Survey and Spatial Data
In the Vicinity of the
Mississippi River Gulf Outlet (MR-GO)

Prepared for

Plaintiffs in *Robinson v. United States*

By

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September 16, 2007

I have been retained by Plaintiffs in *Robinson v. United States* to review survey data, spatial data, aerial photography, LIDAR data, etc. related to the flooding of Greater New Orleans in the wake of Hurricane Katrina. The primary focus of this report is to obtain and interpret key survey related data for use in examining the relationship between the Mississippi River-Gulf Outlet (MR-GO) and the flooding of the Greater New Orleans area during and after Hurricane Katrina.

Professional Qualifications:

I am a Professional Land Surveyor registered to practice in Louisiana and Texas. I have over 16 years of experience in the field of surveying and mapping. My experience includes traditional surveying, Global Positioning System (GPS) surveying including static, differential (DGPS) and real time kinematic (RTK) techniques, extensive work with photogrammetric data, use of Light Detection and Ranging (LIDAR) data. I also have extensive experience in performing and supervising inland hydrographic surveys, and experience in dealing with vertical datum issues unique to southern Louisiana.

I graduated with honors from the University of Florida in 1991 with a Bachelor of Science Degree in Surveying and Mapping. While at the University of Florida, I received the national Schonstedt Scholarship in Surveying.

In August, 2006, I established CMor Consulting, LLC, specializing in litigation support and specialty industrial surveying. I have performed, or currently am performing, litigation support on cases involving an oil spill in Chalmette, Louisiana, a case involving an oil spill in Coffeyville, Kansas, Katrina related cases against Mercy Hospital in New Orleans, in addition to cases related to the flooding of Greater New Orleans. I have also performed quality control reviews of highly critical projects in

industrial sites, including recently completed reviews of 3D Laser Scanning projects in Fawley, England and Torrance, California.

I was the Vice President of LandSource, Inc., a Baton Rouge, Louisiana, surveying and mapping firm from 2004 to 2006. I was Project Coordinator and later Operations Manager for Hydro Consultants, a Baton Rouge, Louisiana surveying and mapping firm from 1991 to 2004.

I am a member and past-president of the Louisiana Society of Professional Surveyors (LSPS). I served as President of LSPS in 2003 to 2004, and as Secretary-Treasurer of LSPS in 2002 to 2003. I was Chairman of the LSPS State Convention Committee in 2001 to 2002. I served as LSPS District 6 Chairman in 2001. I have held several other LSPS offices and have served on a number of other committees.

I have prepared maps, which have won the nation-wide American Congress on Surveying and Mapping (ACSM) – National Society of Professional Surveyors (NSPS) Map and Plat Competition in 2001, 1999 and 1997.

I have written several articles which were published in the Louisiana Engineering and Survey Journal in 2003 and 2004.

I have testified as an expert in surveying and mapping in both state and federal courts.

Coordinate System, Units and Datum

Horizontal coordinates for spatial data provided in this report refer to the Louisiana State Plane Coordinate System, South Zone, NAD 83. The unit of measurement is the U.S. Survey Foot. Elevations are in feet and refer to the North American Vertical Datum of 1988 (NAVD88-2004.65).

1.0 LIAR Data

I obtained Light Detection and Ranging (LIDAR) data of the Greater New Orleans area from the U.S. Army Corps of Engineers IPET Web site https://**ipet**.wes.army.mil/. The LIDAR data sets listed below were each downloaded from the IPET web site.

(A) 5 meter resolution Pre Katrina LIDAR of the entire area adjusted to NAVD88, 2004.65 datum.

(B) 1 foot resolution Pre Katrina LIDAR of the levees adjusted to NAVD88, 2004.65 datum.

(C) 3 foot resolution Pre Katrina LIDAR of metro New Orleans adjusted to NAVD88, 2004.65 datum

(D) 2 foot resolution Post Katrina LIDAR of the levees adjusted to NAVD88, 2004.65 datum

(E) 3 foot resolution Post Katrina LIDAR of the levees adjusted to NAVD88, 2004.65 datum.

These LIAR data sets were geo-referenced into the Louisiana State Plane Coordinate System, NAD83, South Zone. The horizontal unit of measurement utilized was the U.S. Survey Foot.

LIAR data is helpful in analyzing the spatial relationship and elevation of features throughout the area. Figures 1-1 through 1-3 are LIDAR images depicting portions of the earthen berms along the southwesterly side of Reach 2 of the MR-GO before and after Hurricane Katrina. These images are intended to show some of the ways that LIDAR can be utilized.

