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Final Independent External Peer Review Report

Independent External Peer Review of Greater New Orleans Hurricane Storm Damage Risk Reduction System Design Guidelines

Prepared By
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505 King Avenue
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Prepared for
Department of the Army
U.S. Army Corps of Engineers
Coastal Storm Damage Reduction Planning Center of Expertise
Baltimore District

Contract No. W911NF-07-D-0001
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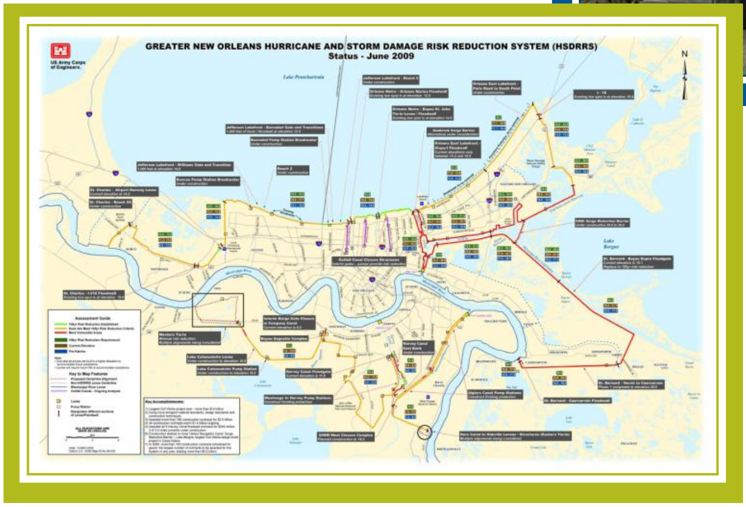

ACKNOWLEDGEMENTS

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SHORT TERM ANALYSIS SERVICE (STAS)

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for the

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The views, opinions, and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

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ACRONYMS

ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
CECW-CP	Corps of Engineers Civil Works – Coastal Protection
CERP	Comprehensive Everglades Restoration Plan
CPGA	CASE Pile Group Analysis Program
CPT	Cone Penetrometer Test
CWALSHT	CE Sheet Pile Wall Design/Analysis Program
DrChecks^{SM}	Design Review and Checking System
DWSE	Design Water Surface Elevation
EC	Engineering Circular
EM	Engineering Manual
ER	Engineering Regulation
FOS	Factor of Safety
GDR	Geotechnical Data Report
GIR	Geotechnical Interpretive Report
GFR	Geotechnical Feature Report
GNOHSDRRS	Greater New Orleans Hurricane and Storm Damage Risk Reduction System
IEPR	Independent External Peer Review
IMC	Interagency Modeling Center
IPET	Interagency Performance Evaluation Task Force
ITR	Independent Technical Review
LECsR	Lower East Coast sub-Regional
MCA	Monte Carlo Analysis
MOP	Method of Planes
MSE	Mean Surge Elevation
OMB	Office of Management and Budget
PDT	Project Delivery Team
PRQCP	Peer Review Quality Control Plan
QA/QC	Quality Assurance/Quality Control
SEI	Structural Engineering Institute
SWL	Still Water Level
USACE	United States Army Corps of Engineers

Final Independent External Peer Review Report

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Executive Summary

The U.S. Army Corps of Engineers (USACE) is currently designing and constructing the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (GNOHSDRRS). A vital component of this system is the GNOHSDRRS Design Guidelines, which will be used to design the various levees and structures throughout the GNOHSDRRS.

Because of the importance of this project, an Independent External Peer Review (IEPR) of the Design Guidelines was conducted. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses and engineering.

Battelle Memorial Institute (hereafter Battelle), as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels, was engaged to coordinate the IEPR of the GNOHSDRRS Design Guidelines. The IEPR followed the procedures described in the Department of the Army, USACE guidance *Peer Review of Decision Documents* (Engineering Circular 1105-2-410) dated August 22, 2008; Corps of Engineers Civil Works – Coastal Protection Memorandum dated March 30, 2007; *Engineering and Design, Quality Management* (Engineering Regulation [ER] 1110-1-12) dated July 21, 2006; and *Engineering and Design, DrChecks* (ER 1110-1-8159) dated May 10, 2001.

This final IEPR report describes the IEPR process developed by Battelle and followed by an external panel of experts, summarizes final comments of that IEPR panel, and describes the panel members and their selection.

The GNOHSDRRS Design Guidelines, hereafter referred to as the Design Guidelines, is a compendium of design guidance and standards for engineers and designers engaged in work for the USACE New Orleans District. This IEPR reviewed the June 2008 version of the document and its appendices.

Battelle initially identified 90 candidate peer reviewers, confirmed their availability, evaluated their technical expertise, and inquired about potential conflicts of interest. Of those initially contacted, 20 external peer review candidates confirmed their interest and availability, and 70 candidates declined due to the schedule, anticipated level of effort, or because of disclosed conflicts of interest.

The ten reviewers selected for the final IEPR panel were independent engineering consultants. Corresponding to the technical content of the Design Guidelines, the areas of technical expertise of the selected peer IEPR panel members included geotechnical engineering (three panel members), structural engineering (two panel members), hydraulic engineering (three panel members), and civil engineering (two panel members).

The IEPR panel members were provided with hard and electronic copies of the Design Guidelines and supporting documentation, along with the charge for conducting the review. On September 16, 2008, the panel members participated in an Orientation Briefing where they were briefed on the Design Guidelines document and visited sites throughout the Greater New Orleans area. The IEPR panel members started their review on September 20, 2008, and produced 538 individual written comments. These comments were initially discussed by the panel and USACE during an IEPR Conference held on November 6 and 7, 2008. IEPR panel member comments included recommendations for the addition of details to improve the document, such as:

- The document should incorporate a systems approach that considers all pertinent scales of conditions and behavior that can significantly affect the overall system performance.
- Additional information should be provided that describes the systematic development of levee/floodwall soil-profile segments and cross sections used for geotechnical analysis and design (i.e., Geotechnical Site Characterization).
- The document should be consistent and accurate across disciplines with terminology and design usage of water levels and their relationships to levee and wall elevations.
- The document should state explicitly how the future effects from continued loss of wetlands, subsidence, climate change, storm frequency, storm intensity and duration, and storm travel speed would be accommodated into the design life of the flood control works.

The remaining comments focused on recommendations to clarify information in the document and ensure consistency among future designs.

The USACE Project Delivery Team (PDT) evaluated and responded to all 538 IEPR panel comments, concurring with 341 comments, agreeing to provide additional information in support of 142 comments, and non-concurring with 55 comments, for which an explanation was provided with each. Upon review of the USACE PDT responses, the IEPR panel members determined that some comments were inadequately addressed and needed further discussion. Therefore, IEPR teleconferences were conducted on January 19 and 21, 2010 for the IEPR panel and USACE PDT to discuss those comments that were identified by the panel as being inadequately addressed. Upon completion of the IEPR teleconferences and subsequent evaluations by the USACE PDT, the IEPR panel members considered many comments adequately addressed. However, the panel still did not consider some of the comments to be fully addressed by USACE PDT responses, as the actual questions were not directly answered (e.g., responses to the Barge Impact Comments only indicated that a separate study was being conducted and did not indicate how the issues would be resolved). When a panel member did not agree with the final USACE response or considered the comment to be thoroughly addressed, the panel member provided a final comment response before closing the comment for further discussion.

In general, the IEPR panel members agreed that the Design Guidelines contain some very important information that will be useful to designers involved with the GNOHSDRRS, although some aspects of the document need improvement. The panel members appreciated that the design methods and criteria in the Design Guidelines are not considered final by USACE and are subject to learning and evolutionary improvement. They also appreciated the use of "plain English" in some sections of the document to help explain the approach, including Design Guidelines intent and limitations. However, the IEPR panel recommends revisions to the document to improve clarity on the issues noted in the Design Review and Checking System (DrChecks[SM]) during the IEPR process.

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1 INTRODUCTION

1.1 Background of Program

The U.S. Army Corps of Engineers (USACE) is currently designing and constructing the Greater New Orleans Hurricane and Storm Damage Risk Reduction System (GNOHSDRRS). A vital component of this system is the GNOHSDRRS Design Guidelines, which will be used to design the various levees and structures throughout the GNOHSDRRS.

Because of the importance of this project, an Independent External Peer Review (IEPR) of the Design Guidelines was conducted. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses and engineering.

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This final IEPR report describes the IEPR process developed by Battelle and followed by an external panel of experts, summarizes final comments of that IEPR panel, and describes the panel members and their selection.

1.2 Project Description

The GNOHSDRRS Design Guidelines, hereafter referred to as the Design Guidelines, is a compendium of design guidance and standards for engineers and designers engaged in work for the USACE New Orleans District. This IEPR reviewed the June 2008 version of the Design Guidelines document and its appendices.

1.3 Purpose of the Independent External Peer Review

The purpose of an IEPR is to strengthen the quality and credibility of the USACE's decision documents in support of its Civil Works program. To help ensure that USACE documents are supported by the best scientific and technical information, a peer review process has been implemented by USACE that utilizes an IEPR to complement the agency technical review, as described in the USACE guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008, and CECW-CP Memorandum dated March 30, 2007. In this case, the IEPR of the Design Guidelines was conducted and managed using contract support from an independent 501(c)(3) organization, Battelle, to ensure independent objectivity, along with a high degree of flexibility and responsiveness, which was essential for USACE to meet deadlines.

2 INDEPENDENT EXTERNAL PEER REVIEW PROCESS

This section describes the approach for selecting IEPR panel members and planning and conducting the IEPR. The IEPR followed the process described in the Peer Review Quality Control Plan (PRQCP) that Battelle developed specifically for this project and was conducted following procedures described in USACE's guidance cited above (see Section 1.1) and in accordance with the Office of Management and Budget's (OMB) *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. In addition, supplemental guidance on the evaluation of conflicts of interest from the National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports*, dated May 12, 2003, was also followed.

2.1 Planning and Schedule

Table 1 defines the schedule followed by Battelle in executing the IEPR.

Table 1. Schedule

Task	Action	Completed By Date
	Notice to Proceed	01-Aug-08
1	Submit Draft PRQCP Submit Final PRQCP Submit Charge	15-Aug-08 02-Sep-08 15-Aug-08
2	Submit list of Final IEPR Panel Members IEPR Panel Members under contract	21-Aug-08 (revised 12-Sep-08) 17-Sep-08
3	USACE provides the Orientation Briefing Materials USACE provides Orientation Briefing IEPR Panel attends Orientation Briefing	10-Sep-08 16-Sep-08 16-Sep-08
4	USACE provides Design Guidelines Conduct IEPR of Design Guidelines IEPR Panel Comments provided in the Design Review and Checking System (DrChecks) USACE Reviews Panel Comments and Responds in DrChecks IEPR Panel responds to (i.e., Backchecks) USACE PDT Responses in DrChecks	19-Sep-08 20-Sep-08 – 20 Oct 08 20-Oct-08 20-Oct-08 – 12-Apr-10 23-Oct-08 – 13-May-10
5	IEPR Conference to Discuss Comments on Design Guidelines IEPR Final Briefing Conference IEPR Panel presents findings at IEPR Conference USACE and Panel Member IEPR Teleconference to Discuss USACE Responses	06-Nov-08 – 07-Nov-08 06-Nov-08 – 07-Nov-08 06-Nov-08 – 07-Nov-08 19-Jan-10 and 21-Jan-10
6	Close out all comments in DrChecks Submit Closeout Report (Final Report) Project Closeout	13-May-10 14-Jun-10 31-Aug-10

2.2 Identification and Selection of Independent External Peer Reviewers

Battelle initially identified 90 candidate peer reviewers, confirmed their availability, evaluated their technical expertise, and inquired about potential conflicts of interest. Of those initially contacted, 20 external peer review candidates confirmed their interest and availability, and 70 candidates declined due to the schedule, anticipated level of effort, or because of disclosed conflicts of interest.

The credentials of the 20 available candidate peer reviewers were evaluated according to the overall scope of the Design Guidelines, focusing on the key technical areas of geotechnical engineering, structural engineering, hydraulic engineering, and civil engineering. Participation in previous USACE technical review committees and other technical review panel experience was also considered.

The peer reviewers were screened for the following *potential* exclusion criteria or conflicts of interest:

- Involvement in producing the Design Guidelines (including related technical reports and supporting appendices);
- Involvement in any USACE projects in the New Orleans, Louisiana area;
- Current USACE, federal, or state government employee;
- Other USACE affiliation [Scientist employed by the USACE (except as described in National Academy of Sciences criteria, see EC 1105-2-408 section 9d)];[a]
- A significant portion of personal or company revenues within the last three years came from USACE contracts;
- Current or future financial interests in GNOHSDRRS contracts/awards from USACE;
- Any publicly documented statement made by the reviewer or reviewer's firm advocating for or against the subject project;
- Financial or litigation association with USACE, "The State" (defined as the State of Louisiana and Local governing entities including Southeast Louisiana Flood Protection Authority), their engineering panel members or subcontractors;
- Paid or unpaid participation in litigation related to the work of the USACE;
- Personal relationships with USACE staff in Mississippi Valley Division Headquarters, Task Force Hope, New Orleans District (Protection Restoration Office), Hurricane

[a] Note: Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE funding have sufficient independence from USACE to be appropriate peer reviewers. See the OMB memo p. 18, "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

Protection Office, or officials from the State of Louisiana and Local governing entities including Southeast Louisiana Flood Protection Authority;

- Participation in the Interagency Performance Evaluation Task Force (IPET), American Society of Civil Engineers External Review of IPET, the Louisiana Coastal Protection and Restoration Study, and/or National Research Council Committee on New Orleans Regional Hurricane Protection Projects; and
- Other possible perceived conflicts of interest for consideration, e.g.,
  - Former USACE New Orleans employee

In selecting final IEPR panel members from the list of peer review candidates, experts who best fit the criteria for the required expertise and did not have any actual or perceived conflicts of interest were selected. Based on these considerations, ten peer reviewers were selected from the list of candidates for the final IEPR panel (see Section 3 for biographical information on the selected panel members). The ten selected panel members were all independent engineering consultants. Corresponding to the technical content of the Design Guidelines, the areas of technical expertise of the ten selected panel members included geotechnical engineering (three experts), structural engineering (two experts), hydraulic engineering (three experts), and civil engineering (two experts). Battelle established subcontracts with each of the ten selected panel members after confirming the absence of conflicts of interest for each panel member through a signed conflict of interest form.

2.3 Orientation Briefing

On September 16, 2008, Battelle staff and the IEPR panel members gathered for an Orientation Briefing on the Design Guidelines at USACE's New Orleans District in New Orleans, Louisiana. During the Orientation Briefing, the USACE Project Delivery Team (PDT) briefed Battelle and the IEPR panel members on the entire GNOHSDRRS program and provided an overview of the Design Guidelines. Following the briefing, members of the USACE PDT, Battelle staff, and IEPR panel members travelled to a few locations around the area to view examples of some new hurricane and storm damage risk reduction system structures that had been designed and constructed since Hurricane Katrina. Throughout the entire trip, the USACE PDT members pointed out various project features and answered questions posed by the IEPR panel members.

2.4 Preparation of the Charge and Conduct of the Peer Review

A charge to the IEPR panel members, which contained specific questions regarding the Design Guidelines (see Appendix A), was developed to guide the IEPR panel and focus the review on the important technical issues. Battelle prepared the draft charge with input from USACE and guidance provided in USACE's guidance *Peer Review of Decision Documents* (EC 1105-2-410) and the OMB's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. The charge was finalized based on the USACE PDT's suggested changes to the draft charge questions. The Design Guidelines IEPR charge consisted of 46 questions applicable to the entire document.

Battelle developed a Microsoft PowerPoint training session to instruct the panel members on using DrChecks^{SM} (Design Review and CHECKing System), a web based tool that facilitates the formal review of complex project documents and automatically tracks, collates, and measures technical discussions. The IEPR panel members received this training session on September 15, 2008, prior to the Orientation Briefing. DrChecks was used to track all comments and responses on the key technical issues identified with the Design Guidelines during the IEPR.

2.5 Document Review

The IEPR started on September 20, 2008 when the IEPR panel was provided with hard and electronic copies of the charge, Design Guidelines (June 2008), and supporting documentation. The IEPR panel was instructed to review the Design Guidelines, focusing on the charge questions, and submit their initial responses to the charge questions via DrChecks no later than October 20, 2008.

To maintain independence and control, the IEPR panel did not have direct or unmonitored e-mail or phone contact with the USACE PDT. All interactions between the IEPR panel and USACE occurred in DrChecks, during the Orientation Briefing, during the IEPR Conference, or via teleconference with Battelle and a USACE Baltimore representative present. In total, the ten IEPR panel members produced 538 individual comments. Of these, the IEPR panel developed 83 comments that they considered critical. Critical comments are defined by the Water Resources Development Act 2035 (Type II IEPR) as being associated with issues that address public safety, health, and welfare. Figure 1 shows an example of a critical comment from the IEPR panel. The names of the IEPR panel and USACE PDT members providing the comment and response have been removed in this example.

On November 6, 2008, the IEPR panel met prior to the IEPR Conference to discuss their findings and remaining issues needing discussion. During that meeting, Battelle compiled information from the panel members on positive feedback, general concerns, recommendations, and critical issues. This information was included in an IEPR Conference PowerPoint presentation that was given at the IEPR Conference (see Appendix B).

2.6 IEPR Conference

On November 6 and 7, 2008, at the New Orleans District in New Orleans, Louisiana, Battelle led an IEPR Conference attended in-person by the IEPR panel and the USACE PDT members providing responses to the DrChecks comments. Members of the State and local stakeholders were also invited to attend. The purpose of the IEPR Conference was to provide a forum for face-to-face discussion of those comments that the IEPR panel members considered critical during the review.

The peer review conference provided an opportunity for the IEPR panel members to understand the USACE PDT point of view and to clarify some of the IEPR panel comments for the USACE PDT. Overall, the conference was successful in clarifying the open issues. At the conclusion of the IEPR Conference, the USACE PDT was tasked with responding to the IEPR panel comments in DrChecks. After the USACE PDT completed their responses to panel comments, the IEPR panel responded by providing Backcheck comments in DrChecks. In some instances, a second round of comments/questions, and responses occurred.

Figure 1. Example of a Critical Comment from the Review

<table>
<tr><td>Id</td><td>Discipline</td><td>Section/Figure</td><td>Page Number</td><td>Line Number</td></tr>
<tr><td>2130898</td><td>Hydrology</td><td>n/a'</td><td>1-9</td><td>5</td></tr>
<tr><td colspan="5">This line mentions the 50 year design, and the previous text mentioned the 1% event. During the Corps verbal briefing, it was described that on a ten year basis the adequacy of the project would be evaluated and modifications, increased heights would be provided if necessary to protect to a 1% frequency. To my knowledge this is unusual for the Corps. I assume this is because of the model forecast and subsidence conditions. Since this considers the possibility of future elevation changes within the 50 year period, it would be wise to ask designers to consider how a design section could be modified for say a one or two foot increase. It also would be wise to consider ROW and utility relocations, that would be adequate for a potential height increase during the 50 year period. How would a "T" or "I" wall be modified? How would armoring be modified? This could be difficult and expensive and should be considered during the initial design.
Submitted By: . Submitted On: 15-Oct-08</td></tr>
<tr><td>1-0</td><td colspan="4">Evaluation Concurred
"All projects are being designed to projected 2057 conditions taking into account effects of subsidence, sea level rise and changes in geomorphology that alter storm surge height and wave environment. This is different from the commitment to revisit design assumptions and methods every 10 years. There is no rational way to predict if, when and by how much design elevations might be increased or decreased due to advances in the science and technology of weather forecasting, storm surge modeling and design methods. For walls that are difficult to construct due to location or other features, ""structural superiority"" is added to provide some latitude in future conditions. Otherwise, the 2057 design elevations represent the best current estimate of future changes based on existing design methods. Should significant changes in requirements be discovered during the 10-year assessments, the need would be identified and follow the traditional process for project modification. The 10-year assessments are required as part of the USACE Levee Safety Program." -

Submitted By: Submitted On: 23-Jun-09</td></tr>
<tr><td>1-1</td><td colspan="4">Backcheck Recommendation Close Comment
During the conference call of 1/19/10, clarified these comments by stating, "All improvements are being constructed to the full 2057 required elevation, including consideration for any potential subsidence. In addition certain sections are constructed with structural superiority, or an additional two feet of elevation" Based on the above, we concur.

