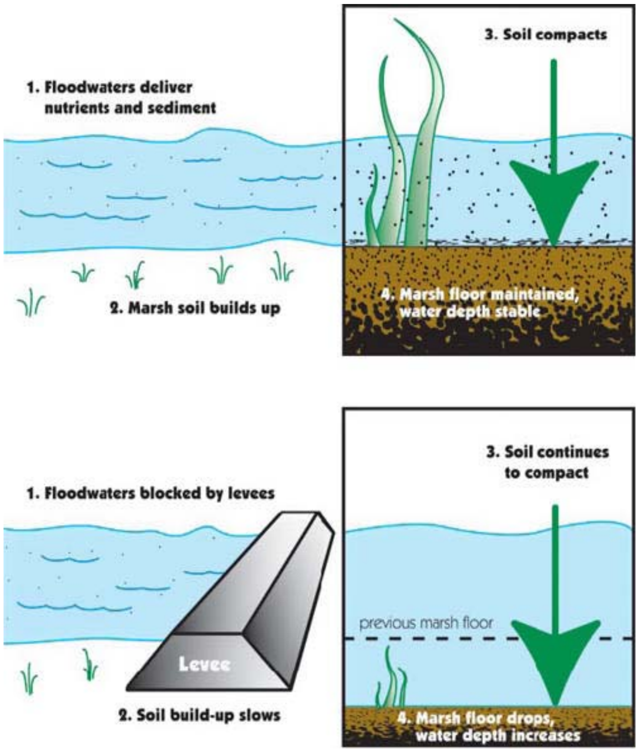


Figure 7: Example of how an anthropogenic structure (levee) reduces sediment deposition (Lacoast, 2005)

The second important function of the sediment transport is the creation of coastal barrier islands. Coastal barrier islands area created in the "deltaic lobe cycle," as shown in Figure 8 (Day et al., 2007). In this cycle, sediments are transported to the river's mouth where they are deposited. As more and more sediment is deposited, a delta begins to form; currents and wave action distribute this sediment laterally to create beaches. This process continues until the river changes course and its channel is abandoned leaving behind a beach ridge (Figure 9). These beach ridges eventually form barrier islands (Penland et al., 1988). However, man-made structures have altered this natural cycle, most notably by preventing the distribution of sediments, thus disrupting the formation of barrier islands.

The most significant system of control structure, The Old River Control Structure (ORCS) was built by the U.S. Army Corps of Engineers in the 1950's. The ORCS is a system of levees and dams upstream of Baton Rogue that prevents the Mississippi River from changing its course to the Atchafalaya River Basin to the West (McPhee, 1989). Figure 8 shows the location of Baton Rogue in reference to the Mississippi River. The red lobe labeled "Teche delta lobe" shows the area of the Atchafalaya basin. This diversion is one of many structures that disrupt the natural sediment transport cycle, and deprive the deltaic plain of sediments. Refer to the ORCS Case Study in Appendix IV for more information.

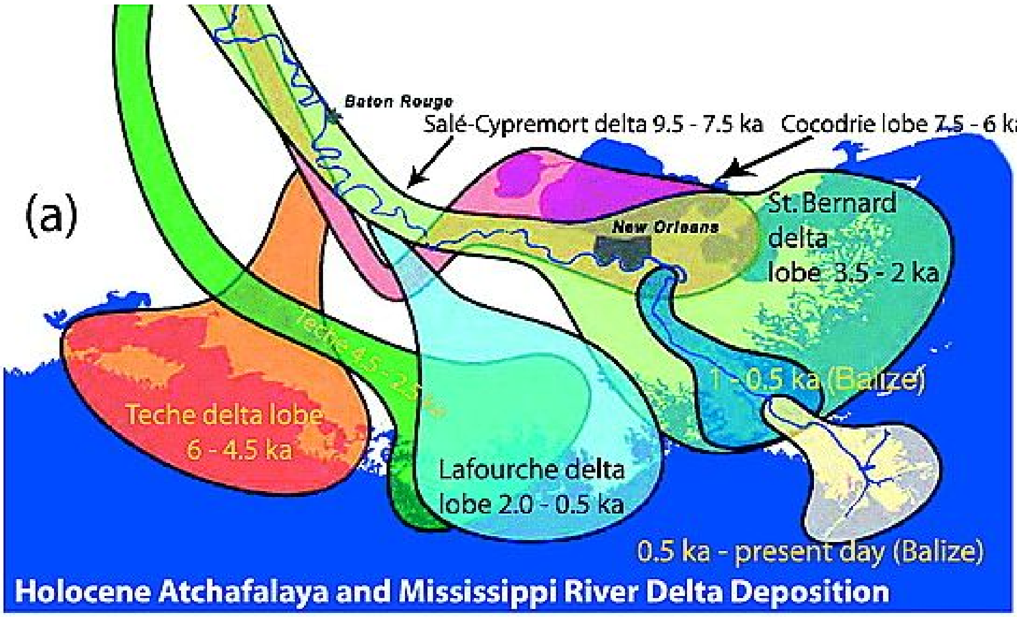


Figure 8: Formation of the Mississippi River delta over time (Ivins, 2007)

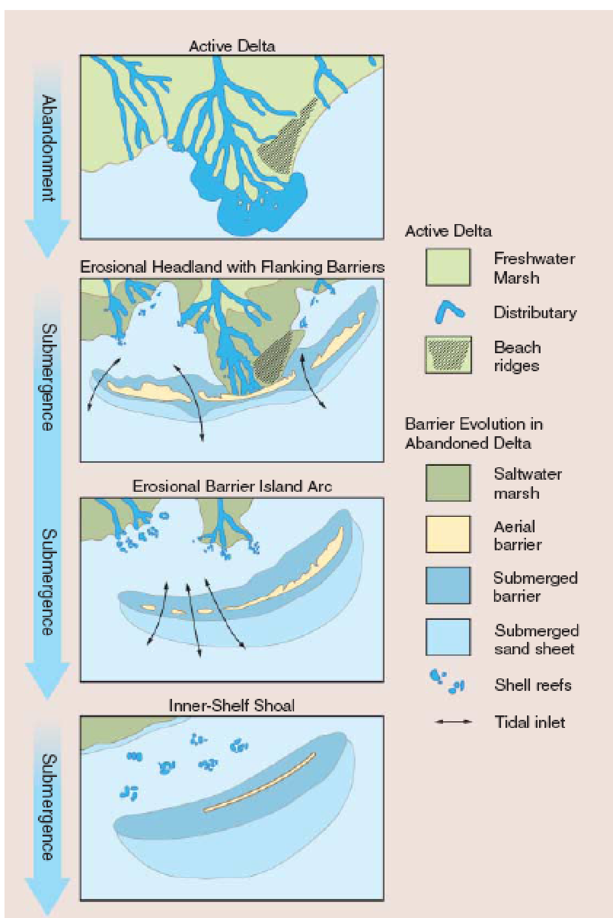


Fig. 2. The barrier island cycle in the MDP. [Modified from (*13*)]

Figure 9: Barrier Island Formation (Day et al. 2007, modified from Penland et al. 1988).

3.3 The Effects on Flood and Storm Protection

The altered hydrology of the Louisiana coastal area, combined with the effects of natural subsidence, significantly affect the ecosystem and its capacity for flood and storm protection. Marsh vegetation and sediment deposition are important factors, not only in terms of the overall ecosystem health, but also for flood and storm surge protection along the Louisiana coast.

- Barrier islands reduce storm surge during hurricanes by creating friction for incoming winds and waves, effectively reducing the force of the elements as they move inland (Day et al, 2007).
- Intact wetlands, and healthy wetland vegetation, also effectively cause friction against storm surges (Koch, 1999).
- Inland tree canopies in these wetlands can diminish wind, which then decreases the wind available to create additional surges (Raupach, 1981).
- Wetland vegetation also effectively absorbs water from flooding, reducing the duration and extent of flooding in certain areas.