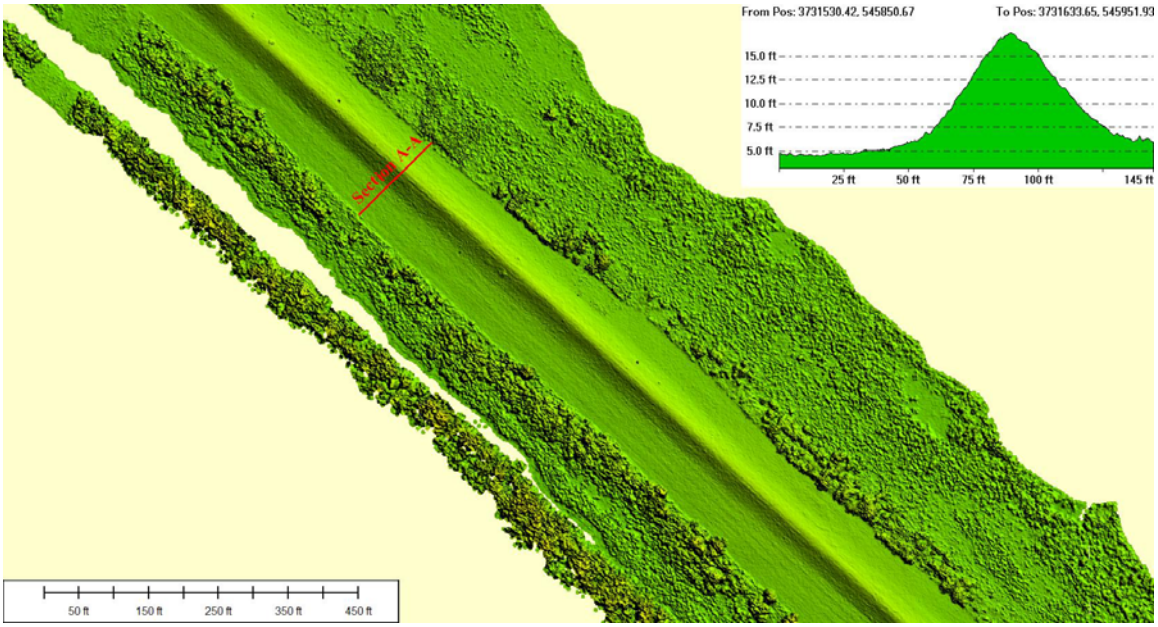


Figure 1-1 Pre-Katrina LIDAR Section A-A

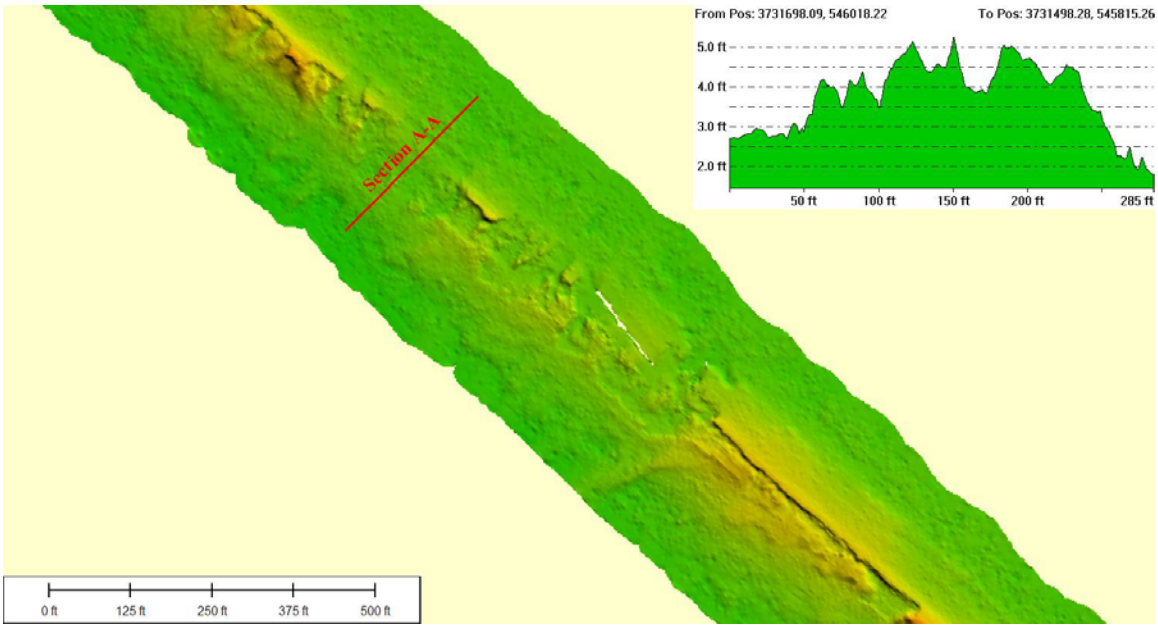


Figure 1-2 Post Katrina LIDAR Section A-A

Figure 1-1 and Figure 1-2 depict the same location before and after Katrina. Note that the earthen berm is heavily damaged in the post Katrina image, and that the top elevation was reduced from approximately 17' NAVD 88 (2004.65) to approximately 5' NAVD 88 (2004.65).