Submitted By: Submitted On: 26-Feb-10</td></tr>
<tr><td></td><td colspan="4">Current Comment Status: Comment Closed</td></tr>
</table>

2.7 IEPR Teleconference

On January 19 and 21, 2010, Battelle led two IEPR teleconferences between the IEPR panel and USACE PDT members who responded to the panel's DrChecks comments. Members of the State and local stakeholders were also invited to attend. The purpose of the IEPR teleconferences was to provide an interactive, real-time forum for discussion of comments that the IEPR panel members considered inadequately addressed during the initial review.

These teleconferences provided an opportunity for the IEPR panel members to understand some of the responses from the USACE PDT. Overall, the teleconferences were successful in clarifying and resolving many of the issues. USACE had some responses that needed clarification through further research; however, at the conclusion of the teleconferences the IEPR panel members considered many of the comments to be adequately addressed.

2.8 IEPR Final Report

After concluding the review, Battelle prepared this final report on the overall IEPR process and the IEPR panel members' findings. The report was reviewed by each IEPR panel member and Battelle technical and editorial experts prior to submission of the report to the USACE.

3 IEPR PANEL MEMBER SELECTION

Potential peer review candidates were identified through Battelle's IEPR Database of experts, trade organizations, engineering societies, targeted internet searches using key words (e.g., terms focusing on technical area and geographic region), search of university websites or other compiled expert websites, and through referrals.

All IEPR panel members met the following minimum requirements:

- Registered professional engineer (or equivalent in home country)
- Masters degree
- 15 years of experience with responsibilities for project engineering work

Panel members in each discipline also were required to have specific technical experience in the areas summarized in Table 2 below.

Table 2. Required Technical Experience for IEPR Panel Members

Discipline (Number of Reviewers)	Required Experience
Geotechnical Engineer (3)	• Very soft Louisiana-type clay soil foundations • Large diameter pile design • Axial and lateral load testing for piles • T-wall and L-wall design • Subsurface investigations in very soft soil • Seepage design • Wave impact/armoring • Slope stability analyses for very soft soils
Structural Engineer (2)	• Sector gates and/or lift gates subject to high wind and wave loading • T-wall and L-wall floodwall design
Hydraulic Engineer (3)	• Hurricane surge and wave generation • Navigational hydraulics
Civil Engineer (2)	• Designs utilizing soft soils • Designs of levees

Battelle screened potential IEPR panel members for availability, technical background, and conflicts of interest, and prepared a draft list of panel candidates to provide to the USACE. Battelle selected the final IEPR panel members (Table 3) based on their specific experience in the areas of expertise specified in the scope of work (Table 4).

Table 3. Final IEPR Panel Members

Discipline/Name	Affiliation	Location	Education	Years of Experience
Geotechnical/Civil Engineer				
Christopher J. Brown	Golder Associates	Jacksonville, FL	BSCE, MSCE, PhDCE	21
David E. Lourie	Lourie Consultants	Metairie, LA	BSCE, MSCE	30
Jack W. Rolston	Independent	Tarzana, CA	MSCE	50+
Structural Engineer				
Jay Jani	Engineering Consulting Services, Inc.	Metairie, LA	BECE, MSCE, PhD. (Ocean Eng)	25+
Jerry Zhou	GC Engineering, Inc.	Pearland, TX	BSCE, MSCE, MSCompE	21
Hydraulic Engineer				
Frank L. Kudrna	Kudrna & Associates, Ltd.	Chicago, IL	BSE, MS, PhD	44
Bijay K. Panigrahi	BPC Group, Inc.	Orlando, FL	BSAgEng, MEHydraulics, MSCE, PhDCE	28
Michael Ports	Independent	Jacksonville, FL	BSCE, MSWR	40
Civil Engineer				
W. Allen Marr	Geocomp Corp.	Boxborough, MA	BSCE, MSGeoTechE, PhDGeoTechE	41
Charles Vita	URS	Seattle, WA	BSCE, MSGeoTechE, PhDCE	37

Table 4. Specific Experience of IEPR Panel Members Requested in Scope of Work

Expertise	Total	David Lourie	Jack Rolston	Chris Brown	Jerry Zhou	Jay Jani	Bijay Panigrahi	Michael Ports	Frank Kudrna	Allen Marr	Charles Vita
Geotechnical/Civil Engineer											
Very soft Louisiana-type clay soil foundations	**5**	1	1	1						1	1
Large diameter pile design	**4**	1	1							1	1
Axial and lateral load testing for piles	**4**	1	1	1						1	
T-wall and L-wall design	**5**	1	1	1	1					1	
Subsurface investigations in very soft soil	**6**	1	1	1			1			1	1
Seepage design	**6**	1	1	1			1			1	1
Wave impact/armoring	**5**	1	1	1			1			1	
Slope stability analyses for very soft soils	**7**	1	1	1	1		1			1	1
Structural Engineer											
Sector gates and/or lift gates subject to high wind and wave loading	**2**				1	1					
T-wall and L-wall floodwall design	**2**				1	1					
Hydraulic Engineer											
Hurricane surge and wave generation	**6**			1	1	1	1	1	1		
Navigational hydraulics	**4**					1	1	1	1		
Civil Engineer											
Designs utilizing very soft soils	**6**	1		1			1		1	1	1
Design of levees	**8**	1		1	1		1	1	1	1	1

The credentials of the ten reviewers selected for the IEPR panel and their qualifications in relation to the technical evaluation criteria are summarized below. Appendix C includes a resume for each reviewer that provides detailed biographical information and his technical areas of expertise.

Dr. Christopher J. Brown is a licensed Professional Engineer. He has worked as a Geotechnical and Civil Engineer for 21 years, including employment for 15 years by USACE Philadelphia and Jacksonville Districts. Dr. Brown has extensive project experience in water resources development, geotechnical engineering, coastal storm protection, and port and harbor development (including embankments built on soft clay dredged material). He has civil engineering experience in Florida, Georgia, Puerto Rico, Pennsylvania, New Jersey, and New York. He is a recognized expert in groundwater seepage, hydrology, water resources engineering, and computer modeling. Dr. Brown has authored numerous publications in technical journals. Dr. Brown teaches foundation engineering and engineering geology at the University of North Florida. Since 2006, Dr. Brown has been employed as a Senior Consultant with Golder Associates, Inc.

Dr. Jay Jani is a licensed Professional Engineer. He has worked as a structural engineer with over 25 years of design experience in civil and marine/offshore engineering industries. Dr. Jani founded his firm, Engineering Consulting Services, Inc., in 1990. Since then Dr. Jani has been the President and Sr. Structural Engineer of Engineering Consulting Services, Inc. and has worked on a variety of structural design and assessment projects, as well as performed independent technical reviews (ITRs) for several structural design projects in the New Orleans area. For example, Dr. Jani performed the ITRs of the structural design of T-walls for several pumping stations in New Orleans, as well as reviews of the Inner Harbor Navigational Canal Replacement Lock, Riverside Gatebay Module, and the Harvey Canal Flood Wall Design in New Orleans. Dr. Jani has also performed the structural design of IPS Weather Station Equipment Support Structures and Lateral Support Systems at various canals in New Orleans, Louisiana. Dr. Jani served as the Chairman of American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) Structures Committee - New Orleans Chapter for 2008 to 2009 term. Dr. Jani is also an adjunct faculty in Civil Engineering Department at the University of New Orleans.

Dr. Frank L. Kudrna founded Kudrna & Associates, Ltd., in 1986, following 24 years of public- and private-sector employment. For over 25 years, Dr. Kudrna has served as Chief Engineer of the Illinois International Port District, (Chicago). The Port has regulatory authority over waterway permits and is a partner/local sponsor with the USACE on all navigational improvements. He has reviewed numerous projects and improvements in this capacity as well as developed regulatory standards and provided regulatory approvals. Throughout his career, Dr. Kudrna has gained expertise in levee and reservoir design and navigational hydraulics, for example in his capacity as the Director of the Illinois Division of Water Resources and Supervising Engineer of Flood Control for the Metropolitan Water Reclamation District of Greater Chicago. Dr. Kudrna's firm provides planning and civil engineering services for site development, municipal and transportation engineering, and water resources management projects, including roads, streets, bridges, airports, railroads, ports and harbors, and parking facilities; drainage, flood control, flood routing, detention reservoirs, and wetlands; land development and landscaping; waste collection and treatment systems and pump stations; marinas, golf courses, parks, and other recreational facilities; and water supply and distribution systems, including Lake Michigan Water Allocation studies.

David E. Lourie is a practicing engineer with expertise in South Louisiana soil conditions, local area geology, and geotechnical design and construction. In his 30-year career, he has performed complex geotechnical investigations for the petrochemical industry, airports, ports, State and Federal agencies, and others in the region. Before forming Lourie Consultants in 1992, he spent nine years directing the technical and financial operations of Fugro-McClelland (Southeast), Inc. and McClelland Engineers in Louisiana. Before that, he worked as an onshore and offshore geotechnical engineer for McClelland Engineers in Houston, Texas, and as a soil and materials engineer for STS Consultants in Chicago, Illinois. He has served as a liaison to the Peer Review Committee of ASFE, Inc. (ASFE/The Geoprofessional Business Association), has served as a Peer Review captain, and is ASFE's immediate national past president. Mr. Lourie has been an adjunct associate professor at Tulane University, a visiting professor at McNeese State University, and a guest lecturer at Louisiana State University and the University of New Orleans. He is an active member of numerous professional societies, including the Louisiana Engineering Society, American Society of Civil Engineers (ASCE), Geo-Institute, ASCE Geotechnical Activities Group of New Orleans, American Council of Engineering Companies, and ASFE, Inc., an ASCE affiliate, recently elected Mr. Lourie a Diplomate, Geotechnical Engineering.

Dr. W. Allen Marr is a geotechnical engineer with specialized expertise in design of large earthwork facilities, ground improvement, and performance monitoring. He has provided consulting services on a wide variety of projects including earthen dams, tunnels, excavations, embankments, natural slopes, landfills, and foundations. Dr. Marr has spent his entire 40-year professional career focused on incorporating the benefits of applied research in geo-engineering into civil engineering practice. He has repeatedly demonstrated a strong ability to identify emerging trends in research and technology and apply those developments in ways that produce safer and more economical solutions to a variety of infrastructure problems. Dr. Marr has also made significant contributions in advanced numerical analysis, laboratory testing to measure engineering properties, and monitoring performance during construction to minimize collateral damage, work for which he was elected to the National Academy of Engineering in 2008.

Dr. Bijay K. Panigrahi is a Principal Engineer and President of BPC Group Inc. in Orlando, Florida. He has more than 28 years of experience in the specialty areas of environmental, geotechnical and water resources engineering, including ground water and surface water modeling. He has directed and managed a number of multidisciplinary projects involving hydraulics and hydrologic modeling, flood protection studies, feasibility studies, stormwater management system design, water quality assessment and modeling, geotechnical and environmental design and studies, seepage and slope stability analyses, foundation analyses, scour and erosion control, water resources facility design, and permitting. He has assessed and designed a number of canal conveyance systems and water resources control structures such as levees/dikes, culverts, reservoirs, and treatment systems. Dr. Panigrahi has completed a number of CERP (Comprehensive Everglades Restoration Plan) and non-CERP projects in Florida involving modeling and design of hydraulic structures (reservoirs/impoundments, canals, and pump stations) and hydraulic measurements and rating analyses. Some of these projects include Site 1 Impoundment, Four-Corner site flow-way design, Southwest Florida Feasibility studies, C-51 Basin Rule, C-139 Regulatory Criteria development, and Everglades Agricultural Area watershed data evaluation, among others. On behalf of the Interagency Modeling Center (IMC), he has peer reviewed more than 20 models for the CERP projects that included a diversified array of issues involving hydrology, hydraulics, hydrodynamic, water quality, operations, optimizations, flood control, water supply, and design of water resources facilities. Some of these projects include Biscayne Bay Coastal Wetlands, Lower East Coast sub-Regional (LECsR) model, C-11 and C-9 Impoundments, C-44 Canal Design, and STA 5&6 Expansion.

Michael A. Ports has more than 40 years of planning, analysis, design, and construction experience in a broad spectrum of water resources engineering applications, including surface water hydrology and hydraulics, navigation engineering, master planning, soil and water conservation, urban drainage and flood control, river training works, stream channel restoration, erosion and sediment control, environmental impact assessment, sediment transport modeling, bridge scour analysis, and environmental regulatory compliance. As a principal engineer, Mr. Ports has overseen numerous water resources projects. For example, for the Kansas City Downtown Airport, Mr. Ports performed the critical review of the hydraulic design for proposed modifications to the Missouri River levee to accommodate safety-required runway lengthening. Previously, he also performed a critical evaluation of the hydrologic and hydraulic engineering aspects of the design, operation, and maintenance of the Upper Mississippi River Navigation System for the U. S. Department of Justice. The system consists of 29 locks and dams on the mainstream of the Mississippi River extending from St. Paul, Minnesota to St. Louis, Missouri, a total distance of 857.6 miles. The evaluation included the critical review of the navigation system regulation and operation, effects of wing dams, erosion on river levees, seepage under and through river levees, maintenance dredging operations, and the need for river levees.

Jack W. Rolston is a geotechnical engineer with over 50 years of experience. Between 1953 and 1985, Mr. Rolston worked for 15 years for the U.S. Army Corps of Engineers, Los Angeles District supervising exploration, laboratory testing, and prepared reports for marinas, breakwaters, flood control channels, and a number of large compacted earth dams. Mr. Rolston also served as the founder and president of a geotechnical firm formed to provide sod exploration and testing, and reports containing design recommendations for high-rise structures, industrial buildings, treatment plants, single-family residences, and graded residential subdivisions. In addition to supervising geotechnical engineering projects, he served as chairman of various committees that contributed to the Grading Sections of the Los Angeles City Building Code, the Los Angeles County Building Code, and the national Uniform Building Code. He also served on the California State Board of Registration for Professional Engineers and Land Surveyors regarding professional registration examinations and enforcement of the professional codes. Mr. Rolston returned to private practice with Foundation Engineering in 1985.

Dr. Chuck Vita is a registered civil and geotechnical engineer with 37 years of geotechnical and geo-environmental experience on hundreds of infrastructure projects associated with site evaluation, development, redevelopment, and cleanup. His expertise includes engineering planning, siting, exploration, site and route characterization, analysis, design, construction, and monitoring; oversight and quality assurance; and forensic engineering and litigation support. Dr. Vita is a technical leader in the analysis of uncertainty; risk and reliability, including probability based site characterization and engineering performance analyses; and reliability-based design. He is noted for rigorous conceptual and statistical data analysis and interpretation, including design and evaluation of exploration, testing, and monitoring programs. Dr. Vita has authored numerous comprehensive reports, professional papers, and presentations on these subjects.

Jerry Zhou brings over 21 years of engineering experience in projects related to environmental restoration, road design, and water resources. His technical experience includes performing analyses related to watershed and drainage studies; hydrologic and hydraulic modeling and analysis; flood control structure design; and detention/storm sewer system design. Mr. Zhou worked on the flood control dam (HeYuan Reservoir) and Meihu canal designs in Huizhou, China. Tasks included dam structure and foundation dynamic analysis and structure design; steel floodgates structure design; earthen levee slope stability analysis and designs; canal geometric sizing per proposed capacity; retaining wall stability analysis and structure design (reinforced concrete); channel impacts analysis using hydrologic and hydraulic analysis. In addition, Mr. Zhou worked on the Dayaowang nuclear power plant in China, including the wave protecting seawall structure analysis and structure design; cooling system hydraulic structure designs including pump house, cooling towers and foundations; water intakes and outlets; and retaining walls.

4 RESULTS – SUMMARY OF REVIEW

The IEPR panel members followed the processes described in Sections 2.4 through 2.7 to conduct their review, execute the IEPR Conference and teleconferences, and to finalize remaining comments in DrChecks. These processes were in accordance with the PRQCP and the USACE guidance documents cited in Section 1.1. In this section the report are summaries of the review approach by the peer review experts (Section 4.1), summaries of the IEPR panel member comments that were entered into DrChecks (Section 4.2), and a summary of the important issues identified by the ten panel members from their overall review (Section 4.3).

4.1 Review Approach

The following review approach first describes how the IEPR panel members in general managed their reviews and documented their comments in DrChecks prior to the IEPR Conference. After the general review approach, the additional discipline specific details of the geotechnical and structural engineering approaches are described.

4.1.1 General Review Approach

The IEPR panel members were encouraged to work independently and in groups according to their assigned expertise and contribute to the reviews being conducted by the reviewers in the other disciplines, as appropriate, based upon their experience (provided in Table 4). In general, each of the ten reviewers chose to work independently in reviewing the Design Guidelines, although there were occasional collaborative discussions between IEPR panel members. The panel members were also able to discuss their comments with each other during a meeting held just prior to the IEPR Conference. During this meeting, the panel reviewed and coordinated the comments for discussion at the IEPR Conference.

In general, during the review the panel members were concerned with ensuring that the Design Guidelines provided the appropriate level of technical details and that the Design Guidelines were written in a holistic and interdisciplinary fashion. In accordance with the IEPR charge, as shown in Appendix A, the panel aimed to answer a series of general questions and issues that included:

- Is the manual clear, logical, well organized, and comprehensive?
- Is the scope and intent clear?
- Are the technical methods and details adequate and transparent?
- Are the limitations and data gaps explicit in an understandable and practical sense—in particular, how is estimation error, including risk and uncertainty, handled?
- Are the recommended guidelines based on sound engineering principles, good and customary engineering practice, and sufficiently flexible to allow for the application of professional engineering judgment?
- Are there readily identifiable technical errors or potential errors?
- Are there potentially "fatal flaws"?
- Are the design methods and recommendations based on accepted engineering principles, good engineering practice, and sound judgment?

4.1.2 Discipline Specific Engineering Review Approaches

In addition to those general questions provided in the IEPR Charge and noted above, the geotechnical and structural engineers further considered the following discipline-specific questions in their approach to the IEPR:

Geotechnical Engineering

- Are the technical methods consistent with current geotechnical engineering practice?
- Are the methods to obtain soil parameters consistent with current practices in geotechnical engineering?
- Do the recommended geotechnical design and analysis procedures reflect adequately the "lessons learned" during Hurricane Katrina and its aftermath?
- Do the recommended guidelines encourage interaction between the geotechnical engineers and the other design professionals?

Structural Engineering

- Do the methods provide structural integrity for the flood protection structures and components?
- Do the structural engineering methods appropriately address the safety of life and property in protected areas within the GNOHSDRRS boundaries?
- Are an adequate number of sketches or figures included in the Design Guidelines to enhance clarity?
- Are the topographical features of metro New Orleans (i.e., areas being below sea level) and the fact that New Orleans is surrounded by water adequately taken into account in the Design Guidelines?
- Were the soil conditions in the metropolitan New Orleans area taken into account?

- Do the Design Guidelines take into account the high traffic of barges and supply vessels in local waterways?
- Is the structural design based on appropriate geotechnical data, sound geotechnical engineering design practices, and current practice in hydrologic/hydraulic modeling?

4.2 Summary of IEPR Panel Comments

This section of the report provides a breakdown by category of the types of comments and the evaluation responses. Also provided are examples of the DrChecks comments entered during the initial review by the IEPR panel members, sorted by panel member discipline.

4.2.1 Comments by Category

The IEPR panel comments on the Design Guidelines have been divided into three categories based on the type of comment provided by the panel member. These categories include:

- For Information – comments for which the IEPR panel member either: (1) requested a clarification narrative from the USACE, or (2) received further explanation or additional documents that allowed the IEPR panel member to agree with the USACE approach;
- Suggestion for Clarification – minor, but important suggestions to improve the document's completeness and/or clarity;
- Value Added – comments that resulted in a significant impact or change that would not have happened without the IEPR review.

