CAUTION: Analysis for this report was completed prior to the issuance of Engineer Technical Letter (ETL) 1110-2-575, EVALUATION OF I-WALLS, dated 1 September 2011.

http://publications.usace.army.mil/publications/eng-tech-ltrs/ETL_1110-2-575/ETL_1110-2-575.pdf

The Corps is performing additional evaluation of the I-walls along the 17th, Orleans and London outfall canals to address the 2011 ETL.

As of June 11, 2013, the new evaluation reports have not been finalized.

Any reference to this report should include this notice.

U. S. ARMY CORPS OF ENGINEERS
NEW ORLEANS DISTRICT

USACE CONTRACT No. W912P8-09-D0014
Task Order 0027

for the

Hurricane Protection Office

Remediation of Floodwalls on the 17th Street Canal
OFC-05

Design Documentation Report (DDR)

100% Final Submittal

February 2011

URS PROJECT No. 10004025

Prepared by:

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DESIGN DOCUMENTATION REPORT (DDR)

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Abbreviations and Acronyms

AASHTO	American Association of State Highway & Transportation Officials
ACI	American Concrete Institute
A/E	Architect and Engineer (URS Jacobs Engineering Group Joint Venture)
ASTM	American Society for Testing Materials
B/L	Baseline
COR	USACE Contracting Officer's Representative
Corps / COE	U.S. Army Corps of Engineers
CPT	Cone Penetration Test
DDR	Design Documentation Report
DM	Design Memorandum
DMM	Deep Mixing Method
DPS	Drainage Pump Station #6
DQAP	Design Quality Assurance Plan
DQCP	Design Quality Control Plan
DrChecks	Design Review and Checking System
EL	Elevation (in feet)
EM	Engineering Manual
ETL	Engineering Technical Letter
ft	feet
FS, FOS	Factor-of-Safety
GPS	Global Positioning System
HPO	Hurricane Protection Office
HSDRS	Hurricane and Storm Damage Reduction System Design Guidelines
HSDRRS QMP	Hurricane and Storm Damage Risk Reduction System Quality Management Plan
I-10	Interstate 10
ICS	Interim Closure Structure
ITR	Independent Technical Review
LADOTD	Louisiana Department of Transportation and Development
LPV	Lake Pontchartrain and Vicinity
MOL	Maximum Operate ring Level
MUTCD	Manual on Uniform Traffic Control Devices
N/A	Not Available or Not Applicable
NAD83	North American Datum 1983
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Administration
OFC	Outfall Canal
P&S	Plans and Specifications
PCR	Project Consistency Review
P.I.	Point of Intersection

REM	Recycled Embankment Material
ROW	Right of Way
SOW	Scope of Work
Sta.	Station
S&WB	Sewerage and Water Board of New Orleans
SWPPP	Storm Water Pollution Prevention Plan
TOP	Top of Protection
TBM	Temporary Bench Mark
TOW	Top of Wall
UNO	Unless Noted Otherwise
URS JEG JV	URS Jacobs Engineering Group Joint Venture
USACE	U.S. Army Corps of Engineers
W/L	Wall Line

Abbreviations and Acronyms
Units

in.	Inch or Inches
ft.	Foot or Feet
ft^3	Cubic Feet
k/ft	Kip per Foot
ksi	Kip per square inch
lb.	Pounds
m	Meter
psi	Pound per square inch
p_b	Balanced steel ratio

1. Project Information

A. Project Number

Architect/Engineer (A/E) Contract No. W912P8-09-D0014, Date Issued: 02-Aug-2010 Task Order No. 0027, Remediation of Floodwalls on the 17th Street Canal OFC-05, Orleans Parish, Louisiana.

Modifications:
No 1. Effective Date: 12-Nov-2010
No 2. Effective Date: 18-Nov-2010

B. Project Name and Location

OFC-05 is located near Lake Pontchartrain, Orleans Parish, New Orleans, LA. The project is located between Veteran Memorial Blvd. and Old Hammond Highway, on the east and west sides of the 17th Street Canal. Figure 1 shows the location of the project. The project length is approximately 7,100 feet long on the east side of the canal and approximately 4,400 feet long on the west side.