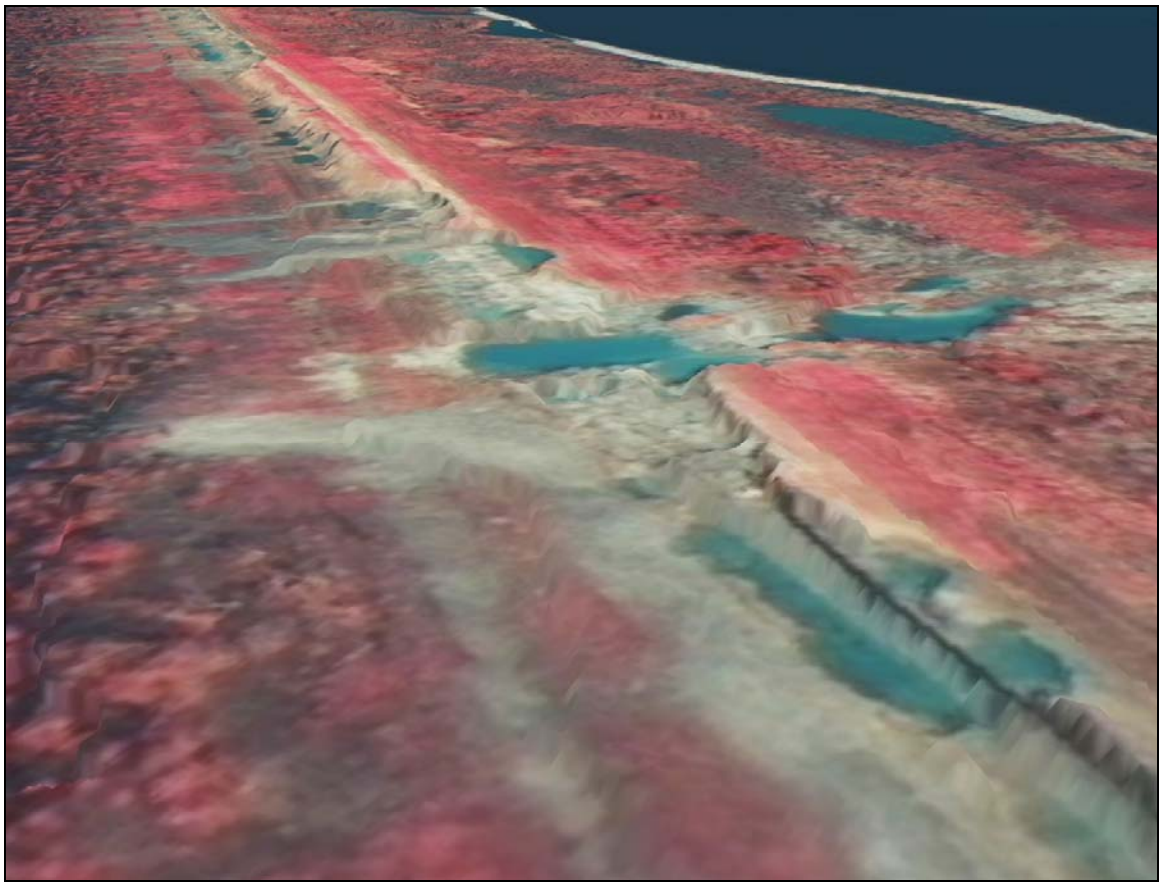


Figure 1-3 Color IR Photography Draped over Post Katrina LIAR

Figure 1-3 depicts a heavily damaged area of the MR-GO earthen berm by utilizing the post Katrina LIDAR with Color IR photography draped over it.

2.0 Aerial Photography

Aerial photography of the area was obtained from several sources. The primary aerial sets utilized in this report are listed below:

(A) Pre Katrina 2004 1 meter ground resolution DOQQ aerials downloaded from the www.atlas.lsu.edu web site.

(B) Post Katrina 1 foot ground resolution 8/31/05 and 9/2/05 GE Energy aerial photography which is available on the IPET web site.



Figure 2-1 Post Katrina Color IR Photograph of Damaged Portion of MRGO Earthen Berm

Figure 2-1 depicts the same are shown in Figure 1-3 viewed from directly overhead. This is an example of the GE Energy aerial photography which was flown on August 31st and September 2nd, 2005.



Figure 2-2 Post Katrina Color IR Photograph of Bayou Bienvenue Structure

Figure 2-2 is a Color IR GE Energy Photograph taken at 11:53 AM on August 31, 2005. The GE Imagery covers most of the greater New Orleans area and is available in Black & White, Natural Color and Color IR formats.

3.0 Flood Protection System

Utilizing the Pre Katrina 1 foot resolution LIDAR and the 1 foot resolution GE Imagery, we prepared a map of the levee and floodwall and other man-made structures (including earthen berms) around the greater New Orleans area. This mapping was prepared utilizing Esri ArcView software. A raster image of the limits of this mapping is shown in Figure 3-1.