All comments were determined to be either critical (83) or non-critical (455). Table 5 provides a summary of the number of comments in each of the above categories. In addition, Table 5 notes the number of comments identified as critical during the initial review by the panel members.

Table 5. Categorized DrChecks Comments

Total Comments	Initial Critical Comments	For Information	Suggestion for Clarification	Value Added
538	83	187	291	60

For each IEPR panel comment, USACE has the option of evaluating the response as either "Concurred," "Non-concurred," "For Information Only," or "Check and Resolve." Table 6 indicates, by discipline, the number of USACE evaluation responses in each category.

Table 6. Total Comments and Evaluation Responses

Discipline		USACE Evaluation*		
	Total Comments	Concurred	Non-Concurred	For Information Only
Geotechnical	236	142	40	54
Structural	91	63	6	22
Hydraulic	103	72	3	28
Civil	108	64	6	38
Total	538	341	55	142

*Based on total provided in the DrChecks report entitled "Snapshot Report per Comment Submitters"

Based upon the discussions during the IEPR teleconferences, at the IEPR Conference, and subsequent close-out of DrChecks comments, the USACE PDT is in general agreement with many of the panel members' concerns (63 percent of the comments were initially concurred with and others were concurred with after further discussion).

4.2.2 Examples of DrChecks Comments by Panel Member Discipline/USACE Comment Evaluation Response Category

Below are examples of the types of specific comments provided by the IEPR panel members in DrChecks. The broad range of experience possessed by the panel members allowed them to offer comments within their assigned discipline as well as in other allied disciplines. For the purposes of this report, the comments presented here have been grouped by the individual panel member's assigned discipline as provided in Table 3, rather than by grouping all discipline-related comments. Within each engineering discipline, the comments are further grouped by USACE evaluation response (e.g., concurred, non-concurred, for information only).

Geotechnical Engineering Panel Member Comments

Three of the ten panel members provided geotechnical engineering comments. USACE concurred with geotechnical comments that ranged from simple editorial suggestions and requests for inclusion of references for clarification to broader comments about the need for justification and supporting information on suggested guidance. Examples of comments with which the USACE "concurred" included:

- Include a factor of safety (FOS) of 1.3 for dry borrow pits since it is lower than any currently listed for the Spencer Method in Table 3.1 and provide clarification of water level terms and notes.
- Explain the rationale, and provide supporting data, for requiring the use of 5-inch-diameter samplers to obtain undisturbed samples in cohesive soils when: (1) subsequent laboratory testing is performed on trimmed, small-diameter samples; (2) factors other than sample diameter have been found to influence sample disturbance; and (3) untrimmed, 3-inch-diameter soil samples are quicker and less costly to obtain and many important onshore and offshore structures in similar soils have been designed, built, and operated successfully for decades.
- Provide guidance for determining the values for *in situ* and laboratory-measured hydraulic conductivity (permeability) testing and field testing for seepage studies including the appropriate ways to estimate horizontal and vertical hydraulic conductivity values.
- State underlying assumptions or criteria about soil properties such as moisture content, plasticity, degree of compaction, and lift thickness when assumed or presumptive design parameters are to be used for analyses.
- Include an appendix with local and regional engineering geology and any existing relevant data as a reference source for the designer.

- Provide a rationale to support the recommendation that sheet piling be used through sand or peat layers to control seepage (e.g., Is this for strength concerns, seepage concerns, or something else?).
- Expand Sections 3.1.2 and 8.1 to highlight the objectives of the field program and integrate them with the overall needs of the design and construction process. In addition, it should be recognized that the field exploration activities could include hydrogeologic studies, field permeability tests, Cone Penetrometer Test (CPTs) and other *in-situ* site characterization methods, geophysics, and the installation of piezometers.
- Expand upon the information provided for various aspects of piles including questions on settlement, group capacity, lateral capacity, and other design aspects along with axial pile loads.
- Explain how cumulative model errors are accounted for (e.g., determination of final levee or wall height).
- Explain how the final determination of a typical breaker parameter of 0.4 was chosen when values were normally 0.5 to 0.78.
- Provide more flexibility in the use of commercially available computer programs than are in common use in the geotechnical engineering profession.
- Avoid referencing specific tables and figures in textbooks and other publications, as well as Internet sites because those items can and will be updated and the references may no longer be correct.
- Confirm that conservative estimates of areal subsidence, sea level rise, and consolidation settlements are used to establish design elevations.
- Consider making changes to the currently used approach for conducting site characterization studies that reflect "best practices" that have been developed for soft-ground conditions over the last 50 years or so in the U.S and around the world.

The geotechnical panel members also provided a few general comments about the overall document, noting that the tone of the document was uneven, felt compartmentalized, and that there is a need to use terms and symbols consistently throughout the document. In addition, they suggested that the use of "absolute" terms be reviewed and eliminated where possible. Finally, the geotechnical engineering panel members recommended that a list of all reference publications and American Society for Testing and Materials (ASTM) standard procedures related to the applicable Design Guidelines be included in the document.

USACE responded with "non-concurred" to geotechnical comments that focused on topics such as:

- Suggested movement or removal of information in various sections of the report, for instance, consolidating or referencing information in Sections 3.0 and 8.0 since they have similar information, and removing information that is not related to "design."
- Requested addition of definition sketches for further clarification on a variety of topics including underseepage, I-, T-, and L-walls.
- Suggested use of software programs other than those recommended or suggested in the document for pile capacity, data recording, boring log, and simple analysis tools and

procedures to allow designers to check the reasonableness of the answers and make "order of magnitude" checks of the various design components.

- Suggested inclusion of additional information about the various computer programs that are recommended or specified to be used for design and analysis. The additionally requested information would address the program's purpose, general method of solution, and present key assumptions and/or limitations, which would enable the designer to assess the appropriateness of the program for the design problem at hand.
- Suggested common terminology use in the document and requests for definitions of terminology for clarification.
- Suggested removal of the Lane's weighted creep ratio, replacing it with a newer computer model or other more appropriate methods.
- Suggested elimination of use of subcontractors by USACE for the design portion.

Lastly, USACE responded to some geotechnical comments with responses of "For Information Only." For these comments, USACE provided, in most instances, an explanation of where the information could be found or provided answers to questions. Examples of the issues addressed by these types of comments included:

- Frictional effects on storm generated waves or surge.
- Surge elevation estimates when models do not converge or do not produce outputs.
- Consistent use of terms like "hydraulic reaches" and "design reaches" in various sections.
- Use of actual versus provided unit weights for soils.
- End of construction FOS determination.
- Whether the criteria and methods in the document shall be required to be used or only suggested.
- Use of active and passive wedges in the methods used (i.e., Method of Planes [MOP]).
- Whether secondary compression was included in the settlement analysis.

Structural Engineering Panel Member Comments

Two panel members analyzed the structural component of the report. Structural engineering comments ranged from suggestions for minor rephrasing for clarification to requests for more detailed information to support the statements made in the Design Guidelines. USACE "concurred" with structural engineering comments covering the following topics:

- The Barge Impact Study discussion in Sections 5.2 and 5.9 showed inconsistencies in the recommended barge impact load used to design structures (i.e., 125 kips for dolphins vs. 100 kips for floodwalls); in addition the recommended 125 kips appeared too low based on the estimated values for the kinetic energy of the vessels used in the area.
- Provisions were not provided for addressing maximum allowable deflection and vibrations in structures from barge impacts; this should be added.
- Additional information was requested on dynamic wave loading; debris impact load; expansion joints; water stops; up-rush and down-rush effects on the stability of rubble mound structures and levees; fire, blasts, and accidental loading; field inspections; pile

stresses during hammer placement and when freestanding; and the potential for multiple barge impacts during slow-moving or stalled hurricane storm events and the associated cumulative damage to structures.

- Further explanation on the intent and background of the provisions for I-walls, T-walls, and L-walls was recommended for inclusion in the document.
- Use of the term “required overbuild” appeared ambiguous and further information was requested.
- Based on recent changes in the standards (ASCE/SEI 7-05-Minimum Design Loads for Buildings and Other Structures) which affect designs, it was suggested that the one-third stress increase in allowable stress design discussed in Section 5.2 and Table 5.1 in Section 5.7 be revisited and reviewed.

The structural engineering panel members provided numerous comments suggesting minor rephrasing for clarification or defining terms to assist the reader in understanding the major concepts. They also suggested updates to Figures 5.1, 5.4 and 5.5 for further clarification.

USACE responded with “non-concurred” to structural engineering comments covering the following topics:

- Sketches showing the protection heights for I-walls, T-walls, and L-walls.
- Resulting impacts on pile size due to reduction of maximum stress ratio and steel allowable stress as noted in Section 5.5 and 5.6.
- Reference Section 6.5.14 of ASCE/SEI 7-05, which addresses the “Design Wind Load on Solid Freestanding Walls and Solid Signs” to assure that the users do not neglect other factors such as gust-effect factors and net force coefficients in their design.

Lastly, USACE responded to some structural engineering comments with a response of “For Information Only.” For these comments, USACE provided, in most instances, an explanation of where the information could be found or provided answers to questions. Examples of these comments included:

- How were the changes in load factors determined?
- Does the software treat the floodwall model as a rigid frame?
- What is the basis for the recommended protection heights for I-walls, T-walls, and L-walls?

Hydraulic Engineering Panel Member Comments

Three of the ten panel members provided hydraulic engineering comments. USACE “concurred” with hydraulic engineering comments ranging from simple editorial suggestions and citation requests to broader comments about the need for additional information or suggested changes. The USACE concurred with the following hydraulic engineering panel member suggestions for adding or providing clarifications:

- Modify the model to consider changes resulting from potential increases in the frequency and intensity of storms that would result in the loss of buffering or protective effects of wetlands, mangroves, and mangrove root structures.
- Explain or fix inconsistencies in the models regarding determination of protection elevations based on sea level rise and subsidence.
- Explain the relationship between future surge elevations and the loss of coastal wetlands due to an increased number of storm events and increased severity of storm events.
- Account for frictional effects in the Steady State Spectral Wave model.
- Maintenance/conservation of coastal wetlands, barrier islands, and other protecting features and future coastal conditions should be considered in the design.
- Additional information should be supplied in the Design Guidelines regarding levee modifications. For example, how design sections should be modified, consideration of rights of way and utility relocations, T- and I-wall modifications, and armoring modifications.
- Adequate utility relocation should be obtained initially so second relocation is not necessary if modifications are needed.
- Provide technical justification and evidence to support the breaker parameter value of 0.4 for all designs when the typical range is 0.5 to 0.78.
- Provide additional specifics regarding the field investigations and guidelines/quantitative methodologies.

USACE responded with "non-concurred" to hydraulic engineering comments covering the following topics:

- Explain what impacts on levee stability will result from extended storm durations (e.g., storms that stall and last for 24, 36, or even 48 hours).
- Include supporting materials found in a referenced White Paper for the modeling.
- Include a list of models used in the "modeling process" that are to be utilized/necessary for hydraulic design, including wave overtopping.

Lastly, USACE responded to some hydraulic engineering comments with a response of "For Information Only." For these comments, USACE provided, in most instances, a definition, an explanation of where the information could be found, or provided answers to questions. Examples of these comments included the following questions:

- In the modeling, how long is peak velocity sustained during a storm?
- How will levees be adapted over time?

Civil Engineering Panel Member Comments

Two of the ten panel members analyzed the civil component of the report. The two panel members provided comments on minor grammatical changes, suggested updates to figures, suggested the addition of figures for clarification, requested reference information, asked detailed questions about the software programs used for calculations, and requested clarification on conclusions. Additionally, the civil engineering panel member suggested adding a section addressing overall goals, design philosophies, and the system-wide approach to the project. USACE “concurred” with the following civil engineering comments:

- A subsection should be added to the Geotechnical Section titled “Geotechnical Site Characterization” that discusses the systematic development of levee/floodwall soil-profile segments and cross sections and provides guidance on dealing with subsurface variability and uncertainty, including establishing geotechnical parameter inputs used for geotechnical analysis and design.
- Add guidance documents (Engineering Manual [EM] 1110-2-1913 and EM 1110-2-1901) as reference for the piping-seepage analysis.
- Provisions should be added to Section 3.1.2.1 to employ CPT results to determine the strengthline for design.
- In regards to the Monte Carlo Analysis (MCA), the procedure provided in the Design Guidelines is not clear and should be elaborated upon and the MCA for wave forces and overtopping should be explicitly identified at a level of completeness that makes it transparent.
- Clarify how the overtopping rates (1% and 0.2%) were determined (i.e., what kind of probability model does the 1% overtopping rate appear to follow?) and applied to levee design and crest elevation.
- Clarification was requested on the Design Water Surface Elevation (DWSE) in regards to the still water level and authorized water surface elevation.
- Clarification was requested noting that the DWSE is associated with surge level rather than waves.

USACE responded with “non-concurred” on the civil engineering comments covering the following topics:

- Clarify that the minimum width of the neutral wedge is equal to 0.7H and whether this applies to the MOP analysis only or to Spencer as well.
- Suggest using Excel instead of MATLAB for MCA, as Excel is more transparent.
- An Appendix discussing “Lessons Learned” from Hurricane Katrina and post-Katrina should be included.
- One panel member believed the FOS of 1.4 should be 1.5 to be consistent with the standard of practice.
- It is believed that wave loads should be included in Tables 3.1 and 3.2.

Lastly, USACE responded to some of the civil engineering comments with a response of “For Information Only.” For these comments, in most instances USACE provided a definition, an explanation of where the information could be found, or provided answers to questions. Examples of these comments included the following issues:

- Use of older methods, which have received considerable post-Hurricane Katrina criticism, to determine strengthlines (i.e., use of unconfined compression tests, triaxial, CPT and field vane shear tests for clays versus a Stress History and Normalized Soil Engineering Parameters approach).

- It was strongly suggested that more emphasis be placed on consolidation tests to define preconsolidation stress as accurately as possible.
- Comments were made on the appropriate use of various methods including Spencer's Method, PLAXIS finite element, and MOP for design in soft clays in the United States and around the determination of the FOS.
- A discussion on whether the required FOS is dependent on a method of limited equilibrium analysis.

4.3 Discussion of Comments

Upon completion of the IEPR Conference and teleconferences and subsequent evaluations by the USACE PDT, the IEPR panel members considered many comments adequately addressed. However, the IEPR panel did not consider some of the comments to be fully addressed by the USACE responses, as the actual questions were not directly answered (i.e., responses to the Barge Impact Comments only indicated that a separate study was being conducted and did not indicate how the issues would be resolved). In cases where a panel member did not agree with the final USACE PDT response, the panel member provided their final comments on the USACE response before closing the comment for further discussion in DrChecks.

In this section of the report, the issues that the panel identified as important or critical to the success of the Design Guidelines document are discussed. The discussion first provides a general analysis by the collective IEPR panel, as well as specific discussion of comments by the Geotechnical, Structural, and Hydraulic engineering disciplines that were not represented in the general analysis.

4.3.1 General Panel Discussion

In general, the IEPR panel members agreed that the Design Guidelines contain some very good information that will be useful to the designers, but recommended revisions to the document to improve the clarity of some of the information and to address the issues identified during the IEPR process. Those items that the IEPR panel members agreed they approved of regarding the Design Guidelines document were:

- **Evolutionary Improvement.** The panel members appreciated that the design methods and criteria in the Design Guidelines are not considered final, but rather are subject to learning and evolutionary improvement. This approach will permit future updates to be included in the Design Guidelines based upon the standard of care in engineering practice, which can and does evolve.
- **Use of Plain English Commentary.** The panel members liked the addition of "plain English" commentary used to help explain the approach, including Design Guidelines intent and limitations. In particular, "plain English" explanations that included "the why" for a given discussion were helpful in enhancing a reader's understanding. The panel members would have liked to see more use of such "plain English" explanations

throughout the document where it could add understanding and insight to the guidance. The explanations should also identify key assumptions and/or limitation about a given approach.

The items in which the IEPR panel members identified as needing improvements or clarifications covered a broad spectrum of subjects from the Design Guidelines document. Detailed discussions of those issues identified by the IEPR panel as requiring further input are below.

- **Barge Impact Analysis.** Several panel members commented on the barge impact analyses provided in the original report. For instance, there was concern regarding development of a realistic value for design barge impact loads. The panel members appreciate that a separate barge impact analysis study was conducted in response to their concerns. At a minimum, this should be included as part of the Design Guidelines. However, not all panel members were allowed to review the separate barge impact study, and these the panel members remain concerned about the implications of barge and vessel impacts on the protection system and the design implications.
- **Systems Approach.** While the GNOHSDRRS is called a system, the panel members did not see discussion in the Design Guidelines related to a philosophy or strategy of taking a comprehensive system perspective (e.g., similar to that taken in the draft Engineering Technical Letter 1110-2-570; September 12, 2007). Taking a comprehensive system perspective for the GNOHSDRRS seems relevant and appropriate because flood-protection performance is the result of aggregate system performance, as Hurricane Katrina demonstrated. A systems approach would consider all the pertinent scales of conditions and behavior that can significantly affect the overall system performance.
    - A systematic approach would require that all the technical details are properly considered and integrated into the overall engineering process to a common level of reliability. This would require substantial effort working out details and making the process not only practical, but also transparent and technically defensible. In particular, any systems analysis procedure must be understandable and transparent, and not so complex that it becomes an impenetrable black box.
- **Geotechnical Site Characterization Section.** A critical identified issue was the addition of a major subsection covering Geotechnical Site Characterization that would describe the systematic development of levee/floodwall soil-profile segments and cross sections used for geotechnical analysis and design. The objectives of the site characterization program should be well-integrated with the overall needs of the specific design and construction process. The integration of existing data (including regional and local geology and historical performance) with the development of supplementary and complementary exploration and testing (field and laboratory) would be described. This section would also provide guidance on dealing with subsurface variability and uncertainty, including establishing ranges in geotechnical parameter inputs for analysis and design. Geotechnical site characterization would help integrate exploration and testing with engineering idealization of subsurface conditions for subsequent analysis and design. The approach to geotechnical site characterization provided in the manual does not reflect "best practices" that have been developed over the last 50 years for soft ground conditions by geotechnical engineers in the U.S. and around the world. The

geotechnical members of the IEPR panel believe that a separate, comprehensive evaluation of soft-ground site characterization methods should be undertaken followed by updating the Design Guidelines as appropriate.

- **Need for Clarity and Consistency on Water Levels and Terminology.** The Design Guidelines should be consistent and accurate across disciplines with terminology and design usage of water levels and their relationship to levee and wall elevations. Water levels used in the geotechnical and structural sections need to be consistent with the predicted water levels developed in the hydraulics section. For example, the mean surge elevation (MSE) is also called the still water level (SWL), and apparently determines the DWSE for geotechnical and structural considerations. The Project Grade (elevation) exceeds the DWSE by an increment of levee-height that accounts for wave action/runup (above the DWSE surge level). The Project Grade therefore exceeds the DWSE, and the top of the as-constructed levee, or constructed levee crest, is at the elevation of the Project Grade plus any overbuild for primary consolidation. The Design Guidelines should make these relationships clear, perhaps using a separate, titled subsection where these relationships are clearly discussed in one central location for easy reference; illustrations also could be added to enhance clarity.
- **Floodside Protection Armoring.** Because floodside protection armoring was not a major topic in the Design Guidelines, the Design Guidelines should be updated with more direction for floodside protection.
- **Flood Wall and Levee Transitions.** A large portion of problems in water retention structures occurs at transitions and connections. This subject was not well addressed by the design manual. The panel members understand that work on wall and levee transitions is ongoing and will be included in the final Design Guidelines.
- **Simple and Transparent Independent Analyses for Quality Control Checks.** Simple and transparent independent analyses should be used where available to check and complement complex analyses, particularly those based on "black box" software tools, for their reasonableness and to provide a quality control "reality check." Examples include both slope and foundation stability (e.g., slope stability software programs can identify erroneous failure surfaces and factors of safety) and seepage analyses (e.g., using blanket theory analysis to check seepage analysis software program results). MCA used in hydraulic analyses is another example where transparency and understanding may be problematic and could benefit from simple independent analysis checks. Where simple check analyses cannot be done, a process should be given to check the validity of the black box models and results.
- **Discussion Clarity and Completeness.** Many Design Guidelines discussions lacked clarity or completeness, and thus limited reader (or user) understanding. In several cases, explanatory figures or illustrations, or flow charts and worked examples where the design approach is complex, would help users to understand and properly apply the process. Many of the specific cases were identified in the DrChecks comments. Analytical approaches often contain assumptions and limitations as do models of "real world" conditions, which can be extremely complex. Therefore, it is critical to clearly state the assumptions and limitations of analytical methods in the Design Guidelines so that engineers and others can judge their appropriateness and be aware of their limitations.

