TO: C. Strebeck
FROM: Salvatore Pellittieri
RE: Proposal Document
DATE: 19 October 2012

PURPOSE

The purpose of this proposal is to receive authorization to research and identify the best flood protection levee alternative for the Mississippi River Gulf Outlet (MRGO) in New Orleans. First, I will summarize the evolution of levees in New Orleans. Second, a comparison will be made between Earthen, I-Wall, and T-Wall levees based on effectiveness, cost, and longevity. In conclusion, I will demonstrate the projected schedule and budget for the research. The best solution will be determined and provided in the technical report.

Two decisive factors that requires consideration in choosing a levee system is the space available and environmental impact. As far as availability of space, the project area could possibly contain residences and businesses. Depending on the mode of flood protection chosen, properties will be in danger of relocating. Concerning environmental impacts, future generations will have to deal with the consequences of attempting to fight nature. Levees are permanent structures that could last for hundreds of years. The long-term effect on the eco-system is an important issue to be reviewed. This report will not address either of these factors.

INTRODUCTION

A **levee** is an embankment of a flood protection system that utilizes materials such as dirt, concrete, or metal to form a boundary that protects the surrounding area against flooding (Oxford English Dictionary). This embankment prevents natural disasters from wreaking havoc on a large population of people by using unique mixtures of materials to counter the force of rising floodwaters. In most cases, this mixture of materials such as dirt, concrete, and metal that make up a levee are the last defense against floodwaters. The aftermath of a levee failure is both financially and personally catastrophic. One article (Amadeo, 2010) states that the damage from Hurricane Katrina cost the U.S. anywhere from $96-$125 million, while the death toll for just the state of Louisiana rose to a staggering 1,836 people.

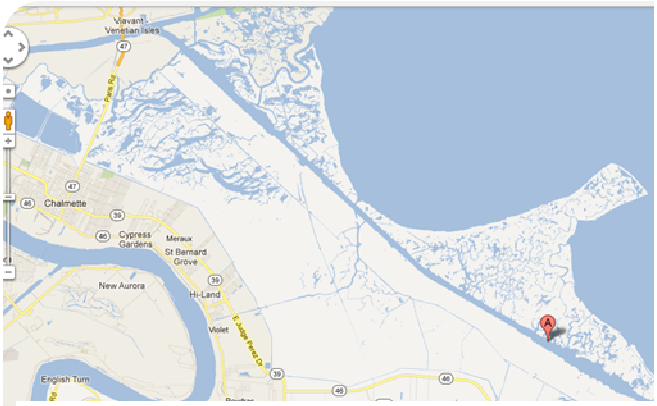

Figure 1: Map of Mississippi River Gulf Outlet
Outlet travels from New Orleans East through northern St. Bernard Parish until it reaches Gulf of Mexico
Source: Google Maps

The most cost-efficient, technologically advanced solution for a levee system must be found. The area in question is the 5 mile canal shown in **Figure 1** that creates a shortcut from the Mississippi River to the

Gulf of Mexico. On the previous page, **Figure 1** displays the map of the project area. For the sake of saving lives and money, approval of my plan is vital. The outline of my proposal is as follows:

- Provide the historical background of levees in New Orleans to help display the flood protection progression the city has gone through
- List and explain Earthen, I-Wall, and T-Wall levees
- Summarize the tasks and schedule to be utilized
- Estimate the budget for the project
- Describe my qualifications and experience for this topic
- Offer a conclusion and cite references

Historical Background of Levees in New Orleans

Levees have been a part of New Orleans since the early 18th Century. Under control of France, it was the overall consensus of the French settlers that artificial control of the Mississippi River would be required in order for their society to benefit. It was this idea that began another chapter in the timeless conflict between humans against Mother Nature.

