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Final Independent External Peer Review Report Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
St. Louis District

Contract No. W911NF-07-D-0001
Task Control Number: 10150
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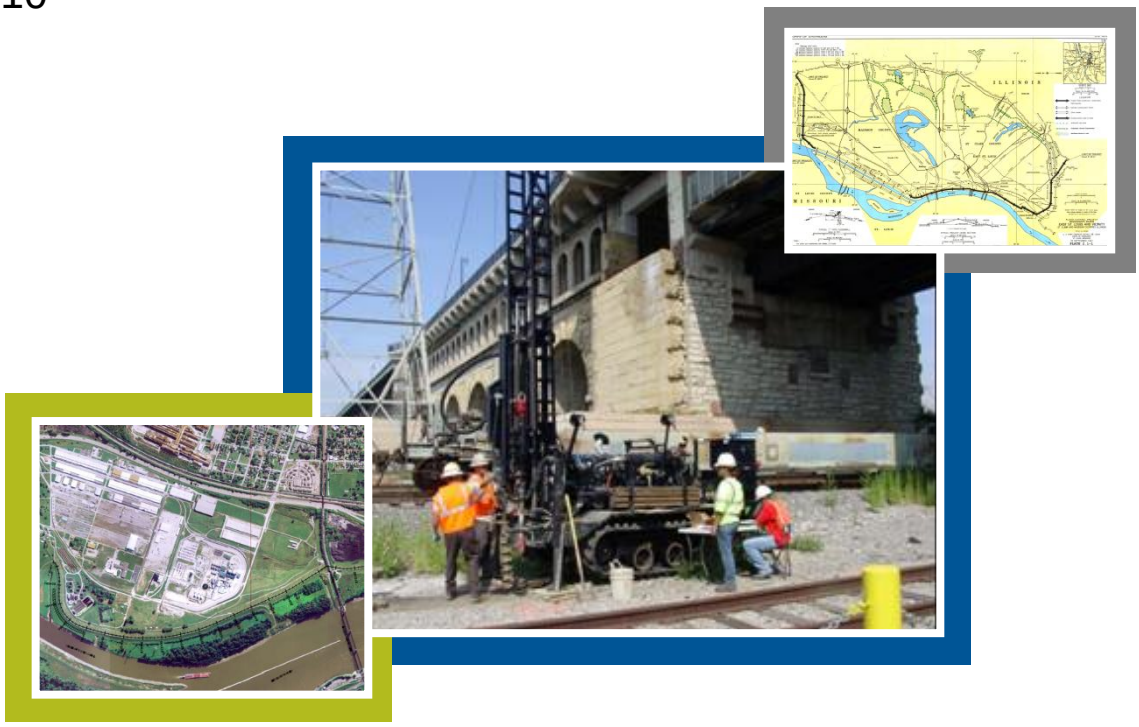
August 3, 2010



SHORT-TERM ANALYSIS SERVICE (STAS)

on

Final Independent External Peer Review Report
Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

by

Battelle
505 King Avenue
Columbus, OH 43201

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Scientific Services Program

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INDEPENDENT EXTERNAL PEER REVIEW REPORT
for the
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EXECUTIVE SUMMARY

The East St. Louis, Illinois Flood Protection Project prepared a Limited Reevaluation Report (LRR) to addresses deficiencies in the Federal design of underseepage and through-seepage controls for the Metro East Sanitary District (MESD) levee. The underseepage analyses used to develop alternative solutions were based on 2009 geotechnical subsurface information and a Mississippi River water surface profile (flood) at 54 ft on the St. Louis gage. Because of the long-term nature of Mississippi River flooding, underseepage problems along the flank levees result from Mississippi flooding rather than from the short-term floods caused by local rainfall. Due to the intense local and regional interest, the LRR report also addresses the deficiencies that would occur during a Mississippi River flood that is 3 feet higher than the theoretical 100-year flood (flood that has a 1 percent chance of occurring in any one given year).

The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project (hereinafter referred to as the East St. Louis LRR). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the East St. Louis LRR. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2010), USACE (2007), and OMB (2004). This final report describes the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Five panel members were selected for the IEPR from more than 16 identified candidates. Based on the technical content of the East St. Louis LRR and the overall scope of the project, the final panel members were selected for their technical expertise in the following key areas: geotechnical engineering, civil engineering, National Environmental Policy Act (NEPA) impact assessment, cost engineering, and economics. Although the Panel was disclosed to USACE, Battelle made the final decision on selecting the Panel.

The Panel received electronic versions of the East St. Louis LRR documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. The draft charge was prepared by Battelle to assist the USACE in the development of the final charge that was to guide the peer review, according to guidance provided in USACE (2010) and OMB (2004).

USACE was given the opportunity to provide comments on the draft charge, and after revisions approved the final charge questions.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the IEPR. Other than this teleconference, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced more than 170 individual comments in response to the 55 charge questions.

IEPR panel members reviewed the East St. Louis LRR documents individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of the following: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. Overall, 20 Final Panel Comments were identified and documented. Of these, five were identified as having high significance, eight had medium significance, and seven had low significance.

Two of the Final Panel Comments discuss the need for an Operations & Maintenance (O&M) Manual for periods when there is a high water event. While similar, these two Final Panel Comments present two distinct issues. One Final Panel Comment states that the O&M Manual should include a recommended levee inspection and monitoring plan for periods when there is water against the levee system based on St. Louis District criteria, while the other Final Panel Comment suggests that USACE develop an internal inspection procedure in addition to the O&M Manual.

Table ES-1 summarizes the Final