- **Additional Useful Appendices.** Several appendices would be helpful additions to the Design Guidelines. First, an appendix that discusses "lessons learned" from Hurricane Katrina and post-Katrina studies should be included. A brief, focused, and pertinent summary of lessons learned could be adapted from the IPET documents, with references back to the pertinent sections, as appropriate. Second, an appendix that summarizes the historical development of the flood protection system would be useful. This appendix could include a chronology regarding construction of various flood protection projects that are part of the current system. This appendix would be valuable to help new designers further understand where their particular part fits into the overall system.
- **Glossary, Symbols, Acronyms, and Index.** The revised Design Guidelines should include the following elements: 1) a "Glossary" that defines relevant terminology, which should be used consistently and clearly throughout the manual; 2) a "List of Symbols" that should be consistent with the equations and the terminology used in the text; and 3) a consistent "List of Acronyms." Equations should identify the inputs with symbols consistent with figures. The final Design Guidelines are likely to be voluminous and comprehensive. A general index placed at the end of the Design Guidelines that included major key words with corresponding page numbers would be very useful.
- **References Section.** The Design Guidelines document should include a separate "References Section" that includes a complete reference for each citation that appears in the document. Each reference should be sufficiently complete to allow a motivated reader to find the document in the literature. In addition, a general bibliography of relevant documents, not all of which were cited in the text, would also be helpful to supply additional information to the designers. The Design Guidelines should not rely on web sites that may not be available or reliable in the future. Additionally, the Design Guidelines should not cite figures or pages in books and other publications that can be revised; instead, those items should be reproduced in the Design Guidelines document.

4.3.2 Discipline Specific Discussion

In addition to the general discussion, the geotechnical, structural, and hydraulic engineering panel members had the following discipline-specific comments they identified as critical to the success of the Design Guidelines document:

Geotechnical Engineering

The three Geotechnical Engineering panel members were in agreement on the majority of the discipline-specific issues. In two instances, one of the three geotechnical engineering panel members felt strongly about some issues, based on his experiences, that were not supported by the other geotechnical panel members. This section of the report provides a discussion of the issues where the geotechnical panel members agreed, but also provides a discussion of the two additional items that the geotechnical engineer felt strongly should be further addressed.

In general, the geotechnical IEPR panel members agreed that the following issues required more attention:

- **Inclusion of all Relevant Engineering Disciplines.** The panel members believe that the inclusion of all of the various engineering disciplines as authors of the Design Guidelines is appropriate given the complex nature of GNOHSDRRS projects.

- **Geotechnical Report Section.** To be consistent with good commercial geotechnical engineering practice, the IEPR panel members believe the geotechnical engineer should be required to prepare and submit various types of written reports for each site characterization study. Therefore, a new section on geotechnical reporting should be included in the Design Guidelines. The actual content of the various project reports must consider a project's many unique aspects, so the geotechnical engineer panel members are not advocating a "standard report" although there are some report elements that should be included and these are described below.

  The first of the reports that the geotechnical engineer should be required to prepare and submit is a Geotechnical Data Report (GDR). The purpose of the GDR is to document the methods used and the information collected during subsurface and laboratory investigation efforts. The geotechnical engineer should use professional judgment when preparing the report and deciding upon its contents, but the report should describe the nature of the project and the scope of services that were performed, as well as the key personnel responsible for developing and executing the scope of services. For each of the site characterization methods used, there should be complete descriptions of what was done, what was observed, and an identification of problems that were encountered, if any. For the laboratory testing portion of the report, there should be an identification of the goals of the testing program, the types and numbers of the tests that were performed, and the test methods that were followed. Finally, there should be a description of the quality control (QC) methods used in the field and laboratory programs. The report should include tables, illustrations, and appendices, as appropriate. The report should be comprehensive and inclusive of all data collected for the project, including historical information.

  The geotechnical engineer also should be required to prepare and submit a Geotechnical Interpretive Report (GIR), which contains detailed geologic and engineering interpretations of the field and laboratory studies. Again, the geotechnical engineer should use professional judgment when preparing the GIR and deciding upon its contents, but the report should describe the nature of the project and the scope of services that were performed, as well as the key personnel responsible for developing and executing the scope of services. The report should contain complete descriptions of the interpretation methods used, as well as results of the data interpretations. When site characterization studies include *in-situ* test methods, the report should provide detailed descriptions of the data correlation efforts and interpretation procedures. Similarly, for the laboratory testing portion of the report, there should be a presentation and discussion of the index and physical property indicator data (e.g., moisture contents, Atterberg limits, grain-size properties, unit weight, organic content, etc.). For strength and deformation properties, the GIR should provide a thorough discussion of the interpreted values and methods of data interpretation. This discussion should include a data quality evaluation, sample quality assessment, and the approach followed for handling "outliers" in the data. Because geotechnical engineers frequently use correlations to supplement and extend laboratory data, the report should contain descriptions of the correlations and the basis of the correlations. The report also should contain a discussion of the site-specific geologic conditions, the interpreted geotechnical engineering properties of the subsurface soils, and the identification of apparent anomalies and their significance. Apparent "outliers" in the test results should not be routinely discarded. These apparent "outliers" should be evaluated carefully by considering geology, sampling procedures, handling procedures, etc., to determine if the values are real or if they are indeed anomalies. The failure to recognize and account for truly weak soils can lead to failures. There should be a description of the QC program, and the report should include tables, illustrations, appendices, and references as appropriate. The GIR should provide all the geotechnical parameters required for the design and explain the basis for the design parameters in sufficient detail and clarity that an external reviewer can independently access the soundness of the geotechnical interpretations.

In some cases, there could be merit to the geotechnical engineer preparing and submitting a Geotechnical Feature Report (GFR) that relies on information presented in a GDR and in a GIR for conducting various types of analyses and developing feature-specific design and construction recommendations. In other cases, the contents of a GFR could be incorporated into the GIR. The GFR should describe project features, design considerations, assumptions and limitations, soil parameters for design, methods of analysis, results, construction considerations, and conclusions and recommendations. The report should state the quality control efforts, and the report should include tables, illustrations, appendices, and references, as appropriate.

- **Geotechnical Data Summary Appendix.** The geotechnical engineering panel members believe that an integrated geotechnical summary document or appendix would be extremely valuable as part of the Design Guidelines. This comprehensive document should include general regional geologic/hydrogeologic data, site-specific geotechnical data (e.g., borings, piezometers, lab data, geophysical data), and relevant load test data. The review panel members believe that this summary document or appendix would provide future designers with a "firm foundation" upon which to plan future exploration and testing programs.

- **Use of Out-of-Date Methods and Procedures.** There are several instances where the panel members have questioned the use of a particular technical method or procedure. The panel members believe that use of state-of-the-practice engineering methodologies is paramount for the USACE to provide a higher level of technical assurance to the public and other stakeholders. The panel members encourage the USACE to update some field and laboratory site characterization methods, design procedures, and take advantage of newer finite-element and finite-difference computer models to evaluate levees, flood walls, etc. These methods can easily be ground-truthed using simple analytical methods providing a more robust and cost-effective design approach.

- **Treatment of Sea Level Rise and Subsidence.** The Design Guidelines outline procedures to be used by outside consultants or future in-house staff when determining the appropriate DWSE. As sea level rise continues in combination with long-term subsidence, water depths are likely to increase over time, which may lead to increasing storm-surge and larger waves. These phenomena are independent of each other, but both greatly influence the future DWSE. In the present Design Guidelines, numerical storm surge and wave modeling has generally determined the appropriate DWSE, however, the

USACE admits that these factors have not been included explicitly in their analysis. It is recommended that future model iterations include these factors directly in the storm surge and wave models. This would provide a higher degree of confidence in the adopted DWSE when completing geotechnical or structural designs.

One of the three geotechnical engineering panel members had the following additional comments based on his experiences that he felt strongly needed to be further addressed:

- **Quality Assurance/Quality Control (QA/QC) is not applicable to Design.** USACE Regulation ER 1180-1-6 specifically states QA/QC is only applicable during and for construction. The District needs to provide closer supervision of work delegated to private engineering firms and other Districts than provided by the QA/QC procedures.
- **Work by Subcontractors.** In the panel member's opinion, the District should not retain an architecture and engineering firm to assign the geotechnical work to a geotechnical firm. The panel member believes that USACE geotechnical work should be assigned by the Geotechnical Branch of the District. He believes the District should determine things like the test hole location, its surveyed location, and request the Louisiana One Call Services. Once the test hole is located in an accessible location that will not disturb underground utilities, a consulting firm retained by the District may continue the work with close oversight by the District. He believes by the District providing close oversight of the geotechnical engineering work, that risk will be reduced.

Structural Engineering

The structural engineering panel members considered a wide range of issues and agreed that those issues in the following list should be further addressed in the Design Guidelines document:

- **General Basic Load Cases.** The panel members believe that the inclusion of comprehensive tables of "General Basic Load Cases" (Tables 5.1 and 5.2) is appropriate and helpful given the complex nature of GNOHSDRRS projects.
- **New Foundation Design Approach.** The panel members believe that a transition to a foundation design approach that uses more modern methods to analyze global stability, such as limit equilibrium methods that use Spencer's method or finite element methods that use the strength reduction approach to compute factor of safety, are appropriate given the complex nature of GNOHSDRRS projects.
- **Hydraulic Computation/Modeling.** The panel members believe that the addition of information on the basis for which the hydraulic computation/modeling was performed is appropriate given the solid conditions in the area and complex nature of GNOHSDRRS projects.
- **Up-rush and Down-rush.** The panel members believe that additional consideration in regards to "up-rush" and "down-rush" and the possible resonance phenomenon for rubble-mound structures needs to be considered in the Design Guidelines.
- **Seiche and Standing Waves.** The panel members believe that further consideration for "seiche" and "standing waves" in calculating the design loads needs to be applied. Standing waves of large amplitudes can occur under hurricane force-winds, which can set the water in the lake and eventually in some canals to motion. This can be especially critical when the period of the wind-driven force is the same as the natural period of the

basin, which can lead to resonance. The possibility of a "standing wave" in the lake or canals is not addressed anywhere in the Design Guidelines. The loading condition due to standing waves should be considered in the Design Guidelines.

- **Slow-moving or Stalled Hurricanes.** The potential for multiple barge impact loads and associated cumulative damage of a floodwall in case of a "slow-moving" or a "stalled" hurricane should be considered in the Design Guidelines.
- **Wind Load Criteria.** The panel members believe that the wind load criteria in Section 5.6.2 needs further development. Wind load is important because in addition to the wind velocity pressure (qh), there are other factors such as "gust-effect factor," "net force coefficient," etc., that are required to be applied to calculate the final value for the design wind load. If this is not clear for the Design Guidelines users, there remains a danger of someone just using the recommended design wind pressure of 50 psf. Multiplying it by the projected area of the structure to calculate the final design wind load without applying these other factors would be incorrect. This section in the Design Guidelines needs to be further developed for clarity.
- **Corrosion Protection.** The panel members believe a detailed section on "corrosion protection" of steel structures should be included.
- **Realistic Wave Height and Wave Loads.** The panel members believe that further development is needed for determining realistic values for wave height and wave loads.

Hydraulic Engineering Comment Discussion

The hydraulic engineering panel members agreed that the following issues should be further addressed in the Design Guidelines document:

- **Minimum Construction Standards.** The panel members believe the Design Guidelines should state clearly that all construction will, at a minimum, be constructed to the 2057 elevation, and in some cases have "structural superiority," exceeding this elevation.
- **Utility Relocation.** The panel members believe that the document should state clearly that all utilities will be relocated to allow the full 2057 project to be constructed and maintained, and, if necessary, modified during its design life.
- **Overall Safety Factor/Standard of Care.** While some of the panel members believe there should be an overall safety factor/standard of care, the USACE stated that different elements of design had different safety factors. The panel members were assured that the minimum standard for these design elements would be the recognized professional standard established for each of these design activities. The panel members believe this should be clearly stated in the Design Guidelines.
- **Modeling.** Considerable discussion took place between the panel members and USACE on the subject of modeling. This included discussion of continued loss of wetlands, subsidence, climate change, storm frequency, storm intensity and duration, and storm travel speed. USACE's document discusses the potential theoretical maximum of 12 to 18 percent increase in wave height and surge elevation, (above the 2057 elevations being used in the design manual). USACE chose to utilize historic storms rather than future storms with this theoretical increase. USACE further indicated that the height of these levees would require them to be reviewed every 10 years and modified if necessary.

While the panel did not have the resources to remodel the system, the panel is concerned about this potential increase. The panel strongly recommends that USACE revise the Design Guidelines to state explicitly how the future effects from continued loss of wetlands, subsidence, climate change, storm frequency, storm intensity and duration, and storm travel speed will be accommodated into the design life of the flood control works. Additionally, the panel members believe designers should be given the option to consider the theoretical maximums cited above in their designs.

4.4 Critical Comments and any other Open Issues that Remain to be Resolved

The IEPR Conference provided an effective face-to-face format to communicate and discuss the IEPR panel's understanding of the technical details of the entire project. In addition, the IEPR teleconferences provided an effective, real-time voice medium to communicate and discuss peer review comments on the Design Guidelines with the USACE PDT. The teleconferences and face-to-face meeting were critical components of the IEPR process, especially since there was no unmonitored e-mail or additional telephone contact between the USACE PDT and the IEPR panel members. As a result of the IEPR Conference and teleconferences, resolution was met on many issues included in DrChecks. However, the panel members did not agree with the USACE response on several issues at the conclusion of the review. For those items, the panel members provided a final response before closing the comment.

5 CONCLUSIONS

The selection of the ten panel members using pre-defined technical and conflict of interest standards, as well as the IEPR process itself, was conducted in strict compliance with USACE peer review guidance documents (see Section 1.1) and the Battelle PRQCP.

The IEPR panel members were provided with hard and electronic copies of the Design Guidelines and supporting documentation, along with the charge. On September 16, 2008, the panel members participated in an Orientation Briefing where they were briefed on the document and visited sites throughout the New Orleans area. The IEPR panel members started their review on September 20, 2008, and produced 538 individual written comments. These comments were initially discussed between the panel and USACE PDT during an IEPR Conference held November 6 and 7, 2008. Examples of IEPR panel member recommendations include requests for the addition of detail to improve the document, such as:

- The document should incorporate a systems approach that considers all pertinent scales of conditions and behavior that can significantly affect the overall system performance.
- Additional information should be provided that describes the systematic development of levee/floodwall soil-profile segments and cross sections used for geotechnical analysis and design (i.e., Geotechnical Site Characterization).
- The document should be consistent and accurate across disciplines with terminology and design usage of water levels and their relationship to levee and wall elevations.
- The document should state explicitly how the future effects from continued loss of wetlands, subsidence, climate change, storm frequency, storm intensity and duration, and

storm travel speed would be accommodated into the design life of the flood control works.

The remaining IEPR panel comments focused on recommendations to clarify the document and ensure consistency among future designs.

The USACE PDT evaluated and responded to all 538 IEPR panel comments: concurring with 341 comments, agreeing to provide additional information in support of 142 comments, and non-concurring with 55 comments, for which an explanation was provided with each. Upon review of the USACE PDT responses, the IEPR panel members determined that some comments were inadequately addressed and needed further discussion. Therefore, IEPR teleconferences were conducted on January 19 and 21, 2010 for the IEPR panel and USACE PDT to discuss those comments that were identified by the panel as being inadequately addressed. Upon completion of the IEPR teleconferences and subsequent evaluations by the USACE PDT, the IEPR panel members considered many comments adequately addressed. However, the panel did not consider some of the comments to be fully addressed by USACE responses, as the actual questions were not directly answered (e.g., responses to the Barge Impact Comments only indicated that a separate study was being conducted and did not indicate how the issues would be resolved). When a panel member did not agree with the final USACE response or considered the comment to be not thoroughly addressed, the panel member provided a final comment response before closing the comment for further discussion.

In general, the IEPR panel members agreed that the Design Guidelines contain very important information that will be useful to designers involved with the GNOHSDRRS, although some aspects of the document need improvement. The panel members appreciated that the design methods and criteria in the Design Guidelines are not considered final by USACE, but rather are subject to learning and evolutionary improvement. They also appreciated the use of plain English throughout the document to help explain the approach, including Design Guidelines intent and limitations. However, the IEPR panel recommends revisions to the document to improve clarity on the issues noted in the Design Review and Checking System (DrChecks) during the IEPR process.

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Appendix A

Charge for the Design Guidelines IEPR

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FINAL CHARGE TO THE PEER REVIEWERS

OF THE

HURRICANE AND STORM DAMAGE RISK REDUCTION SYSTEM (HSDRRS) DESIGN GUIDELINES

by

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Columbus, Ohio 43201

for

U.S. Army Corps of Engineers
Coastal Storm Damage Reduction Center of Expertise
Baltimore District
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Scientific Services Program

The views, opinions, and/or findings contained in this report are those of the author and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

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FINAL CHARGE TO THE PEER REVIEWERS
of the
HURRICANE AND STORM DAMAGE RISK REDUCTION SYSTEM (HSDRRS) DESIGN GUIDELINES

1 BACKGROUND

The Greater New Orleans HSDRRS Design Guidelines is a compendium of design guidance standards for engineers and designers engaged in work for the US Army Corps of Engineers (USACE) New Orleans District.

Because of the importance of this document, an independent objective peer review is regarded as a critical element in ensuring the reliability of the scientific analyses included within the document. In addition, Public Law (110-114) Water Resources Development Act (WRDA) 2007, Section 2035, requires a safety assurance review by independent experts on the design and construction activities of the HSDRRS project. Review of the Design Guidelines, which will be applied to the design and construction of the HSDRRS projects, is critical to safety assurance of each project.

The project will be conducted in partnership with the State of Louisiana. The term “State” refers to both the State of Louisiana and Local governing entities including the Southeast Louisiana Flood Protection Authority – East and West.

2 DOCUMENTS PROVIDED

The only document to be reviewed and commented on is the Design Guidelines and its Addenda that is contained on the following Internet site http://www.mvn.usace.army.mil/ED/edsp/index.htm.

The following supporting documents will be provided:

- Independent Technical Review of Design Guidelines, 29 October 2006;
- Independent Technical Review of Design Guidelines, 27 November 2006;
- Independent Technical Review of Design Guidelines, 16 March 2007;
- ASCE One Percent Review Panel members Report, 03 October 2007;
- Independent Peer Review of Seepage Design Criteria, 21 December 2007;
- HSDRRS Quality Management Plan, 29 February 2008;
- USACE Orientation Briefing Documents, date TBD;
- References used in the Design Guidelines as contained in Appendix B of the report and referenced throughout the report.

The following references to Corps regulations shall be followed in conducting the IPR. These documents are available at http://www.usace.army.mil/publications/eng-regs.

- ER 1110-1-12, Engineering and Design, Quality Management, 21 July 2006;
- ER 1110-1-8159, Engineering and Design, DrChecks, 10 May 2001;

The Battelle Peer Review Quality Control Plan (PRQCP) for the Design Guideline IPR will also be followed.

3 PEER REVIEW PANEL

The peer review panel consists of three (3) Geotechnical Engineers, three (3) Hydraulic Engineers, two (2) Structural Engineers, and two (2) Civil Engineers. Once finalized, the names and contact information will be provided to all panel members.