It is through these processes that the natural system has evolved and survived hurricanes for many centuries. The alteration of these natural systems has led to the vulnerability of the ecosystem and reduced storm protection capacity.

3.4 Scientific Uncertainty

Although it is certain that land loss is occurring in coastal Louisiana, there is some debate about whether the driving forces are anthropogenic or natural. Members of the scientific community have not reached a consensus on the dominant causes of loss. Dr. Turner, of the Louisiana State University (LSU) Coastal Ecology Institute, argues that man-made canals are the primary driver of wetland loss as canals destroy marsh, and increase salinity in freshwater environments (1997). In 2000 Dr. Day, also of the LSU Coastal Ecology Institute examined the work undertaken by Turner in 1997 and concluded that on smaller spatial scales, canals are not responsible for the majority of the loss, although they are a contributing factor. Day maintains that it is the lack of riverine sediments that drives land loss in coastal Louisiana.

Another source of disagreement is the extent to which land loss caused by Hurricanes Katrina and Rita is permanent. In the aftermath of the storms, the USGS estimated that 140,000 acres were converted to open water, an amount equal to 42% of the predicted losses for the year 2050. However, researchers now recognize that the evaluation of permanent losses cannot be made until several marsh, wetland, and cypress growing seasons have passed and the “transitory impacts of the hurricanes are accounted for” (USGS 2006). On the other hand, some scientists contend that hurricanes are in fact a source of sediment distribution (Turner et al., 2006). Further research is necessary to establish consensus about the role of hurricane dispersal of sediments in wetlands.

Despite the numerous controversies surrounding the LCA and contributing factors to land loss, scientific research does inform the proposed solutions and pathways to achieving the restoration and rehabilitation goals of Title VII.

4. PROPOSED SOLUTIONS WITHIN TITLE VII

The alarming rates of coastal land loss in Louisiana have necessitated action to address both the natural and anthropogenic causes of loss. The Army Corps, through Title VII, has outlined a number of proposed solutions to restore the ecological integrity of the LCA and provide valuable flood and storm protection for the population of greater than two million people.

4.1 Short and Long-Term Planning

In order to prevent land-loss and restore natural features of the LCA, Title VII presents several solutions. These solutions include remediation of damaged ecosystems and the creation of flood and storm protection. The solutions are separated into short-term priorities and long-term planning. Prior to Hurricane Katrina, the Army Corps designed 15 short-term priority projects, 10 of which Title VII authorizes. One of the priorities explicitly listed in the legislation is the closure of the Mississippi River-Gulf Outlet (with an estimated budget of $105 million), which would allow the Army Corps to undertake extensive restoration. Additional short-term planning includes the following projects, which have been identified as having the potential to impact the largest area of degraded wetland, thus having the greatest potential to succeed in wetland restoration:

- Hope Canal diversion - $69 million
- Barataria Shoreline Diversion – $243 million
- Small Bayou Lafourche - $134 million
- Myrtle Grove - $278 million

Additionally, Title VII promotes long-term planning through the mandated comprehensive plan, which integrates previous planning efforts to incorporate both ecological restoration and extreme-weather protection plans. More specifically, long-term planning goals involve creating multiple lines of defense against storms and hurricanes. Features of this planning include:

- Restoring wetland vegetation
- Re-constructing barrier islands
- Back-filling canals
- Repairing outdated and damaged flood control structures

Representatives from multiple Federal and State agencies will advise the structure and execution of the plan. In addition, Title VII funds five areas of scientific research that will combine to increase understanding of the coastal ecosystem and the most effective way to manage the area.

4.2 Components of Coastal Restoration

Both the short-term projects and the long-term planning specified in the legislation focus on the restoration of the coastal ecosystem and the repair and creation of new storm surge protection. The main components of the restoration projects will involve wetland restoration, the building of barrier islands, the repair of existing flood control structures, and the decommissioning of obsolete canals.

4.2.1 Wetland Restoration

Title VII authorized more than $2 billion in construction activity to restore wetlands. The United States Environmental Protection Agency (EPA) defines wetlands as areas saturated by either ground or surface water and containing vegetation adapted to grow under such conditions (EPA, 2003). The science behind wetland restoration depends primarily on the type of wetland present and the causes of wetland loss. Wetland restoration is an extremely challenging and complex process requires planning, monitoring, and management (EPA, 2003). In addition, the EPA encourages adaptive management techniques be used when restoring wetlands, due to the uncertainty of success and timetables. Proper implementation is one of the most important parts to wetland restoration

In the LCA, wetland restoration primarily includes establishing natural vegetation to hold sediments in place (EPA, 2003). Native seed banks are used, and germination generally occurs as soon as suitable growing conditions are created. Many plants are grown ahead of time, which can take up to six months. Thus, proper preparations and planning are needed to ensure the plants are ready upon project completion. Figure 10 defines different types of coastal vegetation that are used in different coastal regions.

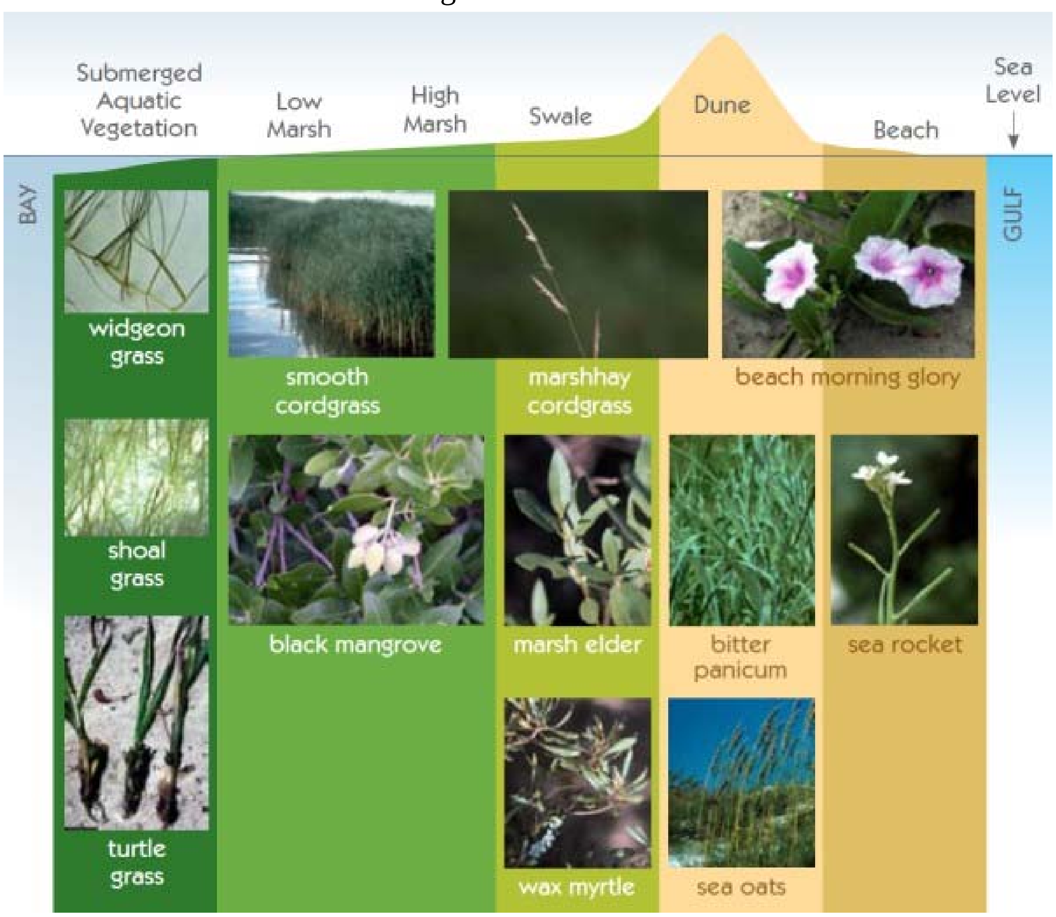


Figure 10: Different types of wetland vegetation that can occur in coastal environments. (Lacoast, 2008)

4.2.2 Barrier Island Restoration

Barrier island restoration in the Mississippi delta region is planned using sand pumped from off-shore deposits. Only sediments that are larger than fine sand are suitable for barrier island restoration because finer sediments are too easily washed away (World Environmental and Water Resources Congress, 2007). The sand can be held in place by the construction of several different structures. These include groins, which are built perpendicular to beaches and help trap sediments, breakwaters, fences, and a permanent cover of rock rubble and plantings to stabilize the structures. However, due to the natural tendencies of barrier islands to migrate and erode these structures will require regular maintenance (Day et al., 2007). Figure 11 shows an example a type of sediment trap.