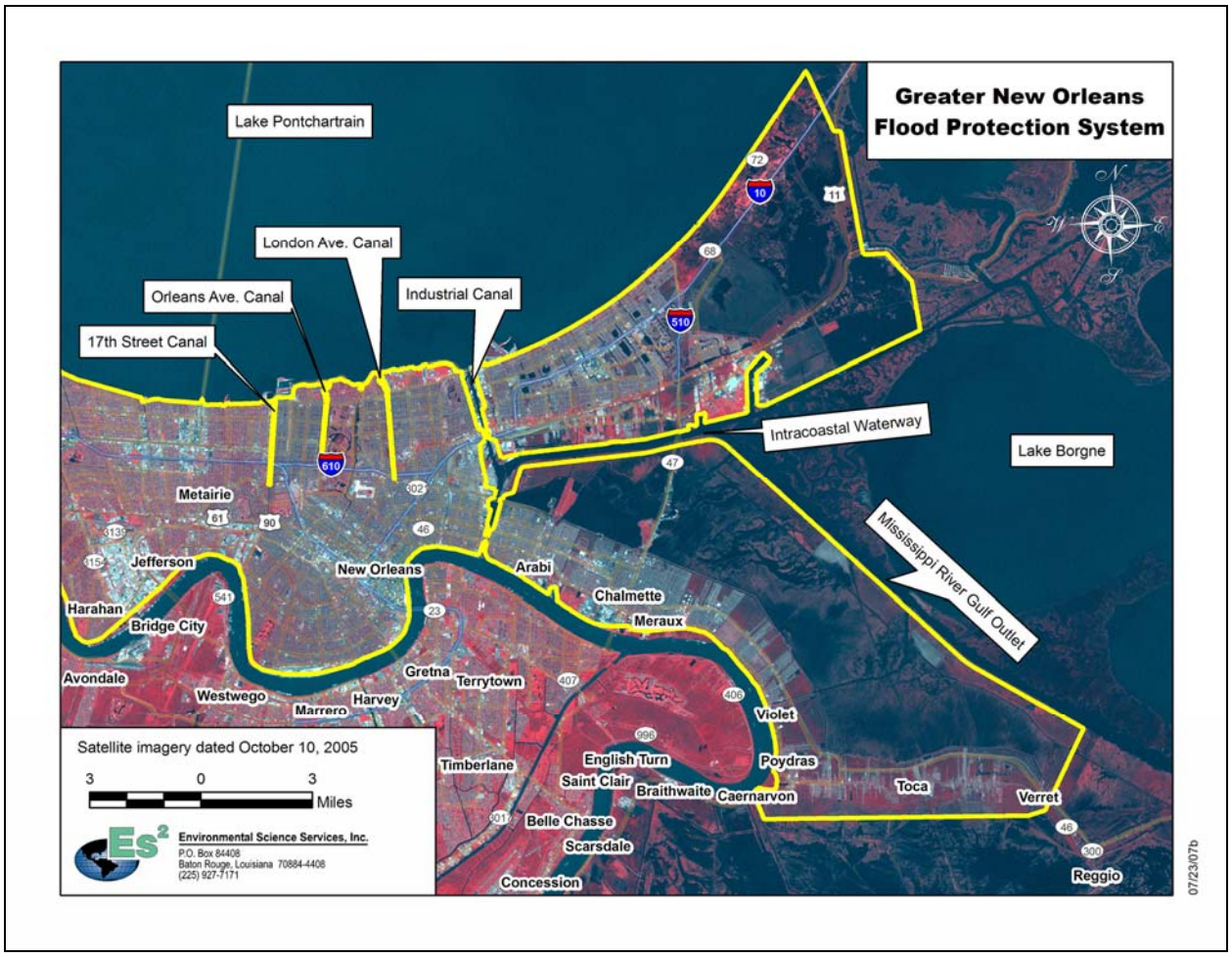


Figure 3-1

4.0 Breach Mapping

Using a combination of the Post Katrina LIDAR and the GE Imagery, we mapped the location and sill height elevation of all visible breaches in the so-called Greater New Orleans Hurricane Flood Protection System. It should be noted that the elevation of the sill could not be mapped in this manner on breaches which extended below the water level at the time of the LIDAR flight. For those breaches, we utilized eye witness accounts of the depths of the breaches, which were provided by Dr. Ivor Van Heerden. We also very recently received Corps of Engineers survey data at some of the underwater

breach sites. Figure 4-1 shows the overall extent of our breach mapping. Figures 4-2, 4-3 and 4-4 show a few examples of mapped breaches.