Task	Action	Currently Suggested Dates
	Notice to Proceed (NTP)	1 August 2008
1	Submit Peer Review Quality Control Plan	15 August 2008
2	Submit list of Final IPR Panel Peer reviewers under contract	20 August 2008 3 Sep 2008
3	USACE provides Orientation Briefing materials USACE conducts Orientation Briefing Peer Reviewers attend Orientation Briefing at New Orleans District	9 Sep 2008 16 Sep 2008 16 Sep 2008
4	Conduct Peer Review of Design Guidelines Cut-off date for Panel Members to enter comments in DrChecks USACE Comment Review and Response Peer Review Backchecks Comments	19 Sep 2008- 17 Oct 2008 17 Oct 2008 17 Oct 2008 – 13 Nov 2008 17 Oct 2008 – 20 Nov 2008
5	Peer Review Conference Peer Reviewers present findings at Peer Review Conference at New Orleans District	6 Nov 2008* 6 Nov 2008
6	Closeout all comments in DrChecks Submittal of Closeout Report Project Closeout	20 Nov 2008 4 Dec 2008 31 Dec 2008

*Tentative date.

4 CHARGE FOR PEER REVIEW

Members of this peer review are asked to determine whether the technical approach and scientific rationale presented in the HSDRRS Design Guideline are credible and whether the conclusions are valid. The reviewers are asked to determine whether the technical work is technically adequate, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. In addition, the reviewers are asked to determine whether the findings are appropriate to help answer the principal study questions that the USACE will consider in its decision-making process for the project noted below.

Once all expert panel members are on contract, Battelle will host a start of work meeting. The documents to be reviewed as well as reference documents will be forward to the expert panel within a week of the start of work meeting. The Contractor will participate in an Orientation Briefing conducted by USACE in New Orleans. Briefing materials will be provided by USACE one (1) week prior to the briefing. Training on the use of DrChecks will be conducted the day before the Orientation Briefing. Once the document review starts, the expert panel will enter their comments into DrChecks. Once USACE starts providing their evaluator comments, the panel members can provide BackCheck comments to closeout each original comment. The expert panel will participate in a review conference in New Orleans to discuss any outstanding unresolved issues with the USACE. It is expected that most of the comments will be closed out prior to the review conference. The review conference will allow in person discussion between the expert panel and the USACE evaluators. Following the peer review conference, USACE will have one week to close out their evaluator comments. Following that, the expert panel will have an additional week to provide final BackCheck comments. The “State” will be invited to both the Orientation Briefing and the review conference.

Specific questions for the peer reviewers, by report section, are included following the general charge guidance, which is provided below.

4.1 General Charge Guidance

- Please answer the scientific and technical questions listed below and conduct a broad overview of the HSDRRS Design Guidelines. Please focus on your areas of expertise and technical knowledge.
- Identify, explain, and comment on assumptions that underlie engineering or scientific analyses.
- Evaluate the soundness of models and planning methods as applicable and relevant to your area of expertise.
- Evaluate whether the interpretations of analysis and conclusions are reasonable.
- Please focus the review on scientific information, including factual inputs, data, the use and soundness of models, analyses, assumptions, and other scientific and engineering matters that inform decision makers.
- Preparation of review comments for all of the tasks in DrChecks will contain the following information: 1) Specific reference to the document; 2) a clear statement of the

concern; 3) the basis for the concern; 4) the significance of the concern (the importance of the concern with regard to the project); 5) comment cross-referencing (if necessary); and 6) recommendations.

- Please **do not** make recommendations on whether you would have presented the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision making.
- If desired, IEPR panel members can contact each other and will have access to other comments in DrChecks. Other than the peer review conference, IEPR panel members should not contact anyone else other that the Battelle Project Manager and/or Deputy Project Manager.
- Please contact the Battelle project manager (Thomas Kuchar, kuchart@battelle.org) or the Deputy Project Manager (Lynn McLeod, mcleod@battelle.org) for requests or additional information.
- In case of media contact, notify the Battelle project manager immediately.
- Your name will appear as one of the panelists in the peer review. Your comments will be included in the Final EPR Report.

IEPR OF HSDRRS DESIGN GUIDELINES
FINAL CHARGE QUESTIONS

INTRODUCTION

[No charge]

1 PART A: DESIGN GUIDELINES

1.0 Hydraulics

1.a - §1.1: Design Philosophy for Preliminary Design - Comment on the approach taken to determine the protection system design elevation sufficient to provide protection from a hurricane event that would produce a 1% exceedence surge elevation and associated waves. (Section 1.1 – note refers to specific section of the Chapter)

1.b. §1.2 –Data/Methods (1.2.1-1.2.3) - Discuss the advantages and disadvantages of using the Joint Probability Method with Optimal Sampling process (JPM-OS) and its associated models. (Sections 1.2.1 thru 1.2.3)

1.c. §1.2 – Data/Methods (1.2.4-1.2.5) - Comment on the methods used for determining wave overtopping and forces. (Sections 1.2.4 thru 1.2.5)

1.d §1.3 – Step-wise Approach - Review and comment on the step-wise design approach used to determine design elevations and minimum cross sections of levees and design elevation for floodwalls. (Section 1.3)

1.e. §1.4 – Design Cond. - Comment on whether the future conditions that will exist in 2057 are adequately described. (Section 1.4)

1.f. §1.5 – Design Elev. & Loads - Are the design elevations and loads for levees (soft structures) and floodwalls and other structures (hard structures) adequately considered? Why or why not? (Section 1.5)

1.g. §1.6 – Armoring - Review and discuss the appropriateness of the plan to use armoring to protect both levees and floodwalls.(Section 1.6)

1.h. All other comments for Chapter 1

2 RELOCATIONS

2.a. Review & comments for Ch 2 - Please review the plan to handle relocations and comment on any other actions that should be added to this plan. (Chapter 2)

3 GEOTECHNICAL (USE JUNE 12, 2008 ADDENDA)

3.a. §3.1–Proc. for Earth. Embankments - Evaluate the typical procedure for the geotechnical design and analysis of levee (earthen) embankments and provide comments on the validity of this approach. Include specific comments on factors of safety used, levee embankment design, seepage analysis and design assumptions. (Section 3.1)

3.b. §3.2 – I-Wall Design Criteria - Evaluate the typical procedure for the geotechnical design and analysis of I-Walls and provide comments on the validity of this approach. Include specific comments on the factors of safety used, I-wall sheet piling tip penetration, piping and seepage analysis, heave analysis, and deflections. (Section 3.2)

3.c. §3.3–Pile Capacity - Comment on the design factors used for concrete and timber piles and steel piles. (Section 3.3)

3.d. §3.4–Wall Design Criteria - Evaluate the typical procedure for geotechnical design and analysis of T-wall and L-wall/kicker pile walls. Specifically comment on the general and geotechnical design guidance, the five step T-wall design procedures, sector gate and drainage structure foundation analysis, and fronting T-walls with trailing structures. Please include your verification of the calculations used in the T-wall design procedures. (Section 3.4)

3.e. §3.5–Levee Tie-ins/Overtopping Scour Prot - See Appendix E charge for examples of the step-by-step design procedure used for T-walls.

3.f. §3.6 – Utility Crossings - In your professional opinion, are the methods proposed for utility crossing of levees and through T-walls credible and technically adequate. Why or why not? (Section 3.6)

3.g. §3.7 – Borrow Specifications - Provide general comments on borrow specifications used for levees and embankments. (Section 3.7)

3.h. All other comments for Chapter 3

4 LEVEES

4.a. Review & comments for Ch 4 - Comment on the process for conducting preliminary work of levee projects through engineering. Discuss the clarity of this section of the report. (Chapter 4)

4.b. All other comments for Chapter 4

5 STRUCTURES (USE JUNE 12, 2008 ADDENDA)

5.a. §5.1 – In General - Comment on the completeness of the general design criteria used for I-walls, T-walls, L-walls/kicker pile walls. (Section 5.1)

5.b. §5.2 – T-Wall/L-wall Criteria - Provide comments and analysis on T-wall and L-wall design criteria. In particular discuss loading conditions, pile design, T-wall and L-wall sheet piling section and sheet piling tip penetration. (Section 5.2)

5.c. §5.3 – I-wall Design Criteria - Discuss the appropriateness of the design criteria used for I-walls. Please include loading conditions, sheet piling sections and tip penetration, and reinforced concrete section. (Section 5.3)

5.d. §5.4 –TRS Design Criteria - Are you in agreement that the design criteria that a contractor must consider in the design and approval of temporary retaining structures are appropriate? Why or why not? (Section 5.4)

5.e. §5.5 – Reinforced Concrete Criteria - Discuss the design guidance used for reinforced concrete. Include in your analysis the structural concrete, load factors (including calculations used), steel reinforcing requirements, concrete requirements, lap splices, and prestress concrete. (Section 5.5)

5.f. § 5.6 – Miscellaneous - In your professional opinion, is Section 5.6 Miscellaneous clear, accurate, and appropriate? If not, why? (Section 5.6)

5.g. §5.7 – General Load Case Tables - Review the general load case tables and comment on the completeness and accuracy of the information provided. (Section 5.7)

5.h. §5.8 – Examples of Uplift Cases - Comment on the examples provided for uplift cases. (Section 5.8)

5.i. §5.9 – Boat/Barge Impact Loading - Review and comment on the boat/barge impact loading tables and maps.(Section 5.9)

5.j. All other comments for Chapter 5

6 MECHANICAL & ELECTRICAL

6.a. Review & comments for Chapter 6 - Review and comment on the guidance provided for mechanical and electrical systems. Include any other considerations that should be included. (Chapter 6)

6.b. All other comments for Chapter 6

PART B: Standards

7 UTILITY RELOCATIONS QUESTIONNAIRES

7.a. Review & Comments for Chapter 7 - Please comment on the clarity and improvement to the eight utility relocation questionnaires. (Chapter 7)

7.b. All other comments for Chapter 7

8 GEOTECHNICAL INVESTIGATIONS

8.a. §8.1 – Contractor Requirements - Are the contractor requirements for conducting geotechnical investigations complete and clear? (Section 8.1)

8.b. §8.2 – Subsurface Investigations - Comment on the procedures listed for subsurface investigations. Please offer any suggested improvements. (Section 8.2)

8.c. §8.3 – Laboratory Soil Testings - Comment on the procedures listed for laboratory soil testing. Please offer any suggested improvements. (Section 8.3)

8.d. All other comments for Chapter 8

9 SURVEYS

9.a. Chapter 9 – Surveys - Comment on the completeness, clarity and detail of the guidance provided for performing detailed surveys of civil works projects. (Chapter 9)

9.b. All other comments for Chapter 9

10 CADD STANDARDS

10.a Chapter 10 – CADD Standards - Are the directions provided for CADD standards appropriate? Why or why not? (Chapter 10)

10.b. All other comments for Chapter 10

11 SIGNATURES

[No charge]

12 TYPICAL DRAWINGS AND DETAILS (USE JUNE 12, 2008 ADDENDA)

12.a. Ch12 – Typical Drwg and Details - Are the typical drawings and details clear, complete, and consistent with the information that was provided in other chapters? Cite specific examples that are not consistent. (Chapter 12)

12.b. All other comments for Chapter 12

13 SPECIFICATIONS

[No questions]

14 APPENDIXES

A. List of Acronyms
[No charge]

B. Links to References
[No charge]

C. Sample Scour Protection and Details

App C –Scour Prot. & Details - Comment on the completeness and clarity of the sample scour protection details.

D. Extract from Draft Scour Study

App D –Draft Scour Study - Provide your professional opinion on the presentation of two of the design issues or solutions presented in the draft report.

E. T-Wall Design Examples (use October 23, 2007 Addenda)

App E – T-wall Design Examples - Please comment on the applicability of the three T-wall design examples. Cite any examples that are not consistent with the design criteria and guidance used in the main chapters of this report.

15 OVERALL

Overall - Please provide your overall impressions and recommendations pertaining to the HSDRRS Program Design Guideline Documents.

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Appendix B

Final IEPR Conference PowerPoint Presentation from the Peer Review Conference Held on November 6-7, 2008

Battelle
The Business of Innovation

IEPR Design Guidelines Review Conference

November 6-7, 2008

1

Battelle
The Business of Innovation

Agenda

- Introduction of Panel 1:00 – 1:10
- Overview of Briefing 1:10 – 1:40
- Breakout Sessions 1 1:40 – 3:10
- Break 3:10 – 3:25
- Breakout Session 2 3:25 – 5:00

Friday Morning

- Breakout Session 3 8:00 – 10:00
- Break 10:00 – 10:15
- Briefs from Breakout Sessions 10:15 – 11:45
- Remaining Schedule 11:45 - 12:00
- Closing Comments 12:00 – 12:05

2

Purpose

- Discuss Design Guidelines review
- Discuss:
  - What the Panel Liked
  - General Concerns
  - Recommendations
  - Critical Issues (in Breakout Sessions)
- Identify path forward

IPR Expert Panel

Name	Firm	IPR Discipline
David Lourie	Lourie Consultants	Geotechnical
Jack Rolston	Independent	Geotechnical
Christopher Brown	Golder Associates	Geotechnical
Jerry Zhou	GC Engineering, Inc.	Structural
Jay Jani	Engineering Consulting Services, Inc.	Structural
Bijay Parnigrahi	BPC Group, Inc.	Hydraulic
Michael Ports	Bergmann Associates	Hydraulic
Frank Kudrna	Kudrna and Associates Ltd.	Hydraulic
W. Allen Marr	Geocomp Corp.	Civil
Charles Vita	URS	Civil

Project Schedule of Deliverables/Milestones

Task	Deliverable (D)/ Milestone (M)	Action	Date
		Notice to Proceed (NTP)	1 Aug
1	D D	Draft PRQCP Final PRQCP and Charge	5 Aug 08 15 Aug 08
2	D M	Submit list of Final IPR Panel Peer reviewers under contract	12 Sep 08 4 Sep 08
3	M D	USACE provides Orientation Briefing materials Peer Reviewers attend Orientation Briefing at New Orleans District	10 Sep 08 16 Sep 08
4	M D M	Conduct Peer Review of Design Guidelines Comments provided in DrChecks USACE Comment Review and Response	17 Sep - 17 Oct 08 17 Oct 08 17 Oct 08
5	M D	Peer Review Conference Peer Reviewers present findings at Peer Review Conference at New Orleans District	6 Nov 08 6-7 Nov 08
6	D D	Closeout all comments in DrChecks Submittal of Closeout Report	15 Nov 08 15 Nov 08

5

Charge - Example

- **PART A: Design Guidelines**
- **1.0 Hydraulics**
- ***1.a - §1.1: Design Philosophy for Preliminary Design*** - Comment on the approach taken to determine the protection system design elevation sufficient to provide protection from a hurricane event that would produce a 1% exceedence surge elevation and associated waves. (Section 1.1 – note refers to specific section of the Chapter)
- ***1.b. §1.2 –Data/Methods (1.2.1-1.2.3)*** - Discuss the advantages and disadvantages of using the Joint Probability Method with Optimal Sampling process (JPM-OS) and its associated models. (Sections 1.2.1 thru 1.2.3)
- ***1.c. §1.2 – Data/Methods (1.2.4-1.2.5)*** - Comment on the methods used for determining wave overtopping and forces. (Sections 1.2.4 thru 1.2.5)

6

Types of Comments

Currently labeled critical (Total 83 comments)
Potential critical (different definitions) or reassessed (i.e. accidentally omitted)
Questions which could lead to
Nice suggestion which is critical
Recommendation
Charge letter (broad)
Intent of the document
Philosophical
Concern with construction

Design Guidelines Review Summary

(as of November 5, 2008)

536 Comments in Total		
Chapter #	**Title**	**Panel Comments (Total/Critical)**
N/A	Overall/Introduction	10/8
1.0	Hydraulics	109/30
2.0	Relocations	2
3.0	Geotechnical	195/7
4.0	Levees	7/2
5.0	Structures	102/24
6.0	Mechanical & Electrical	0
7.0	Utility Relocations Questionnaires	1
8.0	Geotechnical Investigations	49
	Appendices/Other	13/13

What the Panel Liked

1. The desire to improve the guidelines based on lessons learned and best practices
2. Some attempts to provide clear step-by-step examples
3. Some attempts to provide explanatory or illustrative figures
4. Some use of commentary to help convey the reasons assumptions and limitations of an analytical approach or methodology
5. The objective of treating hurricane and storm damage risk reduction measures as one system
6. Use of Design Event (1%) and Check Event (0.2%) in conformance with general standard of care for major infrastructure
7. Probabilistic approach used in the hydraulics section to estimate surge levels, wave heights, and overtopping rates
8. Consideration of structural superiority for critical elements of system

9

General Concerns

- Not implementing a philosophy or strategy of a comprehensive system perspective in terms of safety, risk/reliability, design life, quality, functionality, etc.
- Tone of document is uneven and purpose is unclear (e.g., guidelines vs. guidance, shall vs. should vs. may, editing/writing quality)
- “Whistle-Blower Issues/Provisions”
- Appendix with relevant aspects of the regional and local engineering geology, past performance, and lessons learned
- Lack of a clearly defined design processes
- Philosophy of modifying the design over the 50-year period
- How will IEPR comments and concerns be addressed in the final document?

10

Some Preliminary Recommendations

The document should take an overall systems approach and be organized in a complementary way

- Determine a process for the IEPR comments to be incorporated into a revised document
- Provide consistency in technical content, presentation, and detail throughout the document (e.g., plain English, illustrations, commentary, examples, sketches, etc)
- Provide an overall design philosophy
- Systems management approach
- Move portions of the report involved in detailed design to Appendices or other documents
- Define where the design guidelines are applicable
- Provide appendix with relevant aspects of the regional and local engineering geology, past performance, and lessons learned

Example of Some Critical Issues

- Geotechnical Design Process
- Modeling of 1% event
- 10-year review of the Adequacy and Increasing the Height
- Frequency Analysis of Waves (ADCIRC and STWAVE)
- Levee Embankment Design
- Factors used in Structure Design and Modeling
- Seepage Analysis – Design Assumptions and Considerations
- Levee and Wall Elevations as they relate to the 0.2% surge event
- Inconsistent use of storm events being used to model the 2007 and 2010 protection works
- Breaker Parameter
- Monte Carlo Simulation
- Step-Wise Approach
- Factors Considered under Future Conditions
- Several philosophical issues (overall purpose, tone, use of contractors, quality management

Technical Break-out Sessions

- IEPR panel experts to meet with USACE counterparts
- Review Critical DrChecks Comments
- Discuss
- Identify whether issues are still open or resolved

Schedule of Breakout Sessions

- Breakout Sessions 1 and 2
  - Chapter 1 - Hydraulics
  - Chapter 3,8 – Geotechnical and Geotechnical Investigations
  - Chapter 5 – Structures
- Breakout Session 3
  - Chapter 2, 4, 6 and 7
  - Chapter 3, 4, 5, & 8
  - General Comments

	A	B	C
1	Ch 1	Ch 3,8	Ch 5
2	Ch 1	Ch 3,8	Ch 5
3	Ch 2, 6, & 7	Ch 3,4,5, 8	General

Breakout Session #1

Room Number	204	304	218
	Session 1a	**Session 1b**	**Session 1c**
DrChecks	2127369, 2130678, 2131563, 2131567, 2132028, 2131446, 2132033, 2130898, 2127369, 2131510, 2131593, 2131629, 2131079, 2133333, 2131691, 2131431, 2135423, 2135422, 2136608	2130618, 2134500, 2134773, 2127608, 2129698, 2130646, 2135596, 2131867, 2133173, 2133183, 2133232, 2133234	2134859, 2134860, 2130935, 2130699, 2132186, 2132279, 2135422, 2133998, 2134829, 2134872, 2135576
Chapter	1	3,8	5
General Subject	Hydraulics	Geotechnical and Geotechnical Investigations	Structures
Disciplines	Hydraulics, Geotechnical	Geotechnical, Civil	Structural, Civil, Geotechnical
Panel Members	**Frank,** Mike, Bijay, Chris	**David,** Jack, Chuck	**Jay**, Jerry, Allen

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Breakout Session #2

Room Number	204	304	218
	Session 2a	**Session 2b**	**Session 2c**
DrChecks	Continued from previous session	2145276, 2131997, 2149735, 2134264, 2135636, 2145194, 2131886, 2149587, 2149700, 2145154,	Continued from previous session
Chapter	1	3,8	5
General Subject	Hydraulics	Geotechnical and Geotechnical Investigations	Structures
Disciplines	Hydraulics	Geotechnical, Civil	Structural, Geotechnical
Panel Members	**Frank,** Mike, Bijay,	**Allen**, David, Chuck, Chris	**Jay**, Jerry, Jack

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Breakout Session #3

Room Number	204	218	125
	Session 3a	**Session 3b**	**Session 3c**
DrChecks	Various	Various	**9-10 AM** 2130588, 2130618, 2134200, 2130610, 2131867, 2133201, 2133232, 2133234, 2149825, 2133210
Chapter	3, 4, 5, 8	2, 6 and 7	General
General Subject	Geotechnical and Geotechnical Investigations	Various	
Disciplines	Geotechnical		
Panel Members	**Allen**, Jay, Chris, Jack	**Bijay**, Jerry	**Frank**, David, Mike, Chuck, Bijay, Jerry, Jay

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Back Brief by Team Leaders of Breakouts

- Hydraulics (1A, 2A)
  - 25+ DrCheck items were discussed with 22 agreed to be resolved, based on our discussion
  - Clarification of the 50 year life/10 year review/ modification were made
  - Outstanding Issues
    - 2131431- use of 2 ft structural superiority everywhere
    - 2130881- modeling should include 12-18% increases in extreme wave height and surge elevations
    - 2136608 – Design Guidelines for uprush and downrush may be critical for stability
  - ASCE One Percent Review Team Report, 03 October 2007 was originally listed in the SOW as a support item, but was not supplied. Supplied today.