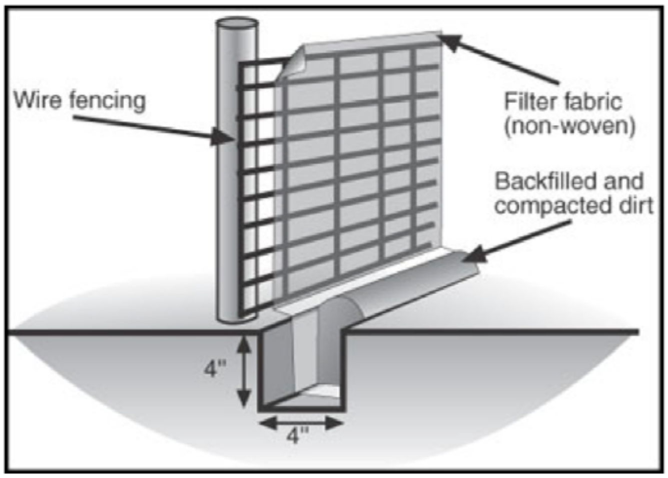


Figure 11: Sediment trap diagram and image (University of Missouri, 2003)

The sediment will be dredged off-shore in the Gulf of Mexico that then can be delivered through a pipeline to areas in need. Types of dredging include *dustpan* and *hopper*. Dustpan dredging collects the sediments from the sea floor delivers them to a floating pipeline which then directs the sediments to the project location. Another technique used in the Louisiana area is hopper dredging. This approach collects the sediments on a ship that then transports them to the project location where the dredged material is offloaded. Both types of dredging are illustrated in Figure 12. Sediment transport pipelines have been used previously in the Louisiana area and already exist through right of ways (ROWs) that intersect the Mississippi/Atchafalaya Rivers.

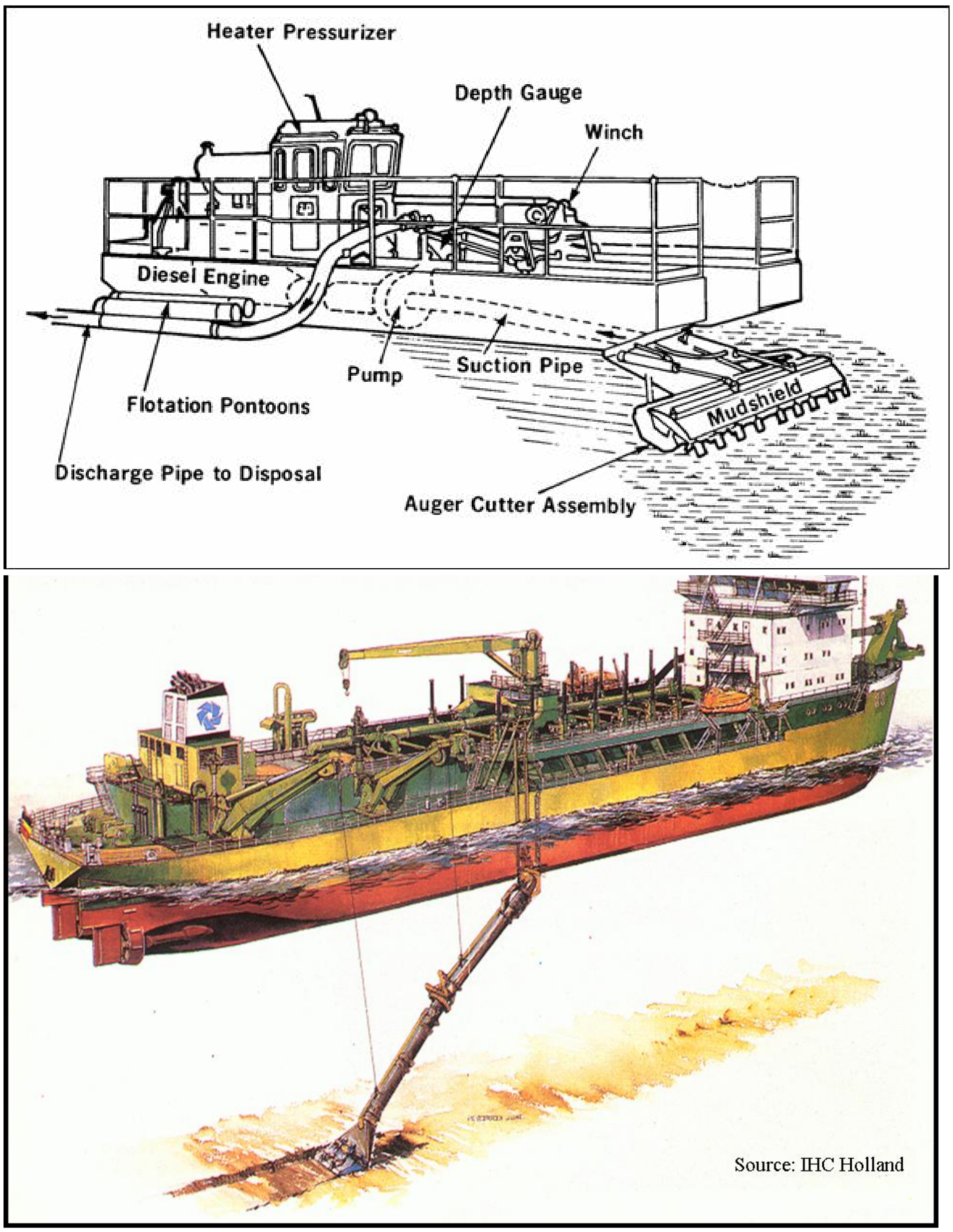


Figure 12: Dredging type diagram (U.S. Coastguard, 2008)

In 2007, the USGS performed surveys to find additional sources of sediment for barrier island construction. Although 400 million cubic yards of sand were found offshore of Barataria Basin, there are concerns about removal. Removing sand will increase wave size from the borrow site where sediments are taken and dredging can be detrimental to the marine life in this area as well. In addition, off-shore sand is a finite resource that can really only be dredged once. However, sediment traps are being utilized to catch sand farther upstream for possible island building uses (World Environmental and Water Resources Congress, 2007).

With regards to barrier islands, scientists agree they are necessary to protect coastal marshes. However there is a degree of uncertainty on the best way to restore them, where to construct them and how to maintain them. For instance, the optimal height and width for barrier island construction is not easy to determine. An island that is too low will easily be eroded and vegetation will not be able to take hold. One that is too high will encourage the growth of vegetation ill-suited to variable conditions where storm surge may periodically cover the barrier islands.