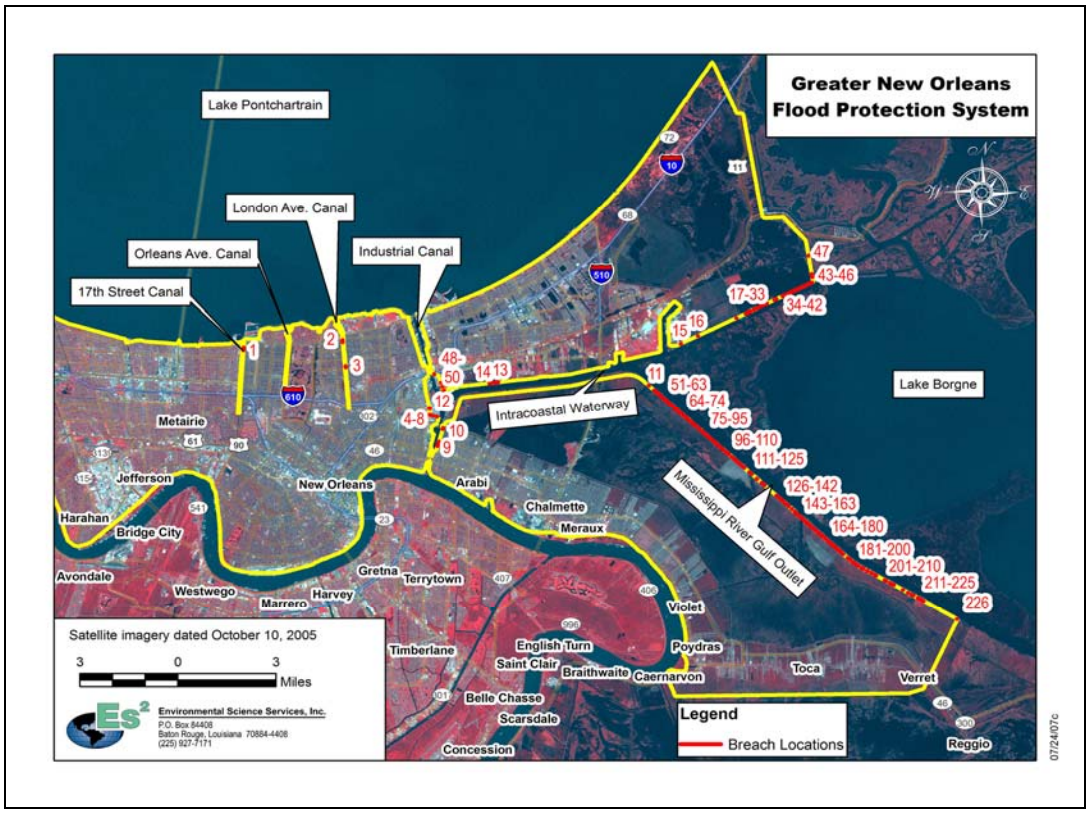


Figure 4-1



Figure 4-2

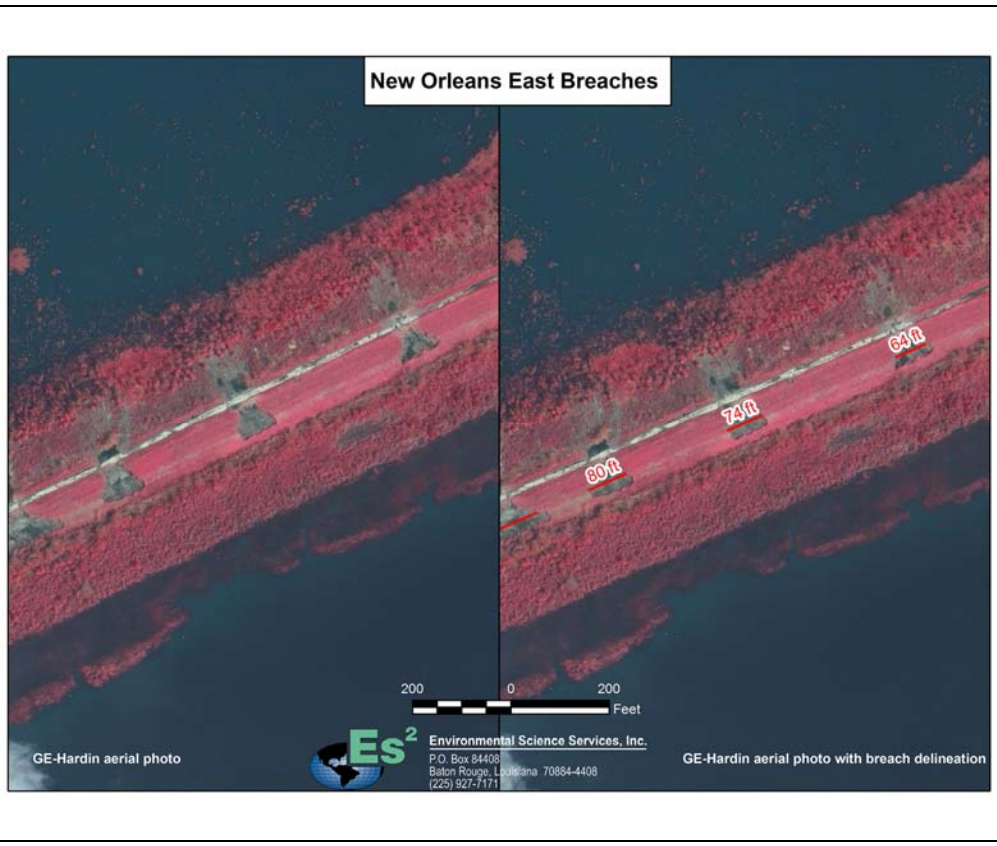


Figure 4-3

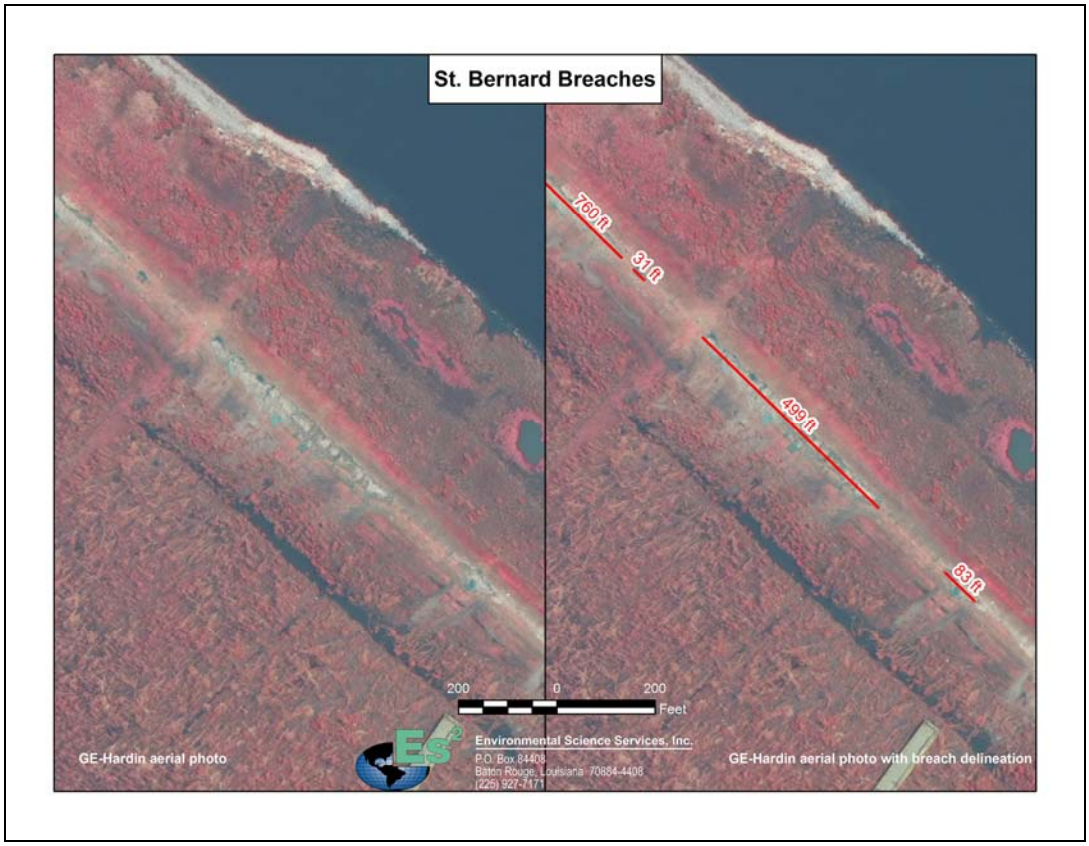


Figure 4-4

5.0 Sheet Pile Along MR-GO

While the Corps of Engineers has not yet provided Plaintiffs with the construction drawings and specifications for the placement of sheet pile along Reach 2 of the MR-GO, we can see in photographs and in the LIDAR imagery that it was present in some areas of the earthen berms along the southwesterly side of Reach 2 of the MR-GO. It appears to have been installed in areas where