18

Back Brief by Team Leaders of Breakouts

- Geotechnical (1B, 2B, 3A)
  - Reviewed and discussed 22 critical items
  - After discussions, the proposed responses and clarifications seemed to indicate no remaining issues with disagreements; General concurrence
  - Understand there is a new Chapter 8 under development that differs significantly from what was provided.
  - Seemed to be a concurrence that an introductory chapter is needed that ties together the design elements, systems design
  - More discussion and references to explain reasons for criteria for FOS
  - More discussion of options to select strength

19

Back Brief by Team Leaders of Breakouts

- Structural (3A, 3B)
  - Discussed 29 DrChecks comment, 20 critical & 9 recommended
  - 16 comments were resolved; 13 comments were unresolved
  - Unresolved issues focused around
    - Barge Impact/Multiple Barge Impact
    - Dynamic Magnification and Dynamic Wave Pressure
    - Dynamic Load Due to Breaking Wave
    - Up-Rush, Down-Rush & Resonance
    - Standing Wave & Seiches
    - 1/3rd Increase and other Allow O.S.

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Back Brief by Team Leaders of Breakouts

- Chapter 2, 6, & 7 (3B)
  - Covered several topics including
    - Gate Design Guidelines (to be added)
    - Bolt/Grease Pan (newer gate structures follow greaseless system)
    - Minimum 12” above maximum expected flood evaluation for electrical systems
    - ROW from final design footprint

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Back Brief by Team Leaders of Breakouts

- General (3C)
  - Covered General Concerns, Recommendations, and What the Panel Liked
  - General consensus and understandings were reached

22

Remaining Actions

- USACE will complete evaluator response
- Expert panel will conduct Backchecks and insure like discipline coordination
- Remaining outstanding issues will be handled by teleconference (probably by chapter)
- Schedule to be determined

23

Closing Comments

- ??

24

Appendix C

IEPR Panel Member Resumes

Christopher J. Brown, Ph.D., P.E.
Geotechnical Engineer

Experience
21 years

Expertise
Water resources engineering
ASR
Geotechnical engineering
Ports/waterways
Dredging
Hazardous wastes
Computer modeling
Water resources planning
Environmental impact statements

Education
Ph.D., Civil Engineering, University of Florida, 2005
M.S., Civil Engineering, Villanova University, 1997
B.S., Civil Engineering, Temple University, 1991

Registration
Professional Engineer:
Florida (No. 65308)
Pennsylvania (No. 049758-E)

Professional Affiliations
American Society of Civil Engineers
International Association of Environmental Hydrologists
American Water Resources Association

Honors/Awards
U.S. Army Corps of Engineers:
Jacksonville District Engineer of the Year, 2002
Geotechnical Branch Engineer of the Year, 2000
Philadelphia District Engineer of the Year, 1998
Player of the Month, 1999
Panel members work awards, 1996 and 2004

Publications
Authored ~20 journal articles, presentations, and reports on topics in geotechnical engineering.

Summary of Experience
A senior consultant with Golder Associates in Jacksonville, Florida, Dr. Brown developed his extensive expertise in the U.S. Army Corps of Engineers where he was a senior technical expert on groundwater hydrology, ASR wells, water resources planning, dredging, confined disposal areas, levees, geotechnical engineering, and subsurface structures such as cofferdams and hydraulic barrier walls. He frequently provided recommendations where existing guidance was not adequate or literature was incomplete. Dr. Brown also worked on numerous civil engineering projects involving levees, dams, and retaining walls.

Relevant Projects
- Beltzville Dam Periodic Inspection, northeast Pennsylvania. Responsible for both annual and periodic inspections of the earth and rock fill embankment dam near Lehighton. Led multidisciplinary panel members from the USACE to inspect the dam and all associated infrastructure including reservoir control tower, main conduit, spillway, access roads, bridges, and control buildings following USACE and Federal Emergency Management Agency protocols.
- General Edgar Jadwin Dam Annual Inspections, northeast Pennsylvania. Responsible for several annual dam inspections of the USACE-owned earth and rock fill embankment dam near Scranton. Led a multidisciplinary panel members of engineers from the USACE to inspect the dam and all appurtenant structures for safety and operational & maintenance issues.
- Prompton Dam Modification Study, northeast Pennsylvania. Responsible for evaluating new spillway options at the USACE-owned Prompton Dam, whose spillway capacity was inadequate based on new hydrologic studies. Developed a range of alternatives for safely passing the design flows through the spillway, and evaluated adding RCC to the embankment crest, new spillway through bedrock, and modifying the existing spillway via blasting and excavation to enlarge its capacity.
- Molly Ann's Brook Flood Control Project, Patterson, New Jersey. Responsible for segments of the T-wall retaining structures for a USACE flood mitigation project located this densely-populated urban area. Design evaluated the overall global stability of the retaining wall, as well as the geotechnical slope stability for certain key segments. Other design features included reinforced earth walls, underpinning of an existing building, and several large culverts and bridge replacements.
- Everglades Agricultural Reservoir, Palm Beach County, Florida. Primary duties included the oversight of geotechnical subsurface investigations to characterize the site geology and hydrogeology, evaluation of potential rock quarry sources, embankment design, and evaluation of embankment dam safety and stability. Multiple types of foundation improvement were considered for the project including jet grouting, slurry walls, and dental concrete. The overall feasibility study also evaluated various embankment types including homogeneous earth, zoned earth/rock fill, rock fill, and RCC. The Groundwater Modeling System (GMS), MODFLOW, and SEEP/W Key were used to evaluate embankment dewatering and seepage.
- Water Preserve Area Feasibility Study, Broward County, Florida. Responsible for feasibility-level evaluations of multiple new reservoirs in support of the Everglades Restoration project. Responsible for

embankment design, erosion protection, surveillance, subsurface explorations, and report preparation. Oversaw a panel of civil engineers who prepared the engineering appendices for the USACE and the District. The evaluations included calculations, design drawings, and a final engineering appendix for eight separate proposed reservoir impoundments. Many of the projects are now under construction as part of the "Acceler8" program including the Site 1 Impoundment, C-9 Reservoir, and C-11 Reservoir.

- Portugues Dam Groundwater Model, Ponce, Puerto Rico. Together with another hydrologic modeler, developed a MODFLOW model in support of the Portugues Dam project. The Portugues Dam is a thick arch RCC concrete dam located in the uplands of Puerto Rico. The dam foundation includes a complicated geologic regime including major near-vertical shear zones. The model development and calibration was difficult since the foundation was probably a combination of porous media and fracture flow systems. The numerical model was compared against older existing models and compared very favorably. The model was used to estimate uplift pressures, under seepage, through seepage, and to help with the design of drainage galleries and grout curtains.
- Levee Assessment Panel members, Louisville, Kentucky. Member of a USACE National Levee Assessment; panel members were charged with the inventory and development of a national levee database, as well as the development of risk-based assessment methodologies to be used for levee assessment and evaluation across the entire U.S.
- L-31 North Seepage Management Pilot Project, Miami-Dade County, Florida. Responsible for the overall assessment and development of a permanent subsurface groundwater barrier system between Everglades National Park and Miami. The evaluations included feasibility-level design and analysis of over 50 separate barrier wall concepts including SB and SCB slurry walls; PVC sheetpile; steel sheetpile; jet grouting; canal lining; and many others. Developed the concept of a pilot project to test a combination of different seepage control technologies.
- C&D Canal Deepening Feasibility Study, Maryland and Delaware. Responsible for the development of a site selection methodology for the disposal of dredged material throughout the study area. The site selection study used linear optimization techniques and various spatial map coverages to screen through over 350 different possible disposal area locations. Spatial map coverages included wetlands, parks, cultural resources, bird habitat, endangered species, and landuse. Linear optimization analysis was performed on combinations of disposal areas to arrive at the least cost disposal option considering pumping distances, access, and other required infrastructure.
- Delaware Main Channel Deepening Project, Pennsylvania and New Jersey. Responsible for exploration, evaluation, and design for proposed channel and harbor deepening study. Work included evaluation of dredgability of sediments, beneficial reuse of dredged material, and design of new confined disposal areas in New Jersey. Oversaw explorations of site "17G" to determine the overall geological and geotechnical foundation properties, and assisted the project engineer with evaluation of potential impacts to groundwater from confined disposal operations.

Jay Jani, Ph.D., P.E
Structural Engineer

Experience
25+ years

Expertise
Structural design
Structural integrity assessment

Education
Ph. D., Ocean Engineering (Major: Structural Engineering) Florida Atlantic University, 1990
M.S., Civil Engineering (Major: Structural Engineering) Carnegie-Mellon University, 1984
B.E., Civil Engineering (Major: Structural Engineering) University of Bombay, Bombay, India,1982

Registration
Professional Engineer:
Louisiana, 1997
Engineer-In-Training:
Pennsylvania, 1983

Special Skills
Extensive software experience:
(i) *ALGOR, COSMOS, MARC, ADINA* - Finite Element Analysis (FEA) Packages
(ii) *RISA-3D* - Interactive 3-D Structural Analysis Software Package
(iii) *MicroSAS, and PIPELAY* - McDermott's in-house Software programs for Structural Design & Analysis of Offshore Structures, and analysis related to Marine Pipe-Laying respectively
(iv) *MOSES* – Naval Architectural/ Ocean Engineering Analysis Package
(v) *AutoPipe* – Pipeline Stress Analysis Package
(vi) *AGA I & II* - Submarine Pipeline On-Bottom Stability Analysis Software Package
(vii) *Caesar II* - Pipeline Stress Analysis Package
(viii) *MathCad*

Professional Affiliations
ASCE, member
ACI, Louisiana Chapter
ASCE-SEI, New Orleans Chapter, Chairman, 2008-2009
Vice Chairman, 2007-2008

Summary of Experience
Dr. Jani is president and senior structural engineer, Engineering Consulting Services, Inc. in Metairie, Louisiana. He has extensive experience in structural design for the civil and marine/offshore engineering industries.

Relevant Projects
- Independent Technical Review (ITR) for USACE's Hurricane Protection Project: Structural Design of T-Walls, 56 feet Sector Gate, Pile Foundation, etc. (95% Submittal*)*, "WBV 16.2 Segnette Pumping Station to New Westwego Pumping Station Flood Wall," N-Y Associates, New Orleans, Louisiana.
- Independent Technical Review for USACE's Hurricane Protection Project: Structural Design of T-Walls, Pile Foundation, etc. (100% Submittal), "Fronting Protection at Cousins, Whitney Barataria and Estelle 1 & 2 Pumping Stations," N-Y Associates, New Orleans.
- Independent Technical Design Review for USACE's Hurricane Protection Project: "Reconnaissance Level Study for three (3) Hurricane Protection Alignments Western Tie-in," Jefferson and St. Charles Parishes, Lake Cataouatche Hurricane Protection Levee, N-Y Associates, New Orleans.
- Independent Technical Design Review for USACE's Project: Structural Design of "Inner Harbor Navigational Canal Replacement Lock, Riverside Gatebay Module," Brown Cunningham and Gannuch, Inc., New Orleans.
- Independent Technical Design Review for USACE's Project: Structural Design of "Harvey Canal Flood Walls," URS Corporation, New Orleans.
- International Matex (IMTT), "Six-Oil" Project: Structural Design of Pipe Bridge (112 feet long), Pipe Racks, Electrical Platform, Reinforced Concrete Pump-Pit Foundation Slab and Containment Wall, Walkway, Pipe Supports, etc., W. S. Nelson and Co., New Orleans.
- Structural design of reinforced concrete pile-foundation of about 56,000 sq. ft. for a proposed new church to be located at Marrero, Louisiana.
- Structural rehabilitation of a floor slab and the foundation for a commercial building by: (i) designing new reinforced concrete foundation slab and grade beams and, (ii) foundation Under-Pinning using concrete Segmented Piles, New Orleans.
- Structural design for reinforced concrete slab with or without pile foundation for: various carwash structures, vacuum canopy structure, etc., New Orleans.
- Structural design of a reinforced concrete foundation for an 8000 gallon insulated double-wall fuel storage tank, New Orleans.
- Structural design of IPS weather station equipment support structure at various canals in New Orleans, Sutron Corporation, Sterling, VA.
- Structural design of lateral support system for DCP stations installed at various canals in New Orleans, Sutron Corporation, Sterling.

Adjunct faculty, Dept. of Civil Engineering at University of New Orleans

- Residential structural assessment of more than 225 houses, to determine the extent of structural damage caused by hurricane-Katrina to the houses in New Orleans, a FEMA/Shaw Project, New Orleans.
- Structural integrity assessment of various shutters, doors, framings, etc., for various wharf structures in Port of New Orleans, to determine the extent of structural damage caused by hurricane-Katrina, Port of New Orleans, Hurricane Reconstruction Program, PB Americas, New Orleans.
- Structural design of a proposed new casino building, and a food court building to be constructed in Baton Rouge, LA, using PolySteel Form, Insulated Concrete Building System. Also designed roof system for both the structures using Vulcraft Steel Joists.
- Structural integrity assessment of all phases of offshore platform design for various projects including in-place analysis, transportation analysis, installation engineering (lift analysis, lift rigging design, etc.), pile foundation design, earthquake analysis of offshore platforms, etc., J.Ray, McDermott Inc., New Orleans.
- Analysis and structural integrity assessment of Shell's Na Kika (TLP) hull pipe support design based on PDMS model. Consultant to Deepwater Consultant Alliance (DCA), New Orleans.
- Design and analysis of A&R and SCR hooks for several deepwater pipeline installation projects, using J. Ray McDermott's J-Lay System. The pipeline hook design included a 775 Kips capacity A&R hook for one of Shell's subsea pipeline projects. Also performed a finite element analysis for 775 Kips hook, using 'COSMOS' FEA software to study the stress distribution in the hook in a more comprehensive manner.
- Reassessment of PEMEX's Bay of Campeche platforms and subsea pipelines. Responsibilities involved evaluation of structural integrity of potentially unstable marine pipelines subjected to a 100-year storm condition. The analysis included: (i) assessment of on-bottom stability of the pipelines subjected to a 100-year storm condition; (ii) determination of hydrodynamic loads; (iii) determination of the soil friction and passive resistance; (iv) estimation of maximum lateral movement and bending stress in the pipelines caused by a 100 year storm condition. Also performed a 1000-year return period earthquake analysis for the ductility assessment of Pemex's CA-AC-1 platform.
- Worked on all phases of structural design engineering in the field of offshore marine construction including: (i) analyses of offshore oil/gas pipelines; (ii) earthquake analysis of offshore platforms; (iii) installation engineering, including jacket/deck tow-safety analysis, jacket and deck lift analyses, hook evaluations, jacket/deck/pile tie-down design, jacket on-bottom stability analysis, barge structural integrity assessment, etc.
- Worked on all phases of naval architecture and structural design engineering in the field of offshore marine construction including mating of the deck-hull of Shell's "Auger" Tension-Leg-Platform (TLP), analyses of lateral mooring system for TLP-hull, deck transportation analyses, and miscellaneous installation procedures for "Auger" TLP installed in a water depth of 2,860 ft. in the Gulf of Mexico.

Frank L. Kudrna, Ph.D., P.E.
Hydraulic Engineer

Experience
44 years

Education
Ph.D., City and Regional Planning, Illinois Institute of Technology, 1975
M.S., City and Regional Planning, Illinois Institute of Technology, 1973
B.S., Engineering, Chicago Technical College, 1963
MBA, University of Chicago, 1986
Advanced Management Program, University of Chicago, 1981

Registration
Professional Engineer:
Illinois (062-26664)
New York (060063-1)
Michigan (33817)
Indiana (20357)
Wisconsin (E-100282)
California (C-37799)
Florida (0035720)

Professional Affiliations
ASCE National Transportation Policy Committee
American Public Works Association
American Society of Civil Engineers, Fellow
Chairman, Urban Planning and Development Division, Executive Committee
Vice Chairman, Technical Council on Research
Chairman, Committee for Environmental Quality
Illinois Society of Professional Engineers
National Society of Professional Engineers
National Water Well Association
Society of American Military Engineers (S.A.M.E.), Director, Chicago Post
Urban Land Institute

Honors/Awards
Who's Who in Science and Engineering
Who's Who in the Midwest
Who's Who in Finance and Industry
Who's Who in the World

Summary of Experience
Dr. Kudrna founded Kudrna & Associates, Ltd., in Chicago in 1986 following 23 years of public and private-sector employment. The firm provides planning and civil engineering services for site development, municipal and transportation engineering, and water resources management projects. This includes roads, streets, bridges, airports, railroads, ports and harbors, and parking facilities; drainage, flood control, flood routing, detention reservoirs, and wetlands; land development and landscaping; waste collection and treatment systems and pump stations; marinas, golf courses, parks, and other recreational facilities; and water supply and distribution systems, including Lake Michigan Water Allocation studies.

He has a long record of public service through assignment to numerous commissions, legislative task forces, and government panels, for example:

- *Council of Great Lakes Governors*—serves on Advisory Committee to the Great Lakes Charter Annex 2001 (an amendment to the Great Lakes Charter of 1985) for the purpose of implementing a new standard for diversions and consumptive uses of Great Lakes waters.
- *Chicago Lake Michigan Committee*—served with Commissioner of Environment, Chicago Park District Superintendent and City of Chicago Cabinet to develop policies and monitor activities that benefit Lake Michigan.
- *Chicago Shoreline Commission*—has served as Commissioner, Chairman, and Member of the Engineering Subcommittee.
- *Northeastern Illinois Planning Commission*—Advisory Committee of Regional Water Resources Management.
- *Great Lakes Commission*—member of the Executive Committee and current chairman of the Illinois delegation.
- *NOAA*—member of the National Sea Grant Review Panel and the Science Advisory Board.
- *Great Lakes/St. Lawrence Maritime Forum*—U.S. co-chairman.
- *DuPage County Regional Planning Commission*—board member.
- *Global Climate Change Task Force*—Illinois legislative appointee.