4.2.3 Decommissioning Obsolete Canals

Canals crisscross the LCA landscape, providing navigational routes for the transportation of goods and people. However, many of these canals are obsolete or unused and can be decommissioned. As explained above in Section 3, spoil banks, a byproduct of canal construction, have several negative effects. The Louisiana Department of Natural Resources believes the best solution is to restore the area to natural ecosystem conditions. This can be accomplished by returning the dredged material from the spoil banks back into the canal, a process called backfilling, illustrated in Figure 13. Vegetation will recolonize the new land area, stabilizing it (Campbell et al. 2008). The growth of vegetation on the top of a backfilled canal decreases the occurrence of floods and unnecessary erosion.

Figure 13: Backfilling canals (Ramasar, 2008)

The Mississippi River Gulf Outlet (MRGO) is one of the large scale short-term projects under Title VII. This canal was constructed to provide a shorter route from the Gulf of Mexico to the Port of New Orleans, but large portions of this canal have been out of use since the 2005 hurricanes deposited significant amounts of sediments in the channel. Title VII deauthorizes the shipping channel and directs Army Corps to develop a plan for its closure and restoration. Closure of MRGO will include a total rock structure to prevent unauthorized navigation and assist restoration efforts. (See case study at end of this section.)

4.2.4 Repairing Outdated and Damaged Flood Control Structures

Although not one of the solutions to the problem of coastal land loss, repairing and updating existing control structures is an integral part of protecting the human population centers, and thus one of the clearly outlined goals of Title VII. As such, the legislation recognizes that the solution to the overall goal of protecting the region from hurricanes and storm events cannot be achieved through natural restoration processes alone. Title VII thus authorizes the improvements to a number of levees around the New Orleans area to meet the 100-year flood standard.

The 100-year flood standard is a statistical average that indicates that there is a 1% chance that a damaging flood will occur in any given year. The term does not mean that a flood will only occur once during a century. Figure 14 shows the population density in the LCA, indicated by the concentration of red dots. The second image in this figure shows the area of land loss if sea level were to increase by one foot. This increase is also a good proxy for the flooding that can occur during extreme storm events. It is evident that large portions of the population are extremely vulnerable to flooding and increasing sea level. The levees in the region served to protect the coastal population from these threats. Unfortunately, many of the levees in the region do not meet the 100-year flood standard. In addition, Hurricanes Rita and Katrina significantly damaged a number of levees. Figure 15 shows the number and location of levees that are currently not up to standard or are damaged.

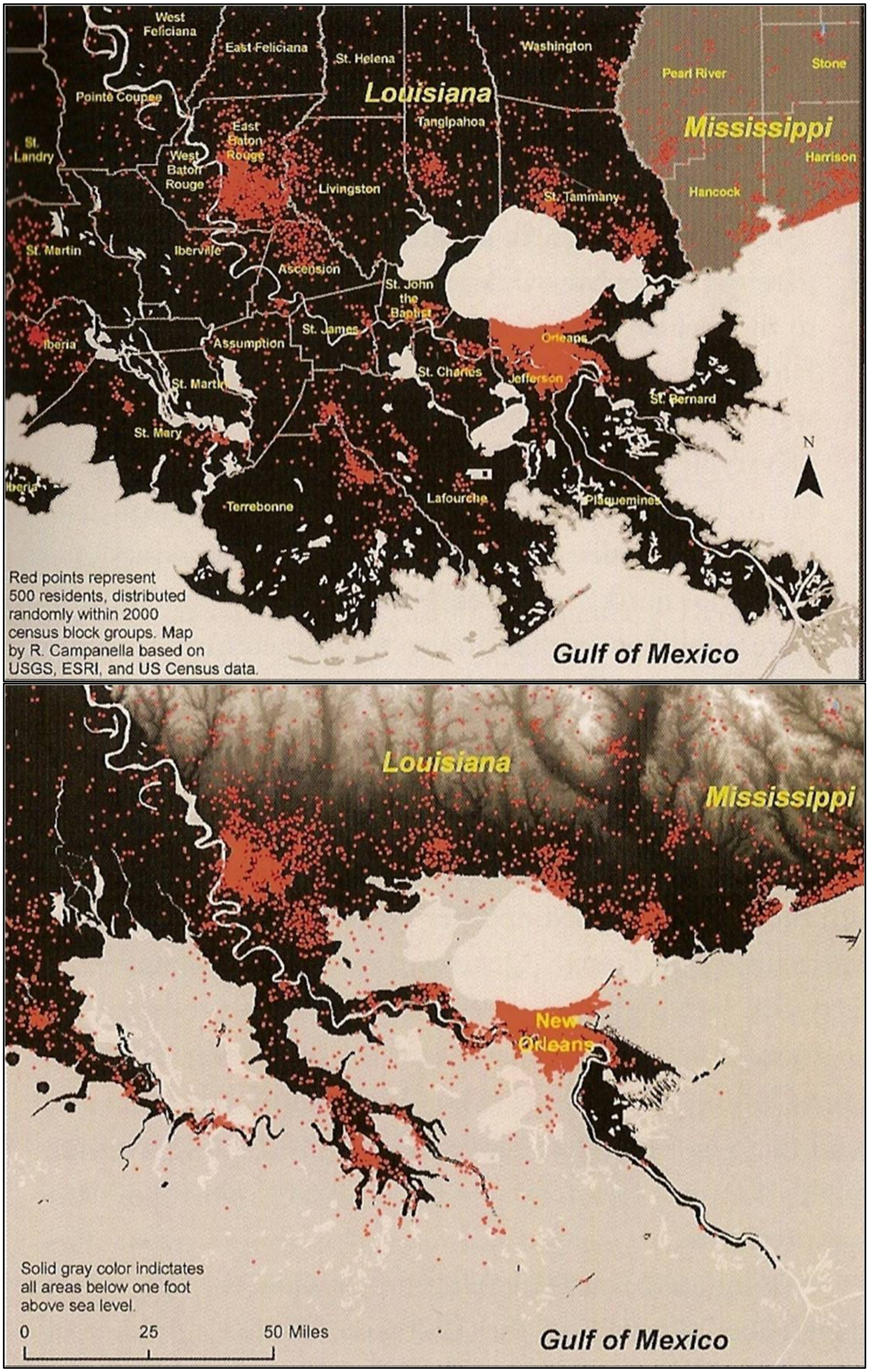


Figure 14: Population below sea level in LCA (Campanella, 2005)