In general, natural levees form around a river due to its naturally-occurring flood. Without human intervention, sediment would build-up in the form of a levee from these floods. But this natural levee was not sufficient protection for New Orleans. In the article *The Mississippi Levee System and the Old River Control Structure*, Katherine Kemp explains, "The first solution to the flooding problem was building on top of these natural levees." Based on this concept, the first manmade levee system was established. To put it simply, dirt was piled onto dirt forming a boundary between the river and the land. For the most part, it was farmers who built these boundaries to protect their own farm land from flooding. For over a hundred years this method of flood protection did not change.

Earthen Levees

In the early 19th Century, the disorganized levee system was turned over to the Army Corps of Engineers. This government organization, comprised of mostly civil engineers, worked toward organizing the previous method of flood control. Although technological advances had not yet arrived, these engineers created systematic **Earthen** levees of soil that rose a few feet higher than the side of land it was protecting. The earthen levees main objective was to protect the surrounding area from flooding.

I-Wall and T-Wall Levees

During the middle of the 20th Century, the age of technology had finally reached the levee system. This technology caused engineers to be more focus on hurricane protection. Instead of the primitive method of using dirt, levees were constructed out of stronger materials, such as concrete and metal. Presently, the most common levees that combine dirt, concrete, and metal are the **I-Wall** and the **T-Wall** levee. These forms of levees are built to sustain storm surges (offshore rise of water that is known to occur during hurricanes) that would otherwise flood the surrounding area. The following section describes each of these three types of levees.

LEVEE ALTERNATIVES

Flood Protection systems evolved technologically in the past years. As a result, there are many types of levees for many different situations. This proposal focuses on three types of levees that offer the best chance for successfully protecting the surrounding area from the dangerous possibility of the Mississippi River Gulf Outlet from flooding: Earthen, I-wall, and T-wall.

Earthen Levee

Earthen levees are barriers made entirely from soil material; this boundary holds water away from civilization. A properly built land, or earthen, levee takes a lot of space. Long, gentle side slopes increase stability and provide for easier maintenance (Bankston). An earthen levee works best when holding back water under relatively constant pressure where the height of the water is not rapidly changing (Scandaliato). **Figure 2** illustrates a sample earthen levee. Three layers of soil make up a land levee:

Figure 2: Cross-section of Earthen Levee
Three layers of an earthen levee
Source: Earthen Levee Design

- The **bedrock** (layer of soil deep underground that contains broken rock fragments) is the foundation needed to build a levee. The bedrock level is the very bottom layer of the levee.

- The **critical section** is contains the clay core that prevents the actual embankment from sliding (Scandaliato). This middle section of the levee is level with both the body of water and the protected side of land.

- The **overbuild section** is the actual barrier between the floodwaters and the protected land. The mound of dirt at this point is elevated high enough to avert any rising water from overtopping the levee. The overbuild section is the top layer of an earthen levee.

I-Wall Levee

I-Wall levees are reinforced concrete (concrete interlaced with steel bars) vertical walls that prevent rising water from flooding an area whose elevation is lower than that of the levee. This wall is built into the ground around which the levee is built up ("Can We Protect New Orleans). Taking a relatively small amount of space, I-Wall levees are a strong, compact alternative to flood protection. **Figure 3**, on the following page, illustrates the main materials of this levee. The three major components make up an I-Wall are, from bottom to top:

- The **Steel Sheet Pile** acts as an anchor for the wall. Moreover, the steel pile prevents under seepage (water that travels underneath barrier) from causing the levee to fail. The pile is driven under ground to a depth of 120 feet.

- **Reinforcing Bars** provide the wall with the tensile strength (pulling force) needed to combat floodwaters. These bars are made of steel, which is one of the strongest and flexible metals used in construction.