Relevant Projects
- Chief Consulting Engineer to the Illinois International Port District, Chicago, since the 1980s. Completed numerous studies and design improvement to Chicago's harbor and port system. Project have included FEMA studies, hydraulic studies, dredging, sediment testing, landfills, permitting, structural assessment of shoreline structures, dock wall replacements, and railroad improvements.
- Consulting engineer to the Chain-O-Lakes Fox Rive Waterway Management Agency involving Ackerman Island Dredge Disposal Site Preparation, preparation of a Comprehensive Dredging and Spoil Disposal Plan, and a feasibility study for Fox Bay Marina in McHenry.
- Principal on the Lumber Street, Seymour Avenue, Waveland Avenue, and Kostner Avenue reconstruction for the City of Chicago; Illinois Route 43 and Busse Road/U.S.Route 14 reconstruction for the Illinois Department of Transportation; and site engineering for RTA Bus Maintenance Facilities in Markham and Melrose Park, Ill.
- For the Chicago Metropolitan Sanitary District, directed staff responsible

for the preparation of comprehensive watershed plans, project design, and plan preparation for flood control structures.

- Directed professional staff in the preparation of conceptual, physical, environmental, and financial plans concerning the Chicago Metropolitan Sanitary District, including preparation of the Metropolitan Sanitary District's funding and recycling plans.
- For the Chicago Metropolitan Sanitary District, coordinated critical path analysis of the ten-year program, critical path analysis of the expansion of the West-Southwest Treatment Plan to a two billion gallon per day plant; critical path analyses of the 1968-69 Land Reclamation Program, and ten-year program development.
- For the State of Illinois Department of Transportation, coordinated planning studies and advanced planning studies for future construction. The studies involved geometrics, estimating, alignment coordination, programming, long-range planning, land use, and traffic studies.
- The award-winning, 35 hole Harborside International Golf Course on Lake Calumet, Ill.
- The 1500-slip North Point Marina in Winthrop Harbor, Illinois.
- Planning and concept development for downtown area improvement for the Village of Franklin Park involving redesign of storefronts, streetscape, street and sidewalk improvement, and parking lot improvements.
- Combined Sewer Relief System, annual street rehabilitation and resurfacing improvement programs, and numerous street, water main and sewer reconstruction projects for Franklin Park, Illinois.
- Thunderhawk Golf Complex in Beach Park, Illinois.

David E. Lourie, P.E., D.GE
Geotechnical Engineer

Experience
30 years

Expertise
South Louisiana soil conditions, local area geology, geotechnical design and construction

Education
M.S., Civil Engineering, Illinois Institute of Technology, 1981
B.S., Civil Engineering, Illinois Institute of Technology, 1979

Registration
Professional Engineer, Louisiana, Civil Engineering (1984)
Environmental Engineering (1994)
Water Well Drillers, Louisiana, (1987)
Diplomate, Geotechnical Engineering (2010)

Professional Affiliations
Louisiana Engineering Society (former Lake Charles Branch President)
National Society of Professional Engineers
American Society of Civil Engineers (former New Orleans Branch President and Chairman of the Geotechnical Activities Group)
Geo-Institute
American Council of Engineering Companies (former New Orleans Chapter President)
ASFE (immediate national past President)
Chi Epsilon

Publications
Authored and co-authored numerous technical papers and presentations on coal mine waste material disposal, use of electric cone penetrometers, building large tanks on very weak soils, soil sampling, expansive clays, Brownfield site development, professional liability, professional ethics, and alternate covers and liners for waste disposal facilities.

Summary of Experience
Mr. Lourie is founder and CEO of Lourie Consultants, Metairie, Louisiana, a consulting engineering firm that has been providing geotechnical and geoenvironmental consulting and engineering services to clients in the commercial, governmental, and industrial business sectors since 1992.

He has served as a liaison to the Peer Review Committee of ASFE/The Geoprofessional Business Association, has served as a Peer Review captain, and is ASFE's immediate national past president. Mr. Lourie has been an adjunct professor at Tulane University, a visiting professor at McNeese State University, and a guest lecturer at Louisiana State University and the University of New Orleans.

Relevant Projects
- Worked 11 years for Fugro-McClelland (Southeast), Inc. (formerly McClelland Engineers) in Louisiana and Texas. Between 1983 and 1992, served as president of FMSE, and gained broad experience in the financial and technical operations of the firm's geotechnical, environmental, and construction materials engineering and testing (CoMET) practice in Louisiana.
- Served as the primary engineer on hundreds of studies for many types of projects, dealt with commercial buildings, industrial facilities, offshore and near-shore structures, roads, bridges, railroads, groundwater studies, landfills, site assessments, and pipelines.
- Formulated and conducted forensic investigations and engineering studies to assess failure causes and identify remedial measures for sheet pile walls, earth slopes and levees, foundations, and pavement systems.
- Worked on the field, laboratory, and engineering aspects of many types of projects throughout Texas, in the Gulf of Mexico, and in the Arabian Gulf. Worked on roadways, bridges, major transportation projects (rail and highways), industrial facilities, schools, hospitals, landfills, etc. Frequently planned, supervised, and participated in site investigation programs and developed laboratory testing programs to determine relevant soil properties for design and construction.
- Conducted detailed geotechnical engineering analyses, including those to compute axial and lateral pile capacity, assess the bearing capacity of foundation soils, predict settlements of shallow and deep foundation systems, evaluate the stability of earth slopes, compute lateral earth pressures for permanent and temporary retaining structures, identify constructability issues, develop performance monitoring programs, and interpret the results from various types of field tests.

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W. Allen Marr, P.E., PhD, NAE
Civil Engineer

Experience
41 years

Expertise
Design and construction of large earthworks
Value engineering for earthworks and earth retention systems
Active risk management
Instrumentation and real-time monitoring systems
Forensic evaluations and litigation support

Education
Ph.D., Geotechnical Engineering, Massachusetts Institute of Technology,1974
M.S.C.E., Geotechnical Engineering, Massachusetts Institute of Technology, 1972
B.S.C.E., Civil Engineering, University of California at Davis, 1970

Registration
Professional Engineer:
Massachusetts
New Hampshire
Connecticut
New York
Georgia
Arizona
California

Professional Affiliations
American Society of Civil Engineers, Fellow
ASTM D18, Honorary Member
ASTM D35, Former Member of Executive Committee
Geo-Institute, Former Chair of TPC
Geosynthetic Institute, Member
USSD, SME-UCA

Honors/Awards
Elected to National Academy of Engineers, 2008
Recipient of Distinguished Alumnus of College of Engineering, Univ. of California at Davis, 2007
Invited Keynote Speaker for Geo-Institute Geo-Congress 2006, Atlanta, Georgia, 2006
ASTM D-18 Woodland G. Shockley Award for exceptional and long-term meritorious service, 2004

Summary of Experience
Dr. Marr is president and chief executive officer of Geocomp Corporation in Boxborough, Massachusetts. He is a geotechnical engineer with specialized expertise in design of large earthwork facilities, ground improvement, and performance monitoring. He has provided consulting services on a wide variety of projects including earthen dams, tunnels, excavations, embankments, natural slopes, landfills, and foundations. Dr. Marr has spent his entire 40-year professional career focused on incorporating the benefits of applied research in geo-engineering into civil engineering practice. He has repeatedly demonstrated a strong ability to identify emerging trends in research and technology and apply those developments in ways that produce safer and more economical solutions to a variety of infrastructure problems.

Dr. Marr has also participated in numerous forensic investigations on projects that experienced problems with geotechnical/geological causes. His in-depth knowledge of the properties and behavior of geologic materials, advanced numerical analysis, testing, ground improvement and remediation methods, and instrumentation to monitor performance have been very helpful to owners, contractors, engineers, consulting boards and project advisors

Relevant Projects
- Primary advisor to US Army Corps of Engineers on advanced numerical analysis of levee failures during Hurricane Katrina.
- Primary resource for advanced laboratory testing of soils involved in levee failures during Hurricane Katrina.
- Consultant to design panel members to strengthen levee system protecting Dupont titanium dioxide plant in DeLisle, Mississippi.
- Consultant to Athens Metro in Greece for design of 30 m deep subway stations in soft to medium clays.
- Consultant to Ontario Power Generation to develop deep repository in limestone for storage to low and intermediate nuclear waste.
- Consultant to Palo Verde Nuclear Station on repairs and upgrades to cooling water storage facilities.
- Group leader to provide real-time monitoring of vibrations and movements of adjacent structures, including active subway line during new construction of South Ferry station in Manhattan, NY.
- A primary panel member to develop new concept of storing cold compressed natural gas (CCNG) in deep caverns for peaking power. Using advanced numerical modeling, Dr. Marr developed a way to safely store CCNG in a deep solution-mined cavern that has economic advantages over warm pressurized gas storage and provides a viable alternative to surface storage of Liquid Natural Gas.
- Principal Investigator for National Academies research effort to expand AASHTO standards for design and construction of mechanically stabilized earth retaining structures to allow marginal soils to be used as backfill materials with a resulting cost savings of up to 30%.

State-of-the-Practice Lecture for Sowers Lecture, Georgia Tech, May 20, 2003

Invited Keynote Speaker for Geo-Institute Specialty Conference on Performance Confirmation of Constructed Geotechnical Facilities, 2000

ASTM award for standard on Interface Shear Strength of Geosynthetic Clay Liners. 1998

IACMAG Award for Significant Paper in Geomechanics, 1994

Wellington Prize from ASCE for paper "Differential Settlement," 1984

Publications

Significant papers from 80+ publications in geotechnical engineering.

- Monitoring Contractor to NY Port Authority and Phoenix Constructors on the reconstruction of the World Trade Center in Manhattan.
- Monitoring Contractor to NY Metropolitan Transit Authority for construction of twin subway tunnels beneath Park Avenue and Grand Central Terminal.
- Consultant to Ohio DOT on foundations for major new suspension bridge across Cuyahoga River in Cleveland.
- Consultant to design build panel members to manage risks associated with construction of deep excavation for underground parking garage in center of Savannah, Georgia surrounded by many historically significant structures.
- Guided first known effort to use probabilistic failure analyses of a dam to design an instrumentation system to manage risk of failure for the US Army Corps of Engineers Clarence Cannon Dam.
- Developed rational design criteria for the allowable differential settlement of above ground storage tanks that became API design standard for oil storage tanks
- As a member of Board of Consultants for foundation design of the 7 km long Oosterschelde Storm Surge barrier, the final and most challenging component of Holland's flood protection system was instrumental in proving that key mechanism of performance for design was deformation and not liquefaction from repeated wave loading.
- Developed methodology to improve earthquake resistance of loose soils by permanent dewatering that saved an Owner more than $60,000,000 and became a design standard for Japanese Fire Defense Agency.
- Co-developer of "The Stress Path Method," an approach to solving soil mechanics problems that is used worldwide in teaching, research, and practice.
- Developer of the concepts of "Active Risk Management," "Key Risk Indicators," and "Risk Monitoring" to better manage risks associated with heavy civil construction. His efforts contributed to an estimated savings of $500,000,000 on the Central Artery/Tunnel project from avoided risks.
- Developer of a suite of devices to automate the measurement of mechanical properties of soil and rock that are used worldwide by universities, governmental agencies and commercial firms to improve the quality and reduce the time and effort to test geo-materials.
- Developer of an integrated iSite™ system to monitor sensors located anywhere in the world via a Web browser. This system is increasingly used to monitor the safety of facilities during construction and provide early warnings of adverse performance.
- Member of Interagency Performance Evaluation Task Force that evaluated the cause of levee failures in New Orleans during Hurricane Katrina.

Bijay K. Panigrahi, Ph.D., P.E., P.G., D.WRE
Hydraulic Engineer

Experience
28+ years

Expertise
Civil engineering
Geotechnical engineering
Environmental engineering
Water resources engineering
Ground water-surface water modeling
Peer review, expert testimony, and litigation support

Education
Ph.D. Civil Engineering, Drexel University, 1985
M.S. Civil Engineering & Geology, Oklahoma State Univ., 1981
M.E. Hydraulics Engineering, Asian Inst. of Tech., Thailand, 1978
B.S. Agricultural Engineering, Orissa Univ. of Ag. & Tech., India, 1976

Registration
Professional Engineer:
Florida
Virginia
Michigan
Professional Geologist:
Florida
North Carolina
Diplomate, Water Resources Engineering – AAWRE Certification
HAZWOPER (29CFR 1910)

Special Skills
Extensive knowledge/experience with the following models/ software:
WASH123D, MIKESHE/11, ICPR, MODBRANCH, MODFLOW, SEEP2D, HEC-RAS/HMS, MT3D, BASINS, SWMM, LOWCAP, RSM, FLONET, GMS, ARCInfo, Statistics/Geostatistics packages

Professional Affiliations
Member, Executive Committee, ASCEEWRI, 2003-2005
Chair, Watershed Council, ASCEEWRI, 2000-2003 (Vice-Chair, 1999-2000)
Chair, Ground Water Quality Committee, ASCE-EWRI and EED, 1998-2000 (Vice-Chair, 1994-1998; Secretary, 1992-1994)

Summary of Experience
Dr. Panigrahi, the president and principal engineer of the BPC Group Inc., Orlando, Florida, has directed and managed numerous multidisciplinary projects involving hydraulics and hydrologic modeling, flood protection studies, feasibility studies, stormwater management system design, water quality assessment and modeling, geotechnical and environmental design and studies, seepage and slope stability analyses, foundation analyses, scour and erosion control, water resources facility design, and permitting. He has also assessed and designed a number of canal conveyance systems and water resources control structures such as levees/dikes, culverts, reservoirs, and treatment systems.

Relevant Projects
- Peer reviewed 30+ hydraulic-hydrologic-hydrodynamic models on behalf of the IMC/SFWMD, which included surface water, ground water, integrated SW-GW, seepage, and watershed water quality models such as WASH123, SWMM, MODFLOW, LECsR, MIKESHE, HEC-HMS & RAS, RMA, SEEP2D, MODBRANCH, FESWMS, LOWCAP, and WaSh among others. Some of the projects included Biscayne Bay Coastal Wetlands, LECsR, C-11 and C-9 Impoundments, 3A/3B SMA, C-44 Canal Design, Lower Kissimmee Basin Ground Water Model, and STA 5&6 Expansion.
- Completed hydrologic and hydraulic modeling of the C-51 basin including ACME Basin B in support of Basin Rule modifications. Used HEC-HMS/HEC-RAS models for calibration to Hurricane Irene and further basin analyses.
- Completed wave run analyses and scour evaluation for extreme hurricane conditions on Big Sand Lake to assist in the design of the Westgate Lakes resort in Orlando, Florida.
- Developed hydrologic-hydrogeologic model for design of the reservoir and the seepage canal for Site 1 Impoundment for SFWMD. Reviewed the hydraulic analyses and wave run analyses for the reservoir design.
- Completed an integrated hydraulic-hydrologic model to simulate the natural systems and future conditions for the Southwest Florida Feasibility Study area (>5000 sq mi) for the South Florida Water Mangement District.
- Developed a FEMA-approved floodplain model using ICPR to delineate 100-year floodplain and then to prepare ESRI/ArcView floodplain maps for revisions to FIRM for Lake Notasulga, Texas basin, and Rock Lake basins for the City of Orlando.
- Conducted stormwater structural inventory survey and database development, performed water quality modeling for existing and future conditions including proposed best management practices, and developed 100year floodplain maps for revisions to FIRM for Big Econlockhatchee River basin in Orange County, Florida.
- Provided comprehensive geotechnical and hydrological engineering services for roadways, culverts, bridges, levees and dikes, reservoirs, canals, stormwater treatment ponds, and rapid infiltration basins for a number of projects in Orange, Hillsborough, Lake, and Duval Counties in Florida.
- Provided civil and geotechnical engineering services for Little Wekiva

Chair, Task Group, Contaminated Ground Water Modeling, ASCEEED, 1991-1993
Blue Ribbon Panel Member, Natural Attenuation of Hazardous Wastes, ASCE, 2002
Blue Ribbon Panel Member, Environmental Site Characterization and Remediation Design Guidance Manual, ASCE, 1998-99
Chair, An International Perspective on Environmental and Water Resources, EWRI/ASCE, Bangkok, Thailand, January 2009
Technical Program Co-Chair, An International Perspective on Environmental and Water Resources, EWRI/ASCE, New Delhi, India, December 2006
Program Co-Chair, An International Perspective on Environmental Engineering, Joint CSCE & ASCE International Conference, Niagara Falls, Canada, July 2002
Chair, Technical Program, Integrated Surface and Ground Water Management, ASCE Specialty Symposium, Orlando, May 2001
Control Member, Non-Aqueous Phase Liquids (NAPLs) in Subsurface Environment: Assessment and Remediation, ASCE Conference, Washington, Nov. 1996

Honors/Awards

Engineering Achievement Award Nomination, NSPE, USA; Project: Design of the Subway Tunnel, Baltimore City, 1990
Engineering Achievement Award Nomination, NSPE, USA; Project: Design of the Hazardous Waste Landfill, Dow Chemical, 1985

Publications

Authored more than 50 technical manuals, monographs, and papers for peer-reviewed journals and proceedings.

River realignment project, including bank stabilization, seepage and slope stability analyses, foundation analyses for multiple bridge crossings in Orange County, Florida.

- Provided expert testimony and litigation support services for sinkhole projects in Lakeland, Florida and Safe Harbor, Florida.
- Provided expert witness and litigation support services for an accidental fire in a chemical storage and distribution facility in Niles, Michigan containing dense non-aqueous phase liquids. Constructed hydrologic and fate-transport models for the project.
- Performed a 3-dimensional shallow aquifer model of a 6.75 square mile area to evaluate the impact of 20± acre stormwater retention pond on a landfill and the cumulative impact on the subject property next to the landfill in Orange County, Florida.
- Designed and recommended an optimal ground water recovery system for a site in Plant City that also involved evaluation of the impacts of the recovery system on Cone Ranch wellfield and the surrounding wetlands using a 3-D model (1200 ft deep, 282 sq mi).
- Directed a low-head earthen dike design project in support of a permit application for Lake Micaela in Brandon, Florida. Performed field exploration plan, data evaluation, seepage and slope stability analyses, design of dike, base and sheet pile, construction specification, and QA/QC plan.
- Provided construction inspection services for Northeast Regional Park in Orange County involving pavilion, restrooms, playgrounds, basketball courts, tracks, and paved roadways.
- Provided construction inspections services for Lamb Island dairy remediation site that consisted of berms, grading, and stormwater treatment ponds for the SFWMD.

Michael A. Ports, P.E., P.H., D. WRE, D. NE, CPSEC
Hydraulic Engineer

Experience
40 years

Expertise
Surface water hydrology and hydraulics
Storm water management
Navigation engineering
Soil and water conservation
Urban drainage and flood control
River training works
Fishery and wildlife habitat mitigation and design
Stream channel restoration
Erosion and sediment control
Environmental impact assessment
Water law
Sediment transport modeling
Bridge scour analysis
Environmental regulatory compliance

Education
M.S., Water Resources, University of Maryland, 1974
B.S., Civil Engineering, University of Maryland, 1970

Registration
Professional Engineer:
Texas (50067) Florida (68707)
Registered Professional Hydrologist (AIH No 644)
Diplomate, Water Resources Engineer (AAWRE No. 002)
Diplomate, Navigation Engineer (ACOPNE No. 002)
Certified Professional Soil Erosion and Sediment Control Specialist (IECA No 198)

Special Skills
Utilizes the latest in computer simulation techniques, including SWMM, HSPF, HEC-RAS, UNET, and HEC-DSS

Professional Affiliations
American Society of Civil Engineers, Fellow; Executive Committee, 2006-2007; Technical Region Board of Governors, 2003-2007, Chair 2006-2007
Environmental and Water Resources Institute, Founder; Governing Board, 2000-2006 and President, 2004-2005
Urban Water Resources Research Council, 1973 to present
Urban Water Infrastructure Committee, 1986 to present

Summary of Experience

Mr. Ports has a wealth of planning, analysis, design, and construction experience in a broad spectrum of water resources engineering applications. Currently an independent consultant in Jacksonville, Florida, he represented the American Society of Civil Engineers on water resources issues before the U.S. Environmental Protection Agency, the Bureau of Land Management, and the U.S. Congress. In addition, he has served as an expert witness before state courts in Louisiana, Maryland, and West Virginia, and federal courts in Louisiana, Maryland, and Washington, DC.