the crown of the berm was lower than average in an attempt to raise the low areas to the height of the nearby berms.



Figure 5-1 Sheet pile Portion of Reach 2 Prior to Katrina.

Figure 5-1 is a LIDAR image near the southerly end of the Reach 2 MR-GO berm where sheet pile was installed in a low section of the crown of the berm. Figures 5-2, 5-3 and 5-4 will show cross sections B-B, C-C, and D-D prior to Katrina.

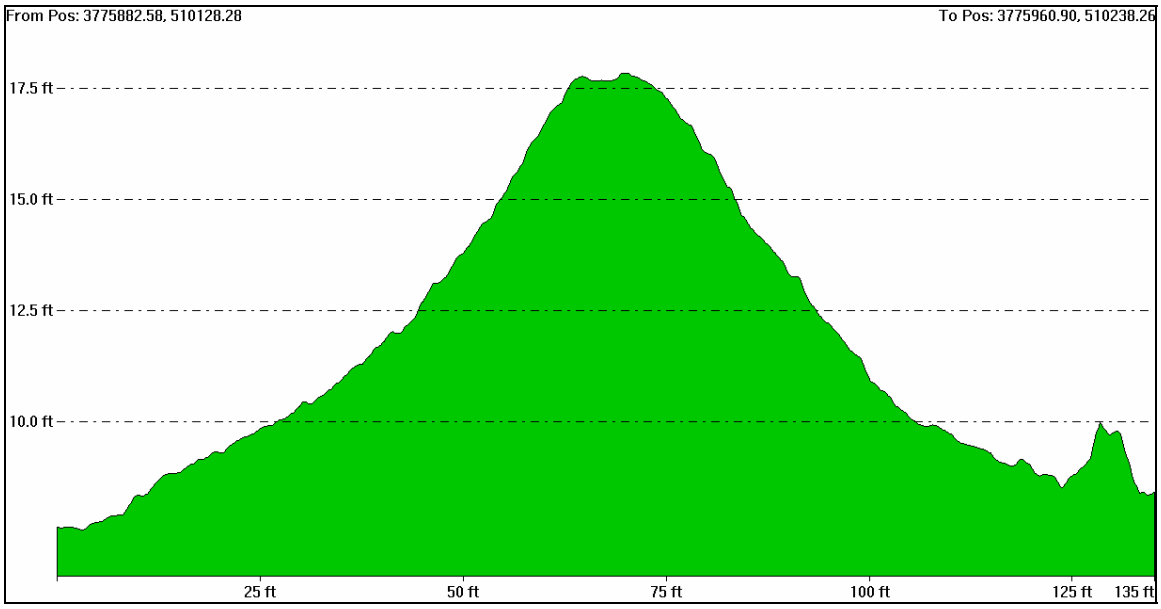


Figure 5-2 Section B-B Prior to Katrina – Note that the crown reaches an elevation of approximately 17.5' NAVD 88 (2004.65).