Figure 1 Project Location

C. Project Description

The 17th Street Canal has been constructed and modified over several decades by both private and public entities. Excavation of the first iteration of the canal was accomplished in the early 1800s. Since that time, the canal has been enlarged and expanded numerous times, and pump stations have been added to facilitate drainage from New Orleans to Lake Pontchartrain. The 17th Street Canal collects and distributes storm water extracted from pump stations from the northern/central portions of New Orleans parishes into Lake Pontchartrain, which forms the northern boundary of New Orleans. The 17th Street Canal levees and floodwalls were constructed during several periods. The subsurface conditions vary along the length of the canal. Based on the expansions and varying subsurface conditions, the structures vary over the length of the canal in cross section, foundation conditions, floodwall dimensions, and sheet pile embedment depths.

The existing 17th Street Canal is approximately 2.3 miles long and extends from Pump Station No. 6 at the head to Lake Pontchartrain at the outlet. The canal ranges in width from 100 to 160 feet and ranges in Elevation -12 to -18 feet, with the deepest section located near Lake Pontchartrain. There is currently an interim protection measure across the outlet which is a closure structure made up of closure gates and pumps. The earthen levees on the east and west banks of the canal were designed to provide parallel protection from tidal inundation via the lake-canal connection. I-walls were constructed at the crest of the levee to provide additional protection from higher water elevations during storm events. During Hurricane Katrina, the existing I-walls were breached and replaced with T-walls. The breach site is located approximately 500 feet south of Old Hammond Highway on the Orleans side of the canal. The new T-wall is approximately 800 feet long.

The majority of the lengths of the east and west banks of the 17th Street Canal are adjacent to residential neighborhoods. As the city has grown, single-and multi-unit homes, apartments, condominiums, businesses, infrastructure, roads, bridges, and other urban developments have been constructed in proximity to the canal and, in some cases, particularly on the east side, have encroached nearly to the toe of the levee.

D. Alignment and Survey

The alignment and survey data used for this project was provided by the USACE. This project is located along a segment of the existing 17th Street Canal. Baseline stationing was established based on the survey files provided to URS JEG JV by Chustz Surveying Inc (June 2009). This segment of baseline consists of (6) control points (MON-14 through MON-19) based on the USACE baseline dated 04-Nov-1988. Information for these control points is called out on the Baseline Layout sheet in the plan set.

E. Limits of Right-of-Way

The right of way for the 17th Street Canal Floodwall remediation project is based on information provided by the USACE and other agencies. URS JEG JV had not received any viable information or drawings to accurately determine the exact location of right-of-way points. The right-of-way used in the plan set is an apparent right-of-way. URS JEG JV used as-builts received from past projects to assume where the right-of-way line should be. The apparent right-of-way for most of the project appears to fall along the protected side toe of the levee plus 6 feet. The Corps set steaks along the apparent property line during the tree and fence removal program in 2009. More information is required to accurately determine the right-of-way for this project.

Exhibit 1 Apparent ROW Marker

F Project/Contract Description

The project includes raising the maximum water level of specific reaches of the 17th Street Canal to create a minimum max. water level of elevation 8.0 for the canal. The remediation will consist of ground improvement (deep mixed material (DMM) or jet grouting) and will be included in the contract documents. Additional design efforts necessary to provide a complete design including final Plans and Specifications as final Construction Documents and Design Documentation Report (DDR) are included in the scope of the project. The design will include ground improvement on various reaches of approximately 4,000 linear feet of ground improvement along the west bank (Jefferson Parish side) of the canal and approximately 7,100 linear feet along the east bank (Orleans Parish side) of the canal. In addition, fill will be required to limit the protected side crest to 4 feet below the MOL of El. 8.0 for approximately 4,400 linear feet along the east bank of the canal where ground improvement will also be constructed.

The following reaches will be remediated per the SOW:

1. 17th St. MOL +8 DPS#6 to the ICS West– Stability

Reach 2 to Reach 6 - Approximately Sta. 553+70 to 582+60
Reach 8 to Reach 9 - Approximately Sta. 585+55 to 593+00

2. 17th St. MOL +8 DPS #6 to the ICS West– Penetration

Reach 9 - Approximately Sta. 588+70 to 593+00

3. 17th St. MOL +8 DPS #6 to the ICS West– D/H = 3:1

Reach 7 - Approximately Sta. 582+60 to 585+55
Reach 9 - Approximately Sta. 588+70 to 593+00

4. 17th St. MOL +8 DPS#6 to the ICS East– Stability

Reach 20 – Approximately Sta. 553+58 to 560+10
Reach 21 to Reach 29 – Approximately Sta. 566+00 to 624+88