Mr. Ports has overseen numerous water resources projects throughout the world. The projects range in complexity from river training and bank stabilization works to navigation engineering and comprehensive flood control investigations and designs.

Since 1990, he has led the hydraulic and scour analyses for more than 3,600 bridges, both existing and proposed, in 28 states and four foreign countries. He led the hydraulic analyses for the design of the following major bridge projects utilizing the latest two-dimensional hydrodynamic model (FESWMS-2DH), conventional hydraulic models (HEC-2 and WSPRO), and scour evaluation procedures from HEC-18, HEC-20, and HIRE. The hydraulic analyses include the comparison of alternative bridge and approach roadway configurations in order to minimize the potential backwater and the redistribution of flow across the floodplain. The scour evaluations include the estimation of local contraction, pier, and abutment scour as well as long-term erosion.

Relevant Projects

- Kansas City, Missouri (KC-One), the first comprehensive city-wide urban storm water management program, which includes fully integrated watershed models and master plans, revised and updated FEMA floodplain submittals, updated watershed master planning manual, strategic asset management plan, consolidated funding program, comprehensive review of City codes, ordinances, and standards, strategic organization plan, and formal public education and inclusion program.
- Long Term Combined Sewage Overflow Control Plans for the Turkey Creek and Missouri River NEID Basins in Kansas City, Missouri, including development of OCP detailed work plan, field reconnaissance, hydrologic and hydraulic modeling, assessment of existing conditions, formulation and analysis of alternative improvement scenarios, facility siting and feasibility, basin plan integration, water in basement analyses, and public education and participation program.
- Emergency Stream Bank Protection (Section 14) throughout Missouri and Kansas, including field reconnaissance, hydrology, hydraulics, and river mechanics for the design of various river training facilities to protect public roads, bridges, or other infrastructure against bank erosion. Typical sites include Kansas River near Eudora, Kansas, Delaware River in Brown County, Kansas, and U.S. Route 169 over the Middle Fork Grand River, Gentry County, Missouri.
- St. Paul Downtown Airport, Holman Field, Levee Design, St. Paul, Minnesota, including data collection, hydraulic modeling, alternatives analysis, and design for approximately 8,000 feet of levee along the right bank of the Mississippi River.

National Energy, Environment, and Water Policy Committee, 2003-2010
American Water Resources Association
American Institute of Hydrology
Society of American Military Engineers
American Public Works Association
Transportation Research Board, Committee on Hydrology, Hydraulics and Water Quality
International Erosion Control Association

Honors/Awards

American Society of Civil Engineers: Certificate of Appreciation, service as Chairman of the First North American Water Resources and Environmental Engineering Congress, 1992.
William Barclay Parsons Fellow, 1994. Parsons Brinckerhoff, Inc., New York.
Principal Professional Associate of Parsons Brinckerhoff, Parsons Brinckerhoff, Inc., New York, 1995.
Colegio Ingenieria Civil de Mexico: Reconocimiento por su participacion en la 1a Reunion Sobre el Futuro de la Ingenieria Civil de America Del Norte, Enero 1996.
American Society of Civil Engineers: Award of Merit, founding member of the Environmental and Water Resources Institute, 1999.
Maryland State Highway Administration: Certificate of Appreciation, December 1999.
Iowa Institute of Hydraulic Research Advisory Committee, University of Iowa, Member January 2001 and Vice Chair 2004.
Environmental and Water Resources Institute: Certificate of Appreciation, 2002.

Publications

Authored more than 120 technical papers, articles, and reports, covering hydrologic analysis, computer modeling, master planning, and flood control.

- Kansas City Downtown Airport, Levee Modifications, Kansas City, Missouri, including critical review of the hydraulic design for proposed modifications to the Missouri River levee to accommodate safety required runway lengthening.
- San Luis Rey River, San Diego County Water Authority. Led the hydraulic and sediment transport modeling for the design of the permanent protection of the buried aqueduct crossings of the San Luis Rey River. The hydraulic modeling using both HEC-2 and FESWMS-2DH and the sediment transport modeling using both HEC-6 and FLUVIAL-12 is required to design the protection of the buried aqueducts from scour, assess the long-term impacts on the extensive flood control levee system from sand mining within the river.
- Directly responsible for the hydraulic engineering aspects of the design for the Alaska Natural Gas Transportation System. As chief hydraulic engineer, he led the development of the hydrologic, hydraulic, erosion and sediment control, restoration and revegetation, fishery and wildlife habitat mitigation criteria, practices, standards, and specifications for the planning, design, and construction of the 750-mile long, 48-inch diameter buried pipeline from Prudhoe Bay to the Canadian border, including access roads, compressor stations, material sites, disposal sites, camps, airfields, and other appurtenant facilities. More than 500 pipeline crossings over streams were designed.
- As project manager and chief hydrologist, directed the development of the master plan for drainage improvements for the 98,000-acre New Orleans metropolitan district, an area largely below sea level, protected by levees and served by a 180-mile network of canals with 20 major pumping stations. Development of the master plan required extensive hydrologic and hydraulic modeling using SWMM as well as statistical analysis of hourly rainfall data collected over a 90-year period. An implementation plan was formulated for a 10-year, $500 million capital improvement program that would double the capacity of the entire storm drainage system.
- Analysis of the hydrologic impacts from the construction of oil pipelines, tank battery, docking facilities, and access roads on runoff quality and quantity for the 140-acre Moseley Tract on Avery Island, Iberia Parish, Louisiana.
- Statistical analysis and computer simulation of the April 6-7, 1983 storm event in order to determine the extent and causes of the resultant flooding experienced within the levee system in the Lower Coast Algiers, Orleans Parish, Louisiana.
- Statistical analysis and computer simulation of the May 1978 and April 1983 storm events in order to determine the extent and causes of the resultant flooding experienced within the levee system of Chalmette, St. Bernard Parish, Louisiana.

Jack W. Rolston, P.E.
Geotechnical Engineer

Experience
50+ years

Expertise
Soil mechanics
Foundation engineering

Education
Degree of Engineer, Geotechnical, Stanford University
M.S., Civil Engineering, Geotechnical, Harvard University
Geology, Colorado School of Mines

Registration
Civil Engineer, Geotechnical Engineer. California

Professional Affiliations
American Society of Civil Engineers ASCE
American Society for Testing and Materials ASTM
Association of Soil and Foundation Engineers ASFE
California Geotechnical Engineers Association CGEA
International Society for Soil Mechanics and Foundation Engineering

Honors/Awards
Lifetime Achievement Award, Region 9 (California) ASCE, 2007
Certificate of Honor, Corps of Engineers Los Angeles District, , for the Gallery of Distinguished Civilian Employees, 2005
California Board of Registration for Civil Engineers and Land Surveyors, for eminent service in the Geotechnical Engineering Program, 1988
SAFE (now CGEA), Award of Merit: founding member and Charter President, 1984
Certificate of Appreciation for service on the Building and Safety Advisory Committee of the ASCE Geotechnical Engineering Group, 1981
ASFE, for service on the Board of Directors, 1977

Publications
Authored papers on ground water problems, compaction density, design and construction of breakwaters, sediment strength, etc.

Summary of Experience
Mr. Rolston is founder and president of Foundation Engineering Co., Inc., Tarzana, California, a firm that performs geotechnical work for large residential graded tracts, high rise buildings, refineries, and water treatment plants.

Relevant Projects and Experience

- Working for Los Angeles District, Corps of Engineers, Materials Section, designed high strength scour-resistant concrete, 12,000 psi. Concrete contained silica fume to increase strength; this was the first time use in the United States.
- As Chief of the Soil Design Section had oversight over principal projects: the Seven Oaks Dam, Santa Ana River, and Fisherman's Wharf breakwater in San Francisco.
- Over a three year period, involved in design of Fukuji Dam in Japan. Included frequent trips to Okinawa to direct exploration and laboratory tests. Determined that the Okinawa laboratory was capable of performing the necessary tests in lieu of shipping samples by air to California for detailed testing.
- In charge of geotechnical exploration, testing, and design of large projects, which included:

  --The Los Angeles flood control channels and debris basins
  --Earth Dams: Whittier Narrows, Pine and Mathews dams in Nevada; Painted Rock, Alamo, Cave Creek, and New River dams in Arizona
  --Harbor Breakwaters and Marinas: Ventura, Oxnard, Marina Del Rey, and Mission Bay
  --Building Foundations: Edwards and Vandenberg Air Force Bases, Fort Irwin, Yuma Test Station
- Prepared Geotechnical Reports that provided recommendations for high rise buildings, parking structures, pavements (streets and parking areas), subterranean structures requiring shoring and retaining walls, industrial buildings, refineries, water treatment plants. Reports included slope stability, bearing capacity, surface drainage, ground water, settlement, and seismic analysis.
- State of California, Governor's Office of Emergency Services. Appointed as a representative of ASCE to the Safety Assessment Program Steering Committee, which consisted of representatives from professional engineering organizations and was formed to supervise training of engineers to respond to disasters
- As member of the American Society of Civil Engineers, ASCE, served as chairman of committees that related to the Grading and Foundations Sections of the City of Los Angeles Building Code (the City had the first Code in the country that provided a Grading Section). The committee provided recommendations regarding compaction testing, slope stability methods for graded, natural and excavated slopes. Later the committee worked on the Los Angeles County Code and the national Uniform Building Code, UBC.

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Charles L. Vita, Ph.D., P.E., G.E.
Civil Engineer

Experience
37 years

Expertise
Geotechnical engineering
Environmental cleanups
Engineering performance analyses
Statistical analysis, interpretation, and modeling
Forensic engineering

Education
Ph.D., Geosystems, Civil Engineering, University of Washington, 1985
M.S. Geotechnical Engineering, University of California, Berkeley, 1973
B.S. Civil Engineering (with highest honors and Civil Engineering Departmental Citation), University of California, Berkeley, 1972

Registration
Professional Engineer/Civil:
California (No. C39263), 1984
Washington (No. 16996), 1977
Alaska (No. 4407), 1977
Geotechnical Engineer:
California (No. GE 864), 1987

Publications
Authored about 60 papers, presentations, lectures, and courses

Summary of Experience
Dr. Vita is a senior principal engineer for URS in Seattle, Washington, with broad geotechnical and geo-environmental experience gained on hundreds of infrastructure projects associated with site evaluation, development, redevelopment, and cleanup. His expertise includes engineering planning, siting, exploration, site and route characterization, analysis, design, construction, and monitoring; oversight and quality assurance; forensic engineering and litigation support.

Dr. Vita is specially skilled and a technical leader in the analysis of uncertainty, risk and reliability, including probability based site characterization and engineering performance analyses and reliability based design. He is noted for rigorous conceptual and statistical data analysis and interpretation, including design and evaluation of exploration, testing, and monitoring programs.

Relevant Projects
- Hurricane Katrina. FEMA Public Assistance Project Officer in New Orleans (Nov. 2005-June 2006) responsible for completing and consulting on Project Worksheets (PWs) for public facilities damaged by Hurricane Katrina (FEMA1603-DR-LA). Completed PWs for the three major public boat marinas in Orleans Parish (the Municipal Yacht Harbor, South Shore Harbor Marina, and Orleans Marina). Other significant efforts and special assignments included the following:
- Provided geotechnical engineering support to FEMA for (non-federal) levee breach repairs in Plaquemines Parish; liaised with USACE.
- Provided engineering statistical support to Southern Parish Hazard Mitigation Section. Prior to the availability of FEMA guidance, developed a focused statistical (probabilistic) frequency analysis of Katrina-Level hurricane damage events for New Orleans. Integrated the analysis with Benefit Cost Analysis (BCA) procedures to evaluate hazard mitigation cost thresholds to effect a B/C=1.
- Consulted on development of technically defensible sampling plan for damaged building contents in New Orleans School District's central warehouse.
- Provided geotechnical engineering support to FEMA's Gentilly Landfill Evaluation Panel members. Evaluated settlement and slope stability analyses in permit documents. Evaluated settlement estimates in terms of strain in landfill cap and affect of strain on clay liner integrity, and related results to expelled soil pore water as part of chemical contaminant fate and transport considerations. Evaluated boring logs and soil lab results in geotechnical report, site characterization, and landfill slope stability analyses. Conducted detailed statistical analysis of soil strength data. Identified major concerns with landfill stability and potential affects on nearby levee stability. Provided FEMA with ongoing reviews and consultations on geotechnical reliability and risk issues associated with construction and operations of the Gentilly Landfill.
- Northern California Winter and Spring 2006 Storms. Provided consultation and final reviews on Landslide Assessment Reports of damage to infrastructure (primarily highways and roads) caused by sever rainstorms

and flooding. Conducted forensic analysis of storm damage to City of Modesto Chlorination Facility; investigated and evaluated subsurface seepage-induced erosion and loss of foundation support to piping and pumping facilities resulting from flood-stage high water behind San-Joaquin-River flood-protection levees located adjacent to the facility.

- Washington State Department of Transportation, I90 Snoqualmie Pass East Project. Responsible for geotechnical characterization and analyses for major bridges and world-class snowshed foundations and embankment and slope stability along the 5-mile 6-lane alignment. The mountainous-terrain alignment passes through very rugged, marginally stable colluvium slopes above soft lacustrine (lake) clays and floodplain areas of deep, liquefaction-susceptible soils. Foundations on steep side slopes of colluvium over steep bedrock include large-diameter drilled shafts socketed into bedrock that are being designed to simultaneously support structural loadings, tall MSE walls, and provide global stability to upslope foundation soils. Global slope stability depends on the steep colluvium and the soft lacustrine clays. A granular-soil buttress has been analyzed for one section of the alignment where the soft clays are hindering global slope stability. Earthquake loadings are based on new AASHTO bridge design standards, which call for stability under earthquake loadings from a 1,000-year event.
- California Department of Water Resources (DWR) Urban Levee Geotechnical Evaluation Program. Part of project team developing and implementing California’s 350-mile urban levee geotechnical evaluation program. Principal author for DWR’s program-wide *Guidance Document for Geotechnical Analyses* on sections concerned with levee geotechnical characterization for reach-by-reach analysis and levee under-seepage analyses, including integration with slope stability analyses; problematic foundations soils included interbedded sands and silts and soft to very soft clays. Developed probabilistic formulation of under-seepage analysis for risk and uncertainty (R&U) considerations. Investigated use of statistical analysis to characterize the probability of undiscovered geologic and geotechnical details affecting levee stability.
- NOAA Sha Dadx Habitat Restoration Project, Puyallup River, Washington. As part of a geotechnical engineering evaluation of the project’s proposed 3,500-ft long ring levee, identified critical design and performance issues associated with seepage and slope stability; identified potential remedial solutions. Problems soils included interbedded sands and silts.
- New Orleans East Levee Improvement Program. Conducted detailed internal technical review and documentation of URS’s implementation of the USACE “DIVR 400” approach to blanket theory being used for seepage evaluation of New Orleans East levee performance. The DIVR 400 procedure was reviewed in detail and considered in context with the EM 1110-2-1913 approach to blanket theory under-seepage analysis.

Jerry Zhou, P.E.
Structural Engineer

Experience
21+ years

Expertise
Structure design and analysis, flood control structure design and analysis, drainage design
H&H modeling & analysis

Education
M.S., Computer Engineering, Lamar University, 2001
M.S., Civil Engineering (Hydraulic Engineering), South China University of Technology, Guangzhou, China, 1999
B.S., Civil Engineering (Hydraulic Engineering), Tsinghua University, Beijing, China, 1988

Registration
Professional Engineer:
Texas

Special Skills
Analyses using:
Staad Pro, Risa 3D, Sap200
HECHMS
HECRAS (Steady and Unsteady)
ICPR3

Summary of Experience
Mr. Zhou, an engineer with GC Engineering, Inc., Pearland, Texas, brings extensive engineering experience in projects related to environmental restoration, road design, and water resources.

Relevant Projects

- Seven Oaks Ranch Development, Cities of Manvel and Iowa Colony, Texas. Responsible for drainage design for the approximately 2,200-acre mixed-use development. Work included entire Chocolate Bayou HEC models revision; project preliminary master drainage plan and impact analysis; storm sewer, sanitary sewer and water system truck line design, calculations, and modeling; flood plain fill calculations, channel conveyance lose and compensating modeling; design and routing simulations for proposed 41 detention ponds. Work also included hydrologic and hydraulic modeling and drainage study to ensure no adverse impact on both upstream and downstream of the receiving channel for the development. Three computer programs were used for the impact analysis: for hydrologic analysis, the US Army Corps of Engineer HEC-1 model was used to develop rainfall runoff flows; the hydraulic analysis was completed using US Army Corps of Engineer HEC-RAS model and Interconnected Channel and Pond Routing "(ICPR3) developed by Streamline Technologies, Inc. In addition, EPA's EPANET 2.0 was used to simulate three water plants and their distribution systems water.
- 100-year Street Ponding Analysis for Seven Oaks Ranch Phase I, Cities of Manvel and Iowa Colony, Texas. Responsible for street ponding analysis for Phase I of Seven Oaks Ranch Development. A detailed dynamic street sheet flow and ponding modeling was performed to ensure the maximum ponding depth was no more than 9 in., which is the requirement by Brazoria County Drainage District #5. Work included ICPR and XPSWMM modeling, which incorporated the time-stage relations conditions from receiving pond for each storm sewer system.
- Master Drainage Plan for Icet Lakes Subdivision, Chambers County, Texas. A single-family residential development. Responsible for drainage study and design for the 370 ac development. Work included existing drainage area and offsite drainage area delineations for the proposed project; detention pond design and modeling using ICPR; impact analyses on receiving channel; floodplain fill and mitigation calculations and simulation.
- Pasadena Flood Reduction Plan—Glenmore Ditch, Cotton Patch, and Armand Bayou (H&H Modeling: Unsteady RAS), City of Pasadena, Texas.- Worked with GIS, and developed new HEC-RAS models for all three bayous. Three alternatives with different detention and channel Improvements were proposed; results were presented to the city based on impact analysis and cost considerations.
- Master Drainage Plan for Reflection Bay Development, League City, Texas. A phased 530-ac multi-use subdivision with five interconnected ponds based on both improved and unimproved channel conditions. Galveston County, TX. Project Engineer on this project that includes five detention ponds to mitigate hydrologic impact of the development.

Three computer programs were used for the impact analysis: for hydrologic analysis, the US Army Corps of Engineer HEC-1 model was used to develop rainfall runoff flows for the study; the hydraulic analysis was completed using US Army Corps of Engineer HEC-RAS model and Interconnected Channel and Pond Routing (ICPR3) developed by Streamline Technologies, Inc.

- Designed Edloe Area Paving, Drainage, and Waterline Improvements Project for the City of Houston. Conducted all paving, drainage, and water line design, performed impact analysis to Poor Farm Ditch and Brays Bayou, as well as drainage calculations for storm sewer design (PER phase).
- Hydraulic Structure Projects for (Coal) Powered Plants. Designed all hydraulic-related structure works for (coal) powered plants, including pump house, cooling towers; water intakes and outlets. Tasks included the drainage system, ash-dam; ash pipeline and its foundation, retaining walls; pump houses, and seawalls; hydrologic and hydraulic analysis on the impact of plant to the local river using XinganJiang Model. Major Projects: Yuanyan 2*350 MW power plant (Hunan); Hanchuang 2*30 MW power plant (Hubei); Xingxang 2*30 MW power plant (Henan); Jiujiang 2*60 mw power plant (Jiangxi).
- Hydraulic Structure Projects for Flood Control Projects. Flood control dam (HeYuan Reservoir) and Meihu canal designs; dam structure and foundation dynamic analysis and structure design; steel flood gates flow simulation and structure design; earthen levee slope stability analysis and designs; canal geometric sizing per proposed capacity; retaining wall stability analysis and structure design (reinforced concrete); channel impacts analysis using hydrologic and hydraulic analysis. Huizhou, China.
- Hydraulic Structure Projects for Dayaowang Nuclear Power Plant. Work included wave protecting seawall structure analysis and structure design; cooling system hydraulic structure designs including pump house, cooling towers and foundations; water intakes and outlets; retaining walls. Dayaowang, China.