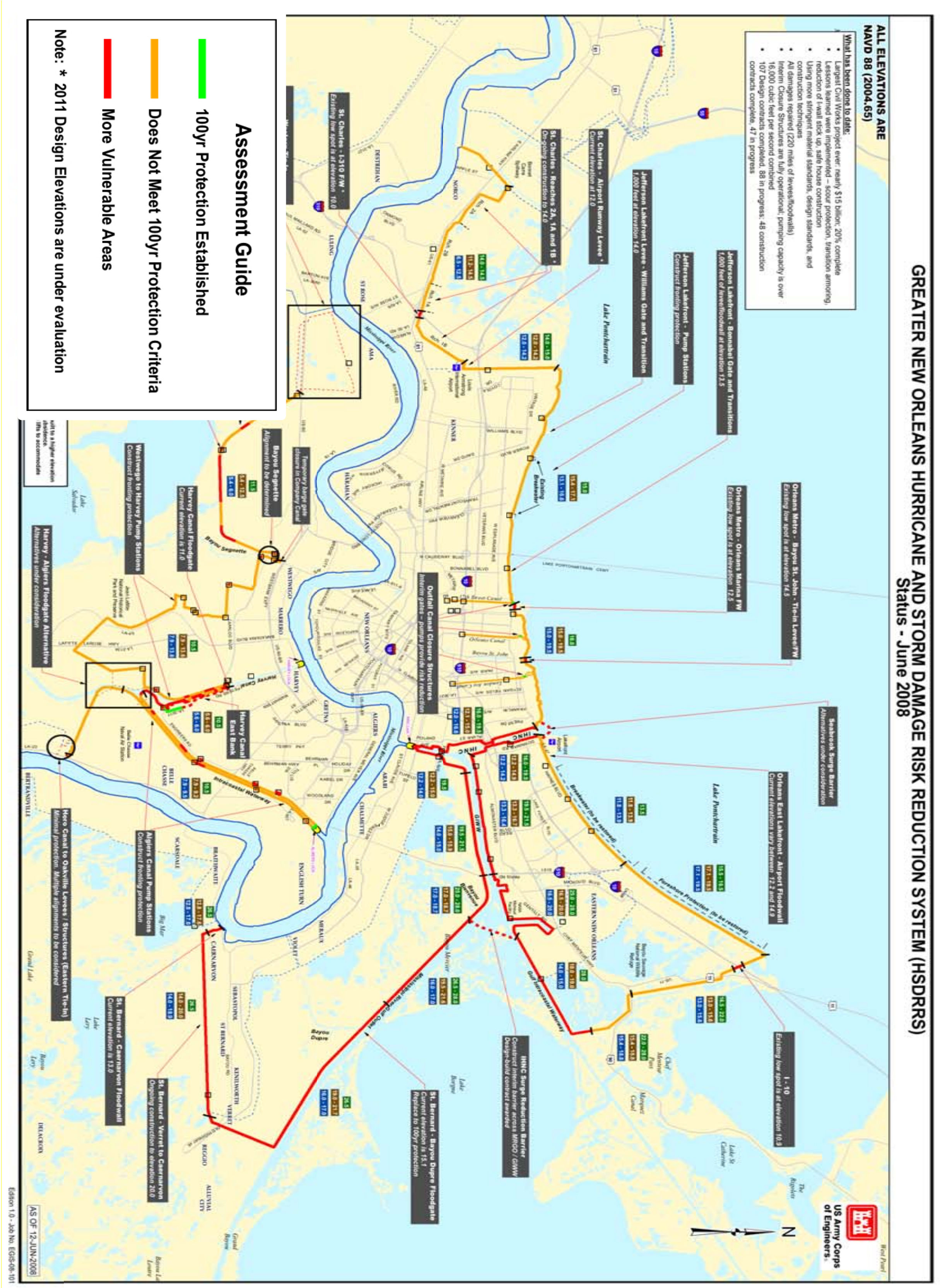


Figure 15: Damaged and outdated flood control structures in the LCA (USACE, 2008)

4.3 Uncertainty Associated with Restoration Efforts

The complexity of both the science behind coastal land loss and the proposed solution result in several uncertainties.

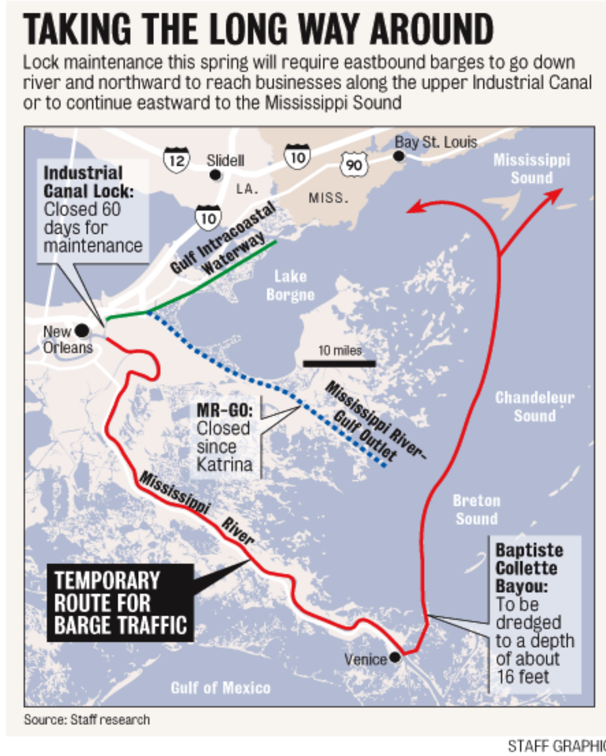
The main controversy that must be resolved is the potential for successful restoration of the entire region. Questions surround the rebuilding of barrier islands and whether there is enough sediment for restoration. Researchers estimate that only 15% of the Mississippi River's sediment is available for land building, since much of it is trapped by up-river dams (Campanella 2006). The remaining sediment reaching the delta is too small for land-building purposes or too difficult to recover. Scientists also question whether enough of the right types of sediments flow to where they are needed for planned diversions. Further complication stems from the tendency for organic materials in diverted sediments to decompose, which leads to subsidence as well as slow and uncertain accretion rates (Streever 2001, Swarzenski & Doyle 2005).

There is also a concern about the impact of multiple restoration projects being carried out simultaneously and how they will interact on a regional scale. Each individual restoration project brings uncertainty about sediment availability, accretion rate, salinity levels, and habitat impacts. The uncertainty grows when multiple projects are planned for and interact at a regional scale. Even in the absence of political considerations, the task of planning a regional-scale salinity and sedimentation regime is tremendously complicated given the Army Corps' limited experience with ecosystem restoration as well as the uncertainties of stochastic impacts. Although hydrologic modeling and field-monitoring capabilities have improved in recent years, the Army Corps still faces unprecedented complexity in the creation of a regional scale comprehensive plan.

Lastly, the task of balancing hurricane protection and ecosystem restoration measures is by far the most challenging responsibility of the Army Corps. The original LCA Restoration Plan was formulated prior to Hurricanes Katrina and Rita and had little emphasis on flood control or hurricane protection. Following the storms, the public demanded increased protection measures and Congress directed the Army Corps to study the possibility of providing category 5 hurricane protection for the region. Title VII establishes the comprehensive planning process to integrate these objectives, but it does not specify how they should be balanced or how far the Army Corps should go to protect population centers like New Orleans. Furthermore, proposed protection measures such as flood gates and 100-year levees could actually work against ecosystem restoration. Negotiating the balance between protection and restoration will be the most complicated and contentious task ahead.

CASE STUDY: *The Mississippi River Gulf Outlet (MRGO)*

MRGO is a 76 mile long man-made navigation channel connecting the Inner Harbor Navigation Canal near New Orleans to the Gulf of Mexico. Construction began on the channel in 1958. It was originally authorized to provide a safer, shorter route between the Port of New Orleans and the Gulf of Mexico. It later became clear that MRGO was exacerbating land loss in the surrounding marsh and increasing saltwater intrusion in Lake Borgne and Lake Pontchartrain. This damaged the ecosystems of two lakes and surrounding the channel. In response, the U.S. Army Corps of Engineers (Army Corps) released a restoration plan in early 2005, recommending environmental restoration of MRGO to protect critical wetland habitat. On April 6, 2005, the Water Resources Development Act of 2005 was introduced into Congress. It was never enacted, but clearly sought to address the growing concern over the implications of the channel, directing the Army Corps to develop modification plan for MRGO to prevent the saltwater intrusion and coastal land loss.



Case Study 1. Graphic showing the location of MRGO. Courtesy of The Times-Picayune, 2-11-08.

Following Hurricanes Katrina (August 2005) and Rita (September 2005), a significant amount of sediment was deposited in the channel, decreasing its depth from 36 to 22 feet, creating serious navigational hazards and substantially increasing the cost of dredging. The hurricanes also resulted in levee damage along the channel, with several miles being overtopped and eroded. This resulted in significant damage to surrounding marshland. This post-hurricane political environment gave Congress the opportunity to change their priorities in the WRDA of 2007, explicitly deauthorizing MRGO for shipping in Title VII and directing the Army Corps to develop and implement a closure plan in addition to the restoration recommended in their 2005 report.

The modifications to MRGO are key components to the solutions given in Title VII. Environmental restoration of the areas affected by the channel is specifically listed in Title VII as an initial project with an authorized budget of $105,300,000 and the closure plan will be carried out in accordance with the Comprehensive Plan. On June 5, 2008, the Army Corps submitted their decision to completely block the entrance to MRGO, preventing all navigation indefinitely.