5. 17th St. MOL +8 DPS #6 to the ICS East– 4' Stick-Up

Reach 20- Approx. Sta 553+58 to 560+10
Reach 22 to Reach 25 (PS) – Approximately Sta. 570+73 to 608+00
Reach 26 to Reach 27 (PS) – Approximately Sta. 608+00 to 615+03

2. Pertinent Data (source: USACE)

A. Material and Unit Weights

Table 2-1 Material Unit Weights

Material	Unit Wt (lb/ft^3)
Water	62.4
Concrete	150
Steel	490
Semi-Compacted Granular Fill	110
Fully-Compacted Granular Fill, Wet	120
Fully-Compacted Granular Fill, Effective	58
Fully-Compacted Clay Fill, Wet	110
Fully-Compacted Clay Fill, Effective	48

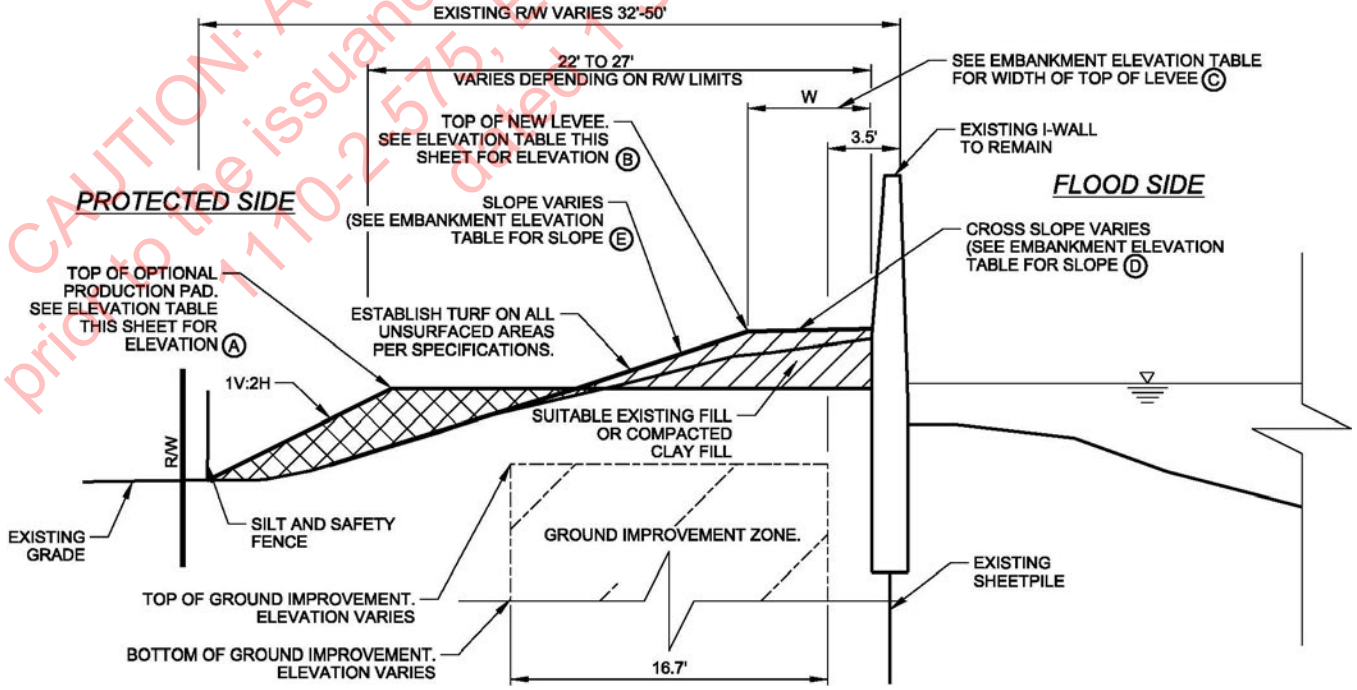
B. Controlling Elevations

Top of existing I-wall is at El. 12.3± NAVD88 (2004.65) along the 17th Street Canal. All the elevations hereafter in this report are referenced to NAVD88 (2004.65). The slopes and elevations are summarized in Table 2-2 based on the typical levee cross-section shown by Figure 2.