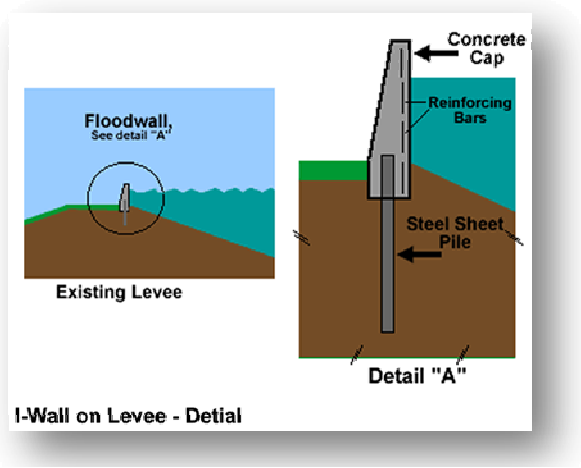

Figure 3: Diagram of I-Wall levee
Components of an I-Wall levee
Source: Floodwalls, Levees, and Dams

- The **Concrete Cap** supplies the levee with a large resistance to rising water due to its incredibly high compressive strength (pushing force). In addition to its strength, the concrete cap ties the land, pile, and reinforcing bars all together. In other words, the cap is the glue of the levee.

T-Wall Levee

A T-Wall levee refers to an embankment of a flood protection system that utilizes materials such soil, concrete, and metal to form a boundary that protects the surrounding area against flooding. The name "T-Wall" refers to the levee's inverted T-shape. Similarly, in the I-Wall, the vertical stem (wall) is built into the ground. Furthermore, the T-Wall utilizes many of the same materials as the I-Wall. However, the T-Wall differs from the I-Wall by containing a wider foundation and additional supporting members. As a result, the T-Wall is very strong and will absolutely work; however, the total cost to construct this levee can be millions of dollars more than other alternatives (Scandaliato). **Figure 4** displays the major parts of the T-Wall levee. The success of the T-Wall levee depends solely on these four components, from ground level to top of levee:

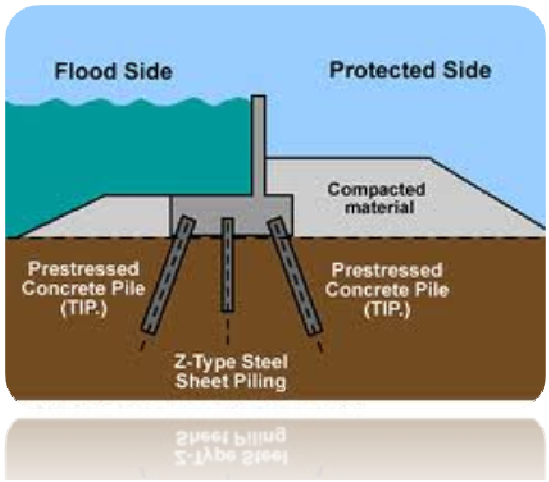

Figure 4: Diagram of T-Wall levee
Components of a T-Wall levee and the separated flood and protected sides.
Source: Floodwalls, Levees, and Dams

- **Pre-stressed Concrete Pile** is a column driven to a depth of 120 feet into the ground to act as an anchor for the entire structure. Two columns are placed at an angle to provide even more stability.

- **Z-Type Steel Sheet Piling** is a thin wall that is treated with anti-corrosion resistance to prevent under seepage, in the same way the I-Wall's sheet does.

- **Compacted Material** is a mixture of low-strength, low-cost concrete that offers extra security for the floodwall. In other words, the compacted material acts as a concrete mound in the same way the overbuild section of an earthen levee does.

- **Reinforced Concrete Floodwall** is a vertical barrier that serves as the boundary between the protected and flood side of levee. It consists of the stem and base. The stem is the actual floodwall that counters the pressure from floodwaters. The base is a horizontal slab that must be 4 to 5 feet thick to prevent overturning (Scandaliato). The base, or foundation, is the most important aspect of the levee, as it provides the support for the wall to remain upright and prevents a breach (gap made in wall) in the levee.

PROPOSED TASKS

The proposed plan, if approved, would lead to the overall levee project description in the technical report. What follows are the tasks necessary to compare the levee systems and determine which would be best for Mississippi River Gulf Outlet in New Orleans.