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5. CONTROVERSIES

Broader controversies exist beyond those related to the science behind the problems and solutions outlined above. A primary element for implementing a successful restoration program in the region is an understanding of the political and socio-economic issues involved. The reality of the region is that there are multiple and sometimes conflicting economic interests in addition to established communities and important ecosystems. The three are connected, but stakeholders are often at odds. This section examines some of these controversies in further detail.

5.1 Passage of the Act

The WRDA of 2007 had popular support during its debate in Congress. However, many conservative legislators and citizen groups, including President Bush were opposed to the Act in its entirety. This does not imply that those voicing opposition to the Act were specifically opposed to Title VII itself, or the work it is calling for in Louisiana. In reality, Title VII had a great deal of support, but those opposed to the whole Act charged that with an authorization of $23 billion, it was fiscally irresponsible. Ultimately, Congress voted to override President Bush's veto. However, the full extent of support for Title VII will not be clear until the funding authorized under the Act is actually appropriated.

5.2 Balancing Human Safety and Ecosystem Restoration

The balancing of ecosystem restoration with the protection of the human population is a source of controversy with Title VII. As discussed earlier, levees contribute primarily to land loss by, depriving wetlands of sediment and nutrients that would counteract natural land subsidence. However, levees remain an integral part of protecting the coastal population from severe storm and flood events. While ceasing levee development would alleviate some of the damage caused to ecosystems, it would result in increased vulnerability to the human population in the region. However, because protecting the human population is a priority within the legislation, the levees MUST be restored to 100-year flood protection.

5.3 Storm Protection Design

A 100-year storm is any storm that has a one percent chance of occurring in any given year. This criteria is used for creation of flood maps and for disaster planning purposes. However, controversy has existed for several years on the accuracy and effectiveness of this criteria. A post-disaster study following Tropical Storm Allison in 2001 revealed that of approximately 45,000 flooded buildings, only 7000 (16%) were located within the 100-yr floodplain (Sinnock, 2001). This shows that techniques for mapping vulnerable areas must be updated and refined to account for future change of climate patterns as current techniques did not properly identify flood-vulnerable areas. In addition, climate change is expected to increase the likelihood of such a storm, as well as lead to an increase in sea-level, which will further strain existing flood-control systems. .

The impact of climate change leads to a degree of uncertainty and controversy surrounding the viability of restoration projects and flood control structure repairs that the Army Corps is attempting. An increase in sea-level or storm surge of two feet would submerge over 3,500 square miles of the coast (LA Coast 2003). In May of 2007, an amendment to the WRDA requiring the Army Corps to increase climate-change related planning was narrowly defeated. The Army Corps responded by creating an interagency task force to address climate change. They also plan to invest $15 billion to construct wide-base levees that could be raised to higher levels in the future if necessary to provide a higher level of protection for the human population in the these vulnerable regions.

5.4 Political Complexities

The Army Corps has managed the lower Mississippi River under Congressional direction for many years. This management system includes dams, dikes, canals, levees and other control structures that direct freshwater and sediment into specific basins, or regions of the Louisiana coast. The consequence of altering the hydrogeology of the delta is that multiple interests petition the Army Corps and Congress for use of the river's resources.

The Army Corps is likely to face many political complexities with each river diversion or restoration project, regardless of the scale. For example, scientists advocate additional river discharge to combat saltwater intrusion and provide sediment for wetland rebuilding. However, various industries in the region prefer different levels of freshwater and sediment to be directed into a particular basin. For example, crawfishermen, navigation interests, and municipal interests advocate for increased flows of varying levels of freshwater to reduce salinity levels and maintain shipping channels. On the other hand, shrimpers, oystermen and other fisherman want less freshwater and sediment. In order to achieve successful wetland restoration in the area, optimal salinity and sediment levels ultimately decided upon as restoration goals must be based upon scientific recommendation, and not the preferences of interest groups. However, the Army Corps may have to consider the positions of various stakeholders before deciding upon future ecosystem conditions.

6. MONITORING RESTORATION ACTIVITIES

Because of the many complexities and uncertainties underlying Title VII, measuring and monitoring the success of the program is imperative. Achieving a successful outcome requires a continuous, cyclical process that involves setting priorities, developing strategies, taking action and monitoring the success for future improvement. Structured feedback is necessary to evaluate the impact of restoration activities as well as the status of restoration projects. In this section, we identify some of the scientific measures to provide feedback, which can be developed as Title VII is implemented.

As outlined earlier in this report, the Army Corps has authorization to implement projects to combat the threat of land lass and hurricane vulnerability, based on their potential to rebuild coastal features and protect population centers. We identify key outcome indicators to measure how well the program meets these goals as well as some methods for measurement.

6.1 Goal: Restoration of Wetlands

Indicator 1: Increased Sedimentation

The reduction of sedimentation rates has been identified as a major contributor to the loss of wetlands in the LCA. A reduction in floodable areas and flow of the Mississippi River over the landscape has led to reduced dispersal of sediments that are vital to maintaining land acreage. An effective restoration plan will seek to mimic the natural hydrological flow and will use other methods to increase rates of sedimentation in wetland areas. Successful implementation of this program will reduce land loss by helping to counteract subsidence and distributing nutrients. It will increase acreage of wetlands and marshes throughout the LCA. Successful achievement of this goal will result in a measurable increase in wetland acreage.

The used of dredged sediment has been suggested as a method of increasing sediment deposition, counteracting subsidence and nutrient loss. Sediment accretion can be monitored at several stations along the Mississippi River and within drainage basins using marker horizons and cryogenic coring. These monitoring techniques will measure the amount of sediment accumulation and will provide scientific feedback on the progress of wetland rebuilding.

Indicator 2: Sustainable Freshwater-Saltwater Balance

Good water quality is essential to ensuring that the reestablishment of wetlands is sustainable over the long-term. Distribution, type, and function of vegetation are determined by freshwater inflow in a wetland system. A spectrum of saline conditions exists in coastal wetlands such as freshwater, intermediate, brackish and tidal marshes. Each environment supports diverse flora and fauna. Saltwater intrusion has been a critical problem that leads to the loss of wetlands and alters the balance between freshwater and saltwater zones. Increasing freshwater flow will counteract the adverse effects of saltwater intrusion. To measure the success of the program, salinity levels should be measured regularly, as well as freshwater inflow.

Indicator 3: Marshland Health

Freshwater marshes are restored by improving the chemistry of the soil and creating optimal water depths for endemic marshland vegetation to flourish. Successfully restored marshland will replicate baseline, or pre-disturbance, ecological conditions and will be similar to undisturbed wetland ecosystems. An increase in the diversity and abundance of plant species in marshlands is an indicator of improved health.

Diversity and abundance of plant species can be determined by conducting a species diversity assessment on a seasonal basis. This would allow scientists to evaluate a change over time in vegetative composition and cover. The assessment would also provide the ability to compare the progress of the recovering marsh to that of a healthy functioning marsh ecosystem. Finding a percent-increase in vegetation, both within marshes and upon barrier islands, would indicate progress in ecosystem restoration in the area.

Indicator 4: Wetland Distribution

Other factors that deserve consideration in monitoring are the spatial relationships between wetlands. This plays an important role in hydrological and ecological processes. Aggregate acreage, wetland type, wetland dispersal and the spatial relationship of different wetlands areas should be monitored using advanced GIS Satellite mapping software to visually analyze and monitor changes in wetland coverage. A significant extension of wetland coverage indicates a healthy ecosystem that is capable of providing a buffer from storm surge.

Successful implementation of the restoration program could be measured by comparing images of present and historic wetland distribution in the area. A return to historic wetland coverage would indicate increased flood and storm surge protection.