Table 2-2 Embankment Elevation Table

	START STATION (FT)	END STATION (FT)	A OPTIONAL PRODUCTION PAD EL (FT)	B TOP OF FINAL FILL EL (FT)	C WIDTH OF TOP OF LEVEE (FT)	D TOP OF LEVEE CROSS SLOPE (%)	E LEVEE SIDE SLOPE (FT)
WEST SIDE	553+45.00	588+30.00	1.5	4.5	10.0 (VARIES)	2.00	SLOPE TO EXISTING TOE
WEST SIDE	588+45.00	588+70.00	TRANSITION				
WEST SIDE	588+70.00	593+30.00	2.5	5.0	10.0 (VARIES)	2.00	SLOPE TO EXISTING TOE
EAST SIDE	553+58.00	559+30.58	1.0	4.4	10.5	4.00	1V:3.3H
EAST SIDE	559+30.58	566+43.87	NO MIX ZONE				
EAST SIDE	566+43.87	575+00.00	1.0	4.0	14.0	6.25	1V:3.5H
EAST SIDE	575+00.00	603+50.00	1.0	4.0	9.0	7.00	1V:3.0H
EAST SIDE	603+50.00	609+50.00	1.0	4.0	10.5	7.50	1V:3.6H
EAST SIDE	609+50.00	620+16.37	1.0	4.0	11.0	7.50	1V:4.2H
EAST SIDE	620+16.37	621+96.37	TRANSITION				
EAST SIDE	621+96.37	624+62.34	4.0	8.0	8.0	7.50	1V:30H
EAST SIDE	624+62.34	625+00.00	SLOPE TO EXISTING GRADE				

Figure 2 Typical Embankment Section



C. Topographic Surveys and Survey Control

1. Vertical Datums

The establishment and use of vertical datums in the design work follows the guidance provided in "USACE New Orleans District Guide for Minimum Surveying Standards for Performing Hydrographic, Topographic, and Geodetic Surveys", Dec 2006; "Hurricane Storm and Damage Reduction System Design Guidelines", Oct 07 with changes in May 08 and Jun 08.

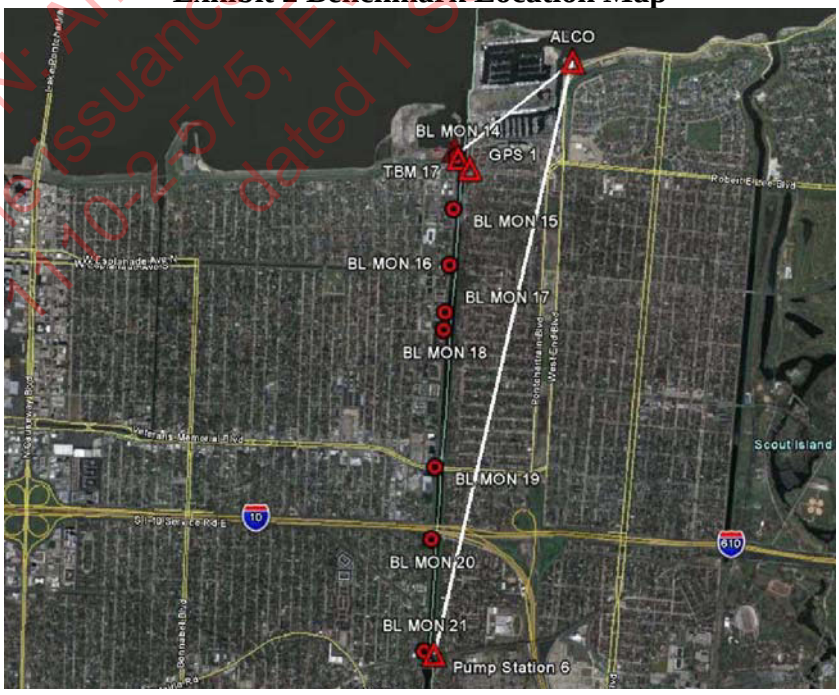
2. Horizontal and Vertical Control

Horizontal data is tied to the State Plane Coordinate System using North American Datum of 1983 (NAD83. Horizontal data shall be tied to the State Plane Coordinate System using North American Datum of 1983 (NAD83, LA Southern 702). Distances are in feet by horizontal measurement. Coordinates are Louisiana Lambert South Zone. Vertical data is tied to the North American Vertical Datum of 1988, Epoch 2004.65 (NAVD88-2004.65). Elevations are in feet. Horizontal and vertical accuracies are of third order.

3. Benchmarks

The following benchmarks shown in Exhibit 2 were used for the Chustz design survey.

Exhibit 2 Benchmark Location Map



a. ALCO (VERIFICATION)

The monument is a disk found on concrete sea wall, stamped “ALCO 1931”. The station is 22.2 feet NE of a light pole, 69.5 feet ENE of the east gate corner of a hurricane fence at address 8001, 14.9 feet west of an expansion joint in the seawall.