Task 1: Research and Analyze Each Levee Alternative

I have already completed some preliminary researching on each levee alternative. Through website articles produced by authorities in civil engineering and levee protection, I have gained valuable information that involves all aspects of the flood protection system. The sources that have been and will be used are highly respected individuals who have achieved ranks such as doctorates or professional engineering in a field related to civil engineering. Sam Scandaliato, P.E., is an expert in levee solutions; furthermore, he has studied and written numerous articles pertaining to each of the three floodwall protection systems in this proposal.

Task 2: Compare Alternatives Using the Established Criteria Below

Listed below are the three criterion that I will use to rate each levee alternative.

A. Effectiveness: The three levee options will be evaluated on how effective they will be in protecting the project area. Since there are three alternatives, each will be given a high, medium, or a low rating. The strength and dependability of the levee are the aspects that will establish effectiveness.

B. Cost: The amount the project will ultimately cost will be one of the most influential criterion. The budget will depend on the cost of materials and labor for the job. Choosing the most effective, cost-efficient floodwall is the ultimate goal.

C. Longevity: The period of time the levee will last is an important feature. The length of time it guarantees protection for the area will determine longevity.

Task 3: Determine Best Levee Solution for Mississippi River Gulf Outlet

Three alternatives of flood protection will be analyzed and evaluated. The research collected from the highly respected scholars will assist in determining the best solution. All of these references have been checked for authenticity and accurateness. These references can be found in the reference section at the end of this document.

Task 4: Recommend the Ideal Levee Project

My overall recommendation for the levee system to be implemented for the project will be based on the research and analysis discovered.

Task 5: Prepare and Submit Technical Report

A technical report presenting my discoveries for the levee solution for the Mississippi River Gulf Outlet will be submitted on February 15, 2013, pending on approval of the proposal.

GANTT CHART SCHEDULE

The Gantt chart below displays the time distribution for the proposed project. The project will begin on the day after the hurricane season ends. The plan is projected to be completed mid-February. As a result, the actual construction for the levee can begin 4 months before the next hurricane season commences.

Project Timeline								
Tasks	1-Nov	15-Nov	30-Nov	15-Dec	30-Dec	15-Jan	30-Jan	15-Feb
Task 1: Research and Analyze Each Levee Alternative								
Task 2: Compare Alternatives Using the Established Criteria								
Task 3: Determine Best Levee Solution for Mississippi River Gulf Outlet								
Task 4: Recommend the Ideal Levee Project								
Task 5: Prepare and Submit Analytical Report								

Estimated Budget

The table on the following page predicts the estimated expenditures that will occur for this project. Management expenses are utilized for the supervision and allocation of tasks. The actual time and effort spent conducting the research makes up the labor expenses. The travel expense is necessary to cover the cost of gas and lodging for a trip to New Orleans. This trip will be made to analyze the actual area where the project will be completed.

Estimated Budget			
	Cost/Hr	**Hours**	**Cost**
Management	$150	5	$750
Labor	$50	40	$2,000
Travel	$30	10	$300
		Total Cost	$3,500

Experience

I am academically qualified to perform research and analysis on any findings on levee alternatives.

I am a Junior Civil Engineering student at Louisiana Tech University. Many of my courses, including Statics and Structural Analysis, have offered me vital information pertaining to structures, such as levees. I have an excellent academic record and GPA; furthermore, I am an outgoing participate in extra-curricular activities. In addition to being Vice-President of the American Society of Civil Engineers, I am currently a member of the concrete canoe team. I am originally from New Orleans; therefore, I possess a certain familiarity to the area and the role flood protection plays.

Conclusion

In summary, approval for this proposal is imperative for the safety of the city of New Orleans from the Mississippi River Gulf Outlet. The citizens of that great city deserve the best protection from flooding caused by hurricanes. There is no excuse in placing thousands of people in harm's way. In the United States, life is a right given to all its citizens. Therefore, it is only ethical to provide its own citizens security from danger. Thank you for reviewing this proposal. If you need to contact me, please call my phone (985-351-5524) or email me at sjp012@latech.edu.

References

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