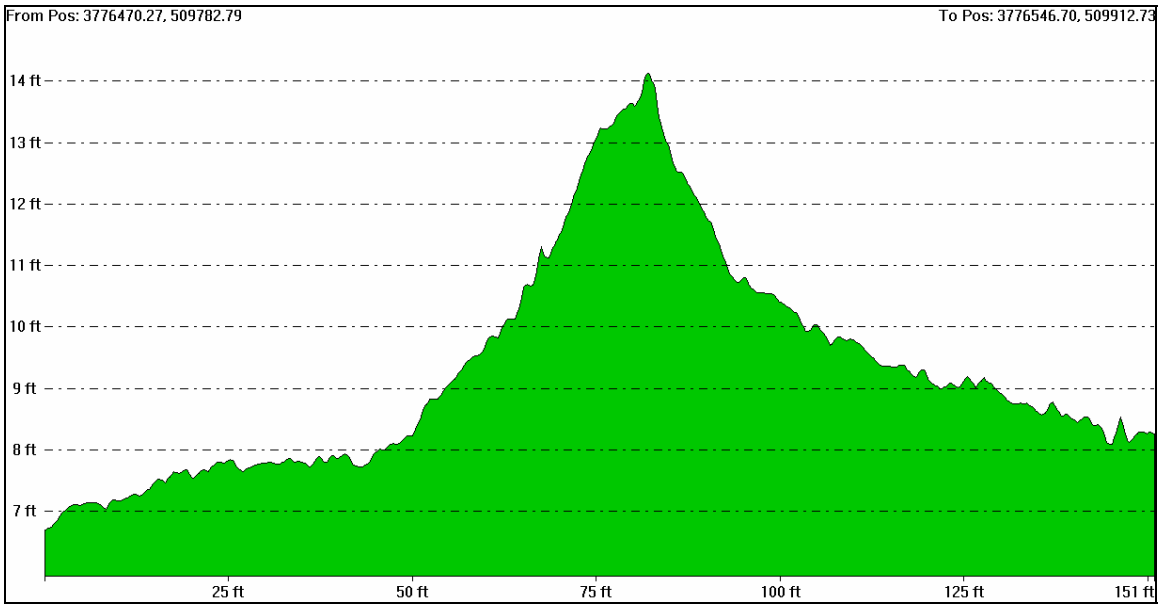


Figure 5-3 Section C-C Prior to Katrina – Note the berm not as wide in this area and that there is a thin finger projecting up from an average elevation significantly lower than section B-B or D-D. It should be noted that LIDAR is limited in its ability to accurately obtain the elevation of a thin structure such as sheet pile.

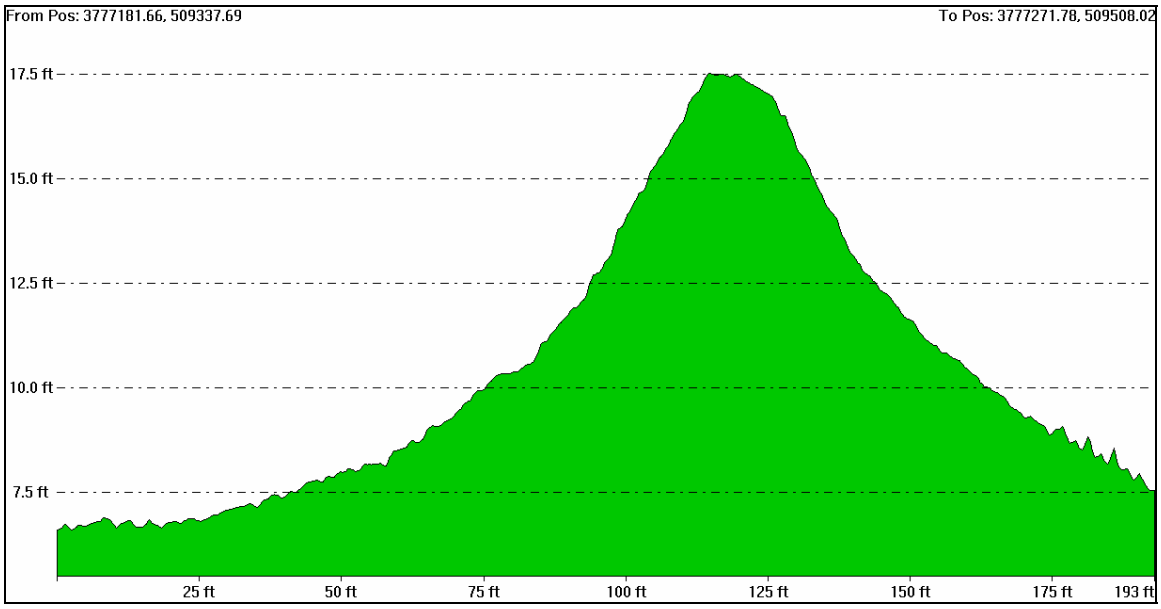


Figure 5-4 Section D-D Prior to Katrina – Note that like Section B-B this area reaches an elevation of approximately 17.5 feet without a sheet pile projection.