To reach the station from the intersection of I-10 and I-610, go north on West End Boulevard for 1.7 miles, the road becomes Lake Front Drive, continue for 0.4 miles to a curve in the road, turn into Landry’s Seafood Restaurant parking lot to the station on right on seawall. The station is located in Metairie, LA, 5.9 miles north of New Orleans, 7.0 miles NE of Bridge City, LA and 8.6 miles east of Kenner, LA.

Lat. 30°01'36.5" N, Long. 90°06'46 2" W
Elevation 6.14 NAVD88 (2004.65)

b. Pump Station #6

The mark is a standard 3 112" COE aluminum disk set in epoxy on top of the east floodwall of the l7th Street Canal, stamped "TBM Pump Station No. 6 - 2006-, and painted yellow (Monument set by COE personnel- elevation of monument established by Lowe Engineers)

The station is located on the east floodwall of the 176 Street Canal at+/- 350 feet north of Pump Station No.6, 80 feet northwest along floodwall from the railroad tracks, 45 feet northward and perpendicular from railroad track centerline, 37 feet west of a fence comer, 3.5 feet above ground level.

Lat. 29°59'15 8" N, Long. 90°07'26.0" W
Elevation 13.28 NAVD88 (2004.65)

c. TBM 17

Brass disk set atop concrete flood wall stamped TBM 17th St. 1994. To reach the station from the intersection of l-10 and 610, travel North 1.6 miles to Metairie Hammond Highway Turn left (East) on to Metairie Hammond Highway and proceed for approximately 0.5 miles to Orpheum Avenue. Turn right (North) on Orpheum Avenue and enter into pump station. Mark is atop of a floodwall PI.

Lat. 30°01'l4" N, Long. 90°07'18" W
Elevation 2.40 NAVD88 (2004.65)

3. References

The EM web link is the following:
http://www.usace.army.mil/publications/eng-manuals/em.htm

A. Civil References

1. Hurricane and Storm Damage Reduction System Design Guidelines, New Orleans District Engineering Division, Interim. October 2007, with revisions dated June 2008.
2. ER 1110-2-1200, Engineering and Design, Plans and Specifications, dated 14 March 1989.
3. EC 1110-1-87, Standards for Maps, Drawings, Engineering Surveys, Construction Site Plans, and Related Geospatial Data Products, dated 1 July 1996.
4. Technical Report CADD-95-April 1995, Part 2, Tri-Service CADD/GIS Technology Center.
5. American Association of State Highway Transportation Officials (AASHTO), "A Policy on Geometric Design of Highways and Streets" 2004, 5th edition.
6. Manual on Traffic Uniform Control Devices for Streets and Highways (MUTCD), Washington D.C., 2003 edition.
7. Louisiana Department of Transportation and Development, Roadway Design Procedures and details, July 2002 edition.

B. Geotechnical References

1. Hurricane and Storm Damage Reduction System Design Guidelines, New Orleans District Engineering Division, Interim. October 2007, with revisions up to June 2008.
2. Stability Modeling with SLOPE/W, GeoStudio 2007 V7.1, GEO-SLOPE/W International Ltd.
3. U.S. Army Corps of Engineers, New Orleans District Engineering Division, Stability with Uplift (MVD Method of Planes).
4. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1901, Seepage Analysis and Control for Dams, 30 April 1993.
5. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1902 Slope Stability, 31 October 2003.
6. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1913 Design and Construction of Levees, 30 April 2000.
7. U.S. Army Corps of Engineers, Engineer Manual 1110-2-2502, Retaining and Flood Walls, 29 September 1989.
8. U.S. Army Corps of Engineers, Engineer Manual 1110-2-2504, Design of Sheet Pile

Walls, 31 March 1994.