6.2 Goal 2: Restoration of Barrier Islands

Indicator 1: Land Stabilization

Rebuilding and stabilizing barrier islands will help protect the region from the full force of tidal action and ocean storms. The restoration plan requires the stabilization of approximately 47.6 miles of barrier shorelines, headlands and islands. Achieving a successful barrier island restoration can be measured by comparing current and historic barrier island acreage.

Indicator 2: Vegetation Cover

Vegetation re-growth is an essential part of recovering and stabilizing the 47.6 miles of barrier islands, shorelines and headlands required by the legislation. An increased abundance of vegetation will prevent erosion of the sediments of the island and will reduce the friction of incoming storms. Monitoring vegetation re-growth provides feedback about the stability of barrier island sediment and other protective structures.

6.3 Goal 3: Reducing Flood Vulnerability

Indicator 1: Reduction of Levee Breach vulnerability

Testing levees for breach vulnerability is an essential component in ensuring flood and storm protection of population areas. Increasing levee height and fortifying levee walls in areas that have been identified as breach-vulnerable significantly increases flood protection. Improving flood wall standards by adding three feet in width for every vertical foot is a minimal starting point for this restoration and reinforcement. Reinforcing levees and canals and testing their resistance before another catastrophic storm hits the region is a critical component of successful flood and storm protection.

Indicator 2: Adherence of levee systems to "100 year" flood protection standard

Measuring successful reinforcement requires that modeling methods, flood mapping, and structural integrity of control structures are up-to-date. Models that predict the impact of floods and storms on the region and on levee systems need to incorporate the increased frequency of intense storms due to climate change.

Title VII requires that successful flood control structures are designed and built to the "l00-year" flood protection standard. Finding that 100% of levees and canals in coastal Louisiana meet or exceed this standard would indicate successful restoration and reinforcement of the engineered flood control system.

Achieving a successful outcome is a continuous, cyclical process that involves setting priorities, developing strategies, taking actions and monitoring success for future improvement. Careful monitoring is critical to success and for ongoing future improvements. Additionally, monitoring informs future planning processes and is essential for adaptive management when faced with uncertainty.

CONCLUSION:

Title VII incorporates existing restoration plans with post-Katrina and post-Rita priorities through the development of a comprehensive plan. This plan will aim to counteract coastal land loss in order to protect, preserve and restore the natural landscape to provide improved protection for coastal populations.

The causes of coastal land loss are both varied and complex. Anthropogenic land loss in the region is exacerbated by natural land subsidence and sea level rise. The relative contributions and causes of land loss in specific areas are surrounded by a degree of uncertainty. It is widely accepted however, that these natural causes in combination with the manipulation of the coastal area have resulted in increased vulnerability to storms and flooding.

With this in mind, the Army Corps, under Title VII, has proposed solutions using short-term projects and long-term planning. Specific actions include restoring natural wetland vegetation, restoring barrier islands, decommissioning obsolete canals and repairing outdated and damaged flood control structures. The solutions, like the problems they attempt to address, are challenging and uncertain. However, the Army Corps will continue to monitor the success of their remediation projects in the coastal area by looking at key indicators such as the successful re-growth of wetland vegetation or the reformation of barrier islands.

On a broader level, the most significant challenges to implementation are the larger political complexities of the issue. Namely, how Title VII can both incorporate the restoration of a natural ecosystem while also addressing human needs for flood and storm protection.

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APPENDIX I: DEFINITIONS

The following terms apply to this report:

TITLE VII:

TITLE VII of the Water Resources Development Act of 2007, which specifically addresses the Louisiana Coastal Area.

COASTAL LOUISIANA ECOSYSTEM:

The term ‘‘coastal Louisiana ecosystem’’ means the coastal area of Louisiana from the Sabine River on the west to the Pearl River on the east, including those parts of the Atchafalaya River Basin and the Mississippi River Deltaic Plain below the Old River Control Structure and the Chenier Plain included within the study area of the restoration plan.

GOVERNOR:

The term ‘‘Governor’’ means the Governor of the State of Louisiana.

RESTORATION PLAN:

The term ‘‘restoration plan’’ means the report of the Chief of Engineers for ecosystem restoration for the Louisiana Coastal Area dated January 31, 2005.

TASK FORCE:

The term ‘‘Task Force’’ means the Coastal Louisiana Ecosystem Protection and Restoration Task Force established by section 7003. The Task Force will provide recommendations on the comprehensive plan to the Army Corps.

COMPREHENSIVE PLAN:

The term ‘‘comprehensive plan’’ means the plan developed under section 7002 and any revisions thereto. The comprehensive plan will incorporate the restoration plan as well as other studies and new scientific research and technology.