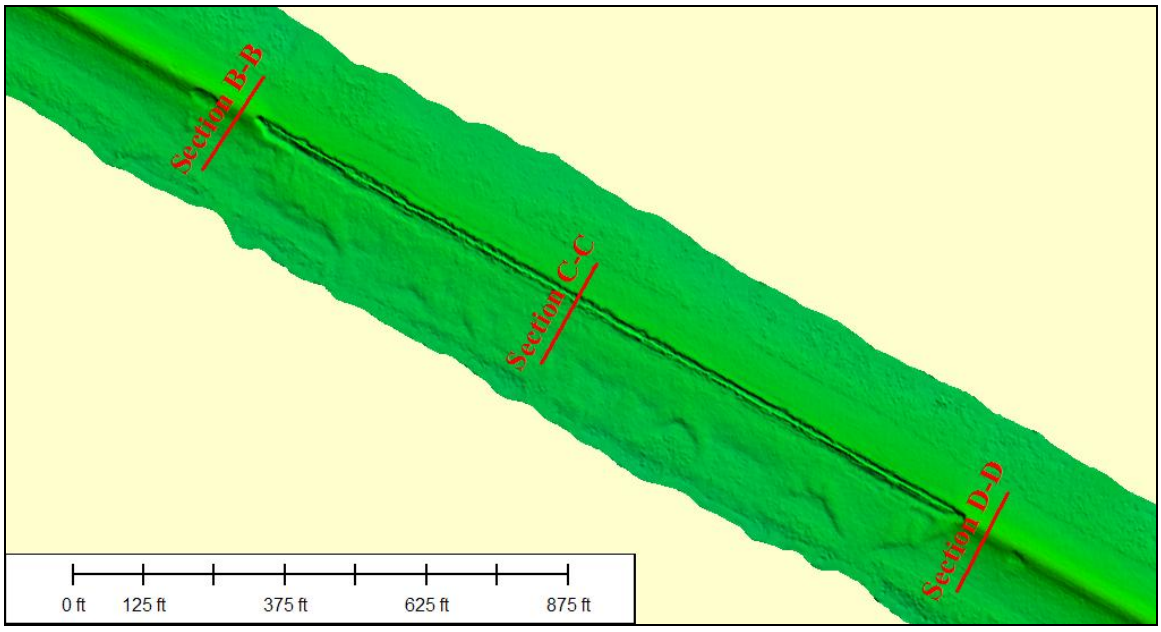


Figure 5-4 Sheet pile Portion of Reach 2 of MR-GO After Katrina – Note that there is considerable erosion in the vicinity of the sheet pile.

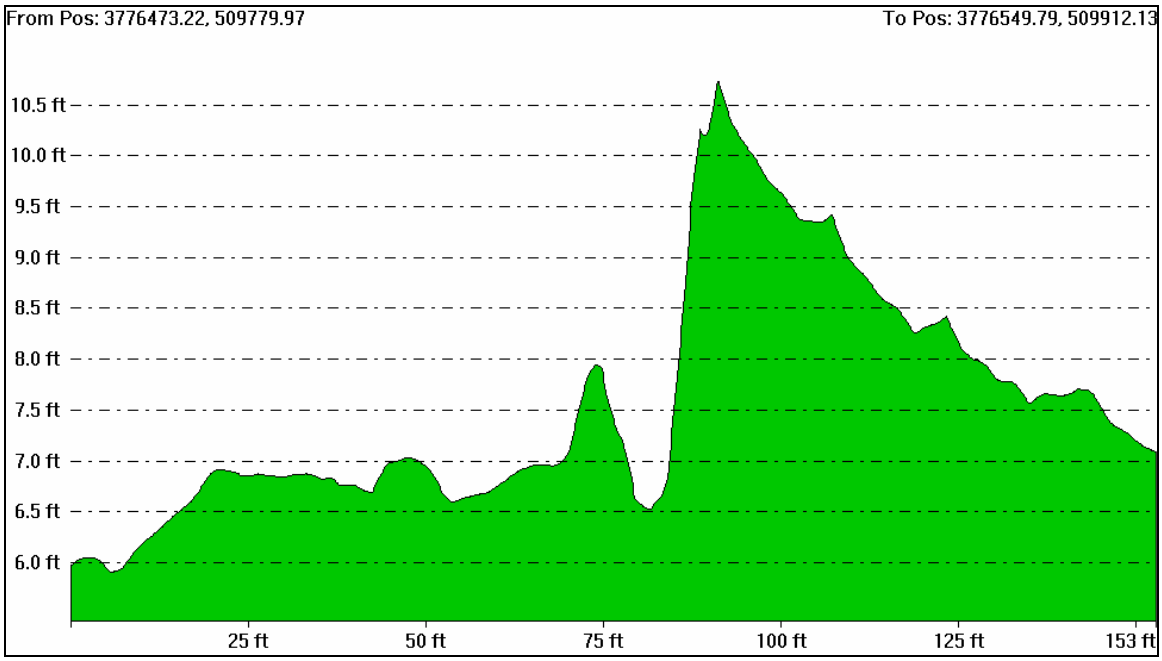


Figure 5-5 Cross Section C-C After Katrina – Note the erosion of the crown along with the scour hole on the back side of where the sheet pile was located.



Figure 5-6 Destroyed sheet pile Along the Bank of the MR-GO. This image was provided by the U.S. Army Corps of Engineers on a hard drive which they produced for Plaintiffs. While it is not the same area as Section C-C, it does show how ineffective the sheet pile was at keeping the storm surge out of the populated areas. The stains on the remaining remnants of sheet pile show that it was sticking out of the ground prior to the storm.



Figure 5-7 Shows a ground level view of a portion of the Reach 2 MR-GO berm that is simply gone. Thousands of feet of this berm were very heavily damaged. This image was contained on the hard drive provided by the U.S. Army Corps of Engineers to Plaintiffs.

6.0 – Additional Data

Only recently did Plaintiffs receive a hard drive from the U.S. Army Corps of Engineers containing approximately 500 Gigs of data. This is roughly equivalent to the information contained in several floors of a research library. We are still in the process of reviewing this and other data sets. As of this date, I have not seen hydrographic survey data in the MR-GO waterway, either pre or post Katrina. In addition, I have not seen detailed plans or specifications for construction of the earthen berms, installation of the sheet pile in portions of the berm, maintenance dredging of the canal, etc. Plaintiffs' counsel believe that this information should be among materials culled from approximately 1,400 boxes of documents produced for review by the United States Army Corps of Engineers. I will continue to review the data provided to date, and will likely

obtain additional data. Accordingly, I reserve the right to update and supplement this report as pertinent data sets are made available and reviewed.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Dated: September 16, 2007

Chad A. Morris