9. U.S. Army Corps of Engineers, Engineer Manual 1110-2-2906 Design of Pile Foundations, 15 January 1991.
10. U.S. Army Corps of Engineers, ETL 1110-2-569, Design Guidance for Levee Underseepage, 2005.
11. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1904 Settlement, 30 September 1990.
12. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1905 Bearing Capacity of Soils, 30 October 1992.
13. U.S. Army Corps of Engineers, Engineer Manual 1110-2-1906 Laboratory Soils Testing, 20 August 1986.
14. Harr, M.E., "Groundwater and Seepage" McGraw-Hill Book Company, New York, 1962.
15. US Army Corps of Engineers, New Orleans District, Elevations for the Initial Design of Hurricane Protection Levees and Structures within the New Orleans District – Draft Report Version 1.2, 26 September 2006.
16. US Army Corps of Engineers, Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Draft Final Report of the Interagency Performance Evaluation Task Force, Volume I – Executive Summary and Overview, 1 June 2006.
17. US Army Corps of Engineers Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Draft Final Report of the Interagency Performance Evaluation Task Force, Volume V – The Performance – Levees and Floodwalls, 1 June 2006.
18. US Army Corps of Engineers (GCAT), "Stability Analysis of I-Walls Containing Gaps between the I-wall and Backfill Soils" with additional examples by GCAT, (adapted from paper by Brandon, Thomas L., Stephen G. Wright, and J. Michael Duncan (2008)), Version 6.0, 14 Sep 09

C Project Design Reports

(Draft) Safe Water Elevation, Evaluation, 17th Street Canal, United States Army Corps of Engineers, Hurricane Protection Office, New Orleans District, August 2010. (Prepared by Black and Veatch)

D. Project-Specific Criteria

Elevations for Design of Hurricane Protection Levees and Structures, Lake Pontchartrain, Louisiana and Vicinity, Hurricane Protection Project, West Bank and Vicinity, Hurricane

Project, U.S. Army Corps of Engineers, New Orleans District (09 October 2007).

E. Other Design Criteria and Information

1. EM 385-1-1, General Safety Requirements, September 2008.
2. ER 415-1-11, Biddability, Constructibility, Operability, and Environmental Review.
3. ER 1110-2-1302, Civil Works Cost Engineering. 31 Mar 94
4. Design Memorandum 20, General Design, 17th Street (Metairie Relief) Outfall Canal, Volumes I and II, U.S. Army Corps of Engineers, New Orleans District, March 1990

F. Computer Program Manuals

1. Stability With Uplift program (Method of Planes), U.S. Army Corps of Engineers, New Orleans District, P.O. Box 60267, New Orleans, LA 70160
2. Stability Modeling with SLOPE/W 2007, An Engineering Methodology, GEO-SLOPE/W International, Ltd, 2007.
3. SEEP/W 2007, Groundwater seepage analysis, GEOSLOPE International, Ltd, 2007.
4. US Army Corps of Engineers, Engineer Research and Development Center, Design/Analysis of Sheet-Pile Walls by Classical Methods (CWALSHT), April 2006.

G. Criteria Waivers

The top of the existing I-wall is at approximately El. 12.3±. The Maximum Operating Level (MOL) in the canal is required to be at El. 8.0. The scope of work for the project requires installation of ground improvement columns to increase the required factor of safety (FOS) for stability for water at the MOL of El. 8.0. In the design of this project it is assumed that the maximum stick-up height of 4'-0" for I-walls required by Hurricane and Storm Damage Reduction System (HSDRS) Design Guidelines updated 12 June 2008 is waived, per direction from the USACE. The MOL of El. 8.0 is therefore considered the top of wall case as well, so the 4 ft. stick-up criteria applies to 4 ft below the MOL of 8.0

4. Design Related Documents

Design related documents will be contained in Appendix B.

5. Engineering Studies, Investigation, and Design

A. Geotechnical Data

1. Slope Stability

Table 5-1 of the HSDRS Design Guidelines updated 12 June 2008 lists factor of safety criteria for slope stability analyses. The criteria applicable to the global stability of I-walls by Spencer's Method and Method of Planes (MOP) are reproduced in the table below.

Table 5-1 Minimum Factors of Safety for Shear Stability Analyses of Levee Sections

	Required Minimum FS	
Analysis Condition	**Spencer**	**MOP**
Canal at El. +8 Maximum Operating Level	1.4	1.3
Low Water Q-case (hurricane condition)	1.4	1.3
Low Water S-case (non-hurricane condition)	1.4	1.3
Temporary Construction Loading, Canal El. 6 and 1.	1.2*	N/A

* Assumed value for "water at project grade" from HSDRRS Guidelines

For I-wall analyses, the Method of Planes is intended as a design check only; it does not control the analysis. This is mentioned in Table 6-1 and explained in Section 3.4.3, T-Wall Design Procedure of the HSDRS Guidelines.