APPENDIX II: ACRONYMS

EPA - Environmental Protection Agency

FEMA – Federal Emergency Management Agency

HPS - Hurricane Protection System

GIWW - Gulf Intracoastal Waterway

LCA - Louisiana Coastal Area

LSU - Louisiana State University

MRGO - Mississippi River Gulf Outlet

ORCS - Old River Control Structure

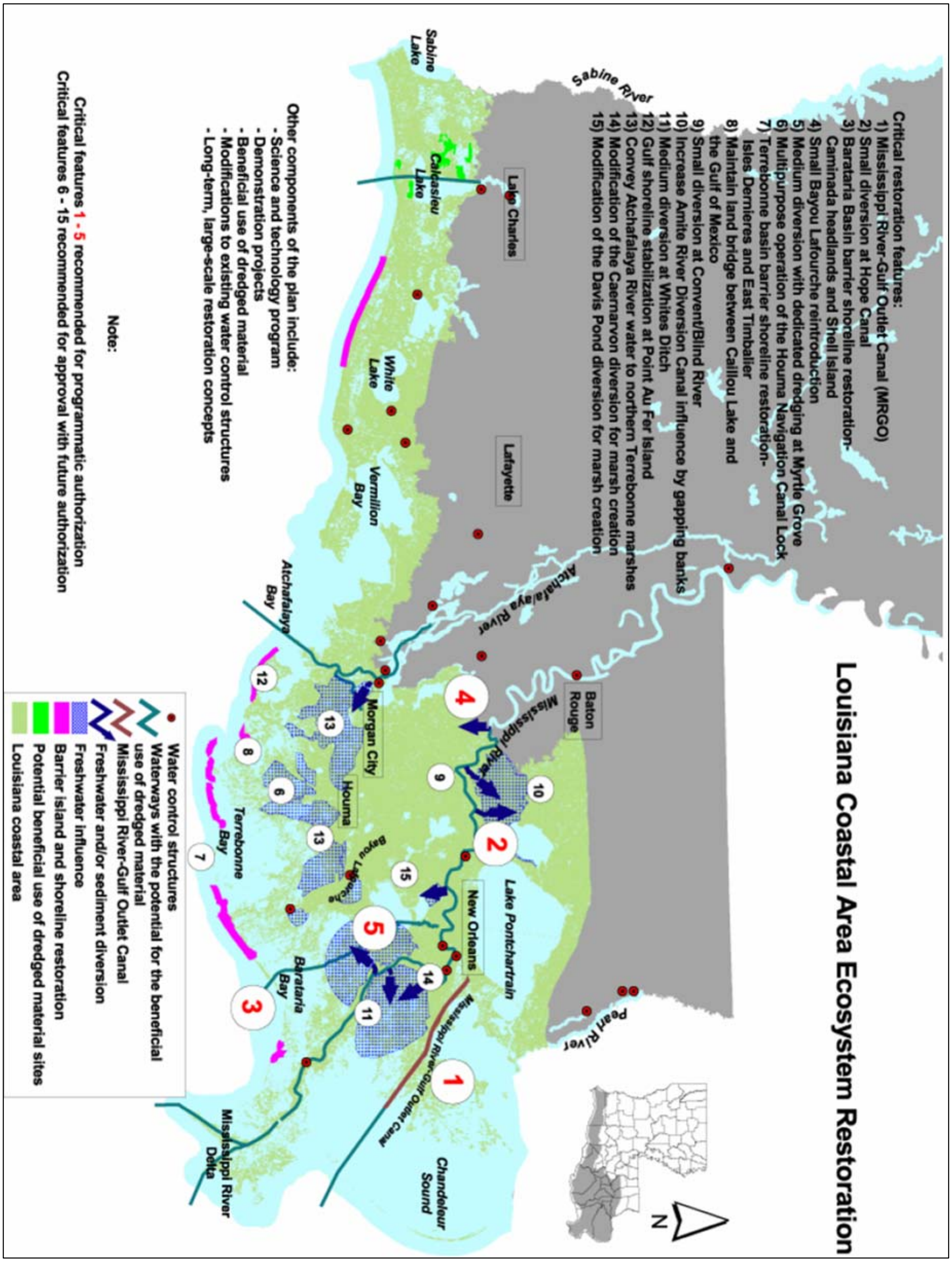
ROWs - right of ways

USACE or Army Corps – United States Army Corps of Engineers

USGS – United States Geological Survey

WRDA – 2007 Water Resources Development Act

APPENDIX III: SHORT-TERM PROJECTS & LONG-TERM PLANNING



Lacoast.gov - www2.selu.edu/orgs/pbrp/redesign_documents/powerpoint_lanier.pdf

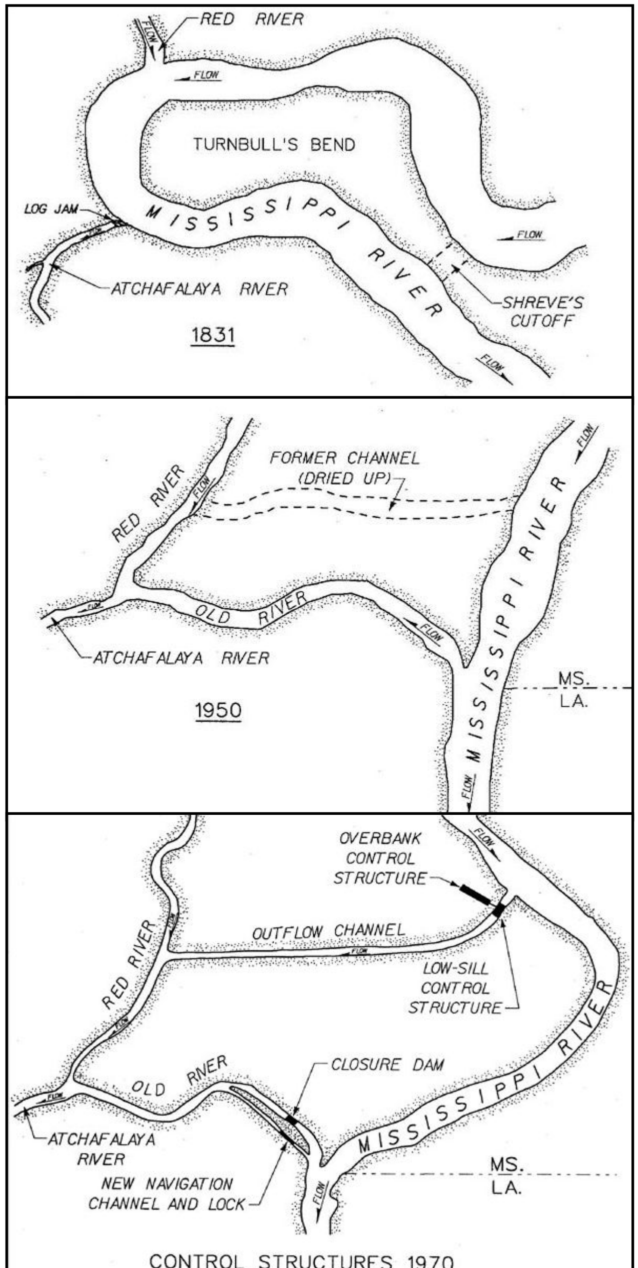
APPENDIX IV: Case Study on Old River Control Structure

History of the Watershed

The Mississippi River and Red River were once parallel rivers flowing through coastal Louisiana out to the Gulf of Mexico. In approximately the 15th century, the Mississippi River shifted course, as rivers naturally do, and formed a new horseshoe bend. The new horseshoe met up with the Red River, connecting the two. The lower portion of the Red River became known as the Atchafalaya River. The Mississippi River had a significantly higher flow of water. Through the new connection of the two rivers, the Atchafalaya became a distributary of the Mississippi, carrying a minimal amount of water down its channel to the Gulf of Mexico.

In 1831, Captain Henry Shreve dug a canal to connect the Mississippi River above and below the horseshoe bend, establishing a shorter navigation route. Creation of this canal, known as Shreve's Cut, essentially eliminated the flow of water in the northern portion of the horseshoe, and eventually dried up. The lower part of the horseshoe was later named the Old River and remained the only connection between the Mississippi and Red Rivers; log jam between the Red and Atchafalaya Rivers prevented any significant flow of water to the Atchafalaya. At this point in history, most of Red River flow at this time was moving eastward through Old River into the Mississippi.

By 1840, the log jam was removed, allowing more water to flow to the Atchafalaya. This reshaped the Atchafalaya, constantly making it deeper and wider. The Atchafalaya began capturing more of the Mississippi River each year. By 1880, flow in Old River had shifted, moving from the Mississippi into the Atchafalaya. Rivers take the path of least resistance toward the ocean. The elevation of the region is such that the Atchafalaya began capturing the flow of the Mississippi, threatening to become the main stem of the river. The distance to the Gulf of Mexico by way of the Atchafalaya was much shorter than the Mississippi: 142 versus 335 miles, respectively.



Corps Old River control structures represent the world's most complex engineering attempt to regulate a major river channel. WES geological investigations led to most advantageous site selections for edifices and channels. (Levee system not shown)

In the 1950s, the Army Corps concluded that the Mississippi would change its course to the Atchafalaya by 1990 if it were not prevented from doing so. New Orleans and Baton Rogue already had significant shipping industries and communities reliant on the Mississippi River. If the Atchafalaya River captured the Mississippi River's flow of water, it would have had serious implications for navigation on the Mississippi.

In response, Congress authorized the Army Corps to engineer and construct a control structure at Old River to regulate the flow of water. Congress also mandated that the flow be maintained at its current ratio of 70% to the Mississippi and 30% to the Atchafalaya. The Army Corps began building the Old River Control Structure complex in the early 1960s and has maintained this ratio since that time.

Re-evaluation

The Army Corps' Restoration Plan from 2005 recommends an Upper Atchafalaya Basin Study as one of six feasibility studies of large-scale and long-term restoration concepts. This study would include an evaluation of alternative operational schemes for the Old River Control Structure and would be funded under the Mississippi River & Tributaries program.

In recent years, previous Governors of Louisiana have requested that the Army Corps periodically increase the flow into Atchafalaya to improve water quality and aquatic resources in the basin. In 2001, the Army Corps increased diversion into the Atchafalaya to provide more freshwater to aid the crawfish industry.

Title VII of the WRDA 2007 calls for an investigation into the maximum effective use of water and sediment from the Mississippi and Atchafalaya Rivers for coastal restoration purposes. A re-evaluation of the operation of Old River Control Structure is part of this overall investigation.

By law, the Atchafalaya River must only receive 30% of the Mississippi River discharge. Re-evaluation could lead to a change in this law at the Federal level. This would provide the Army Corps flexibility in river management and operation of Old River Control to adapt to future changes in navigational and drinking water requirements. Additional Atchafalaya discharge would prevent increased saltwater intrusion in the basin as well as provide sediment for rebuilding wetlands.

Reference:

McPhee, John. The Control of Nature. New York: Farrar Straus Giroux, 1989.