Internal and external stability of the DMM zone was based on the draft "Design Guide for Levee and Floodwall Stability Using Deep-Mixed Shear Walls" by George Filz and Eddie Templeton dated February 10, 2009. Per the guidelines, internal and external stability were only checked for water at the safe water elevation (equivalent to top of protection for levees). This method was modified based on discussions with Dr. Filz to model gap analysis. Analysis was completed for cases with and without a gap. Target factors of safety are listed in Table 5-2. The internal and external stability factor of safety requirements are tied to the values required for Spencer's method and the Method of Planes as listed in Table 5-1.

Table 5-2 Design Factors of Safety for Internal and External Stability of DMM Panels

Mode of Failure	Target Factor of Safety	
	SWL	TOP
Global Stability, Spencer's Method, Fg (From SLOPE/W)	See Table 5-1	
Global Stability, Method of Planes, Fg	See Table 5-1	
Sliding, Fs (based on Method of Planes)	1.3	1.2
Overturning, Fo (based on Spencer's method)	1.5	1.4
Vertical Shearing, Fv (based on Spencer's method)	1.5	1.4
Extrusion, Fe (based on Spencer's method)	1.5	1.4
Crushing, Fc (based on Spencer's method)	1.5	1.4
Non-Vertical Shearing by Spencer's method, Fn (from SLOPE/W)	See Table 5-1	
Non-Vertical Shearing by Method of Planes, Fn	See Table 5-1	

SWL = Still Water Level
TOP = Top of Protection

The zone of soil improvement will be built as a series of overlapping deep mixed columns that will form panels which are oriented perpendicular to the longitudinal axis of the levee. The following properties were assumed for the improved soil based on discussions with the USACE and published information gathered for other design work performed by URS in the New Orleans area.

Table 5-3 Assumed Material Properties and Geometry for the Deep Mixed Panels

Material Property	Value
Design Unconfined Compressive Strength of the deep-mixed ground, qdm	80 psi
Specified Unconfined Compressive Strength of the deep-mixed ground	100 psi
Design Shear Strength for the deep-mixed ground, sdm	32 psi
Area replacement ratio, as	0.24
Design shear strength of the mixed zone	1000 psf
Drained shear strength of the deep-mixed soil, cohesion c', and drained angle of internal friction ' (values from Hayward Baker)	c' = 8 psi phi = 30°
Diameter of deep mix columns	2.62 ft (800mm)
Design overlap of deep mix columns	0.86 ft (264) mm)
Spacing of deep mix panels perpendicular to the longitudinal axis of the levee	10.0 ft

The specified unconfined compressive strength was set higher than the design compressive strength to allow for uncertainty and variability in the field measured

strengths. This is primarily due to the fact that dry mixing will be allowed, which we felt was likely to result in lower strengths and higher variability than wet mix or jet grouting.

2. Seepage

Seepage analyses for each of the 35 reaches along the 17th Street Canal were analyzed for the Safe Water Elevation report and were presented in BV Report. Black & Veatch determined that the safe water elevations based on seepage were above El. +8.0 for all cases and so reanalysis of seepage stability was not included as part of the scope of work for the remediation to raise the safe water elevation. However, during the geotechnical design process, URS JEG JV notified the USACE that it appeared there could be a potential for seepage problems in some reaches and recommended that further investigations be performed. The USACE agreed and issued a modification to the design contract for this seepage investigation work. Results of the seepage investigation have been issued as an addendum to Appendix C, the geotechnical report. At the time of this report, no remediation for seepage has been added to the construction contract.

B. Hydraulic and Hydrologic Data (furnished by USACE)

1. Project/Feature/Contract Hydrology

Hydrology is not part of the final engineering and design of the reconstruction of the floodwall at the 17th Street Canal.

2. Hydraulic Design Features

The hydraulic design features for this project are the maximum operating level water surface elevation, which is El. 8.0 for the 17th Street Canal remediation project

3. Hydraulic Design Data.

Hydraulic design data used to establish the hydraulic design features listed directly above is not part of this task order.

4. Hydraulic Model Tests.

Hydraulic model tests are not part of this task order.

C. Design Features

1. Structural

There is no required structural design for this project.

2. Geotechnical

a. Ground Improvement Methods

The recommended approach allows three alternate types of ground improvement, wet mixing, dry mixing, and jet grouting. The primary reason for allowing three alternates rather than recommending one method is the difficult site access and need to remove spoils. Allowing these multiple technologies will allow the optimum solution to be selected and thereby provide the most economical construction cost. Relative advantages and disadvantages of each method are noted below

Table 5-4 Advantages and Disadvantages of Ground Alternate Improvement Methods

Technology	Advantages	Disadvantages	Remarks
Wet-mix (cement grout is mixed with the soil using mixing tools)	Does not rely on soil moisture for hydration of cement. More uniform mixing than other methods Minimal effect on existing wall or slope.	Large size rigs make access difficult. Creates 25 to 30% spoil that must be removed. Rig size may make it impractical.	Preferred method due to highest quality and least risk of damage to existing wall.
Dry-mix (dry cement is mixed with the soil using mixing tools)	Small rigs, does not create spoil. Barge access may be possible based on discussions with contractor.	Mix is not as uniform as wet-mix. Relies on moisture in soil for hydration of cement.	Least disruptive to neighbors due to lack of spoil
Jet Grouting (cement grout is mixed with the soil using high pressure water and air jets to shear and mix grout with soil)	Small size rigs best for site access. Can mix directly up against sheet pile wall.	Creates at least 10 to 15 percent spoil for single fluid grouting proposed by contractor. 2 and 3 fluid grouting would produce more. Diameter and overlap of panels is less certain than dry or wet mix since auger is not used. Greater risk of damage to walls and slope than other methods - work must be carefully done by qualified contractors to reduce risk.	Least favored approach, but may be only method where access is very tight. Method's success is highly dependent on the contractor's equipment and skill.

b. Overlap of Secondary to Primary DMM Columns

In order to provide shear resistance as a solid panel, as opposed to a series of individual columns, it is vital that the DMM columns have adequate overlap. The design assumes an overlap of approximately 1/3 percent of the column diameter. The overlap affects only the factor of safety on vertical shear (Fv), which is generally 2 or

more for the full design overlap compared to the target value of 1.4. Normal variations in column locations and plumbness can reduce the overlap and therefore the factor of safety. To achieve the target factor of safety, specifications should require columns to be within 3 inches of the plan location and that plumbness be within 1 percent of vertical.

c. Site Access and Work Pad

Portions of the site may be accessible by barge from the canal, however, many areas may not be. Therefore a work pad will need to be installed along the wall by cutting and filling. The amount of allowable cut depends on global stability and sheet pile geotechnical capacity. The amount of allowable cut is less on the west side of the canal due to the much shorter sheet piles compared to the east side. Design Reach C on the west has the shortest sheet piles and limits cutting to El. 2.3 for a canal elevation of 8.0. For a canal elevation of 4.0, the cut could extend to El. 1.0 in Design Reach C. Historic data show that a canal elevation of El. 4 is rare and occurs mainly during hurricanes.

On the east side of the canal, the cut can extend to El. 1 except at the very south in Design Reach G where levee grade is near El 8. Here the cut should be limited to El. 4 (to be confirmed in final report).

Global stability analyses were run assuming a loaded area of 320 psf with a maximum width of 20 feet and length of 50 feet to accommodate the rig and spoil. If contractor's equipment or planned spoil area will exceed these limits, they should provide stability analyses confirming that they meet a factor of safety of at least 1.2 for global stability.

The construction staging area is located at the Hurricane Katrina breach site. The contractor is required to protect all the existing piezometers with a chain link fence.

3. Civil Design

a. Civil Site & Grading

See Table 2-2 and Figure 2 for elevations and slopes for both the east and west side of the canal. The contractor is given the option to use either DMM or jet grout for soil improvement. If the contractor chooses to create a temporary bench or working pad for the mixing rigs, then he must meet the parameters given in Table 2-2.

The existing concrete bike path on the west side will be removed and replace in kind.

b. Traffic Control Design

The road closures and detours will be coordinated with the City of New Orleans, Jefferson Parish Department of Traffic Control, and LADOTD. The contractor is required to inform local emergency services prior to the roadway closures. The roadway closures and detours were designed in accordance with MUTCD, AASHTO and LaDOTD criteria.

The contractor is required to maintain access along Orpheum Ave. Old Hammond Highway bridge can be closed for loading and unloading barges into the canal, however the bridge can not be closed for more than 48 hours.

c. Relocations

No utility relocations are expected on the project. Existing traffic post and signs along Orpheum Ave will be removed and replaced during construction.

d. Water Quality

The contractor is responsible for the development and implementation of the Storm Water Pollution Prevention Plan (SWPPP) as required by the Louisiana Department of Environmental Quality and as listed in the specifications.

e. Disposal Areas

The contractor is responsible for the disposal of spoils from ground improvement operations, debris, trash, and excess excavated material per the specifications.

f. Borrow Material

All embankment material is supplied by the contractor in accordance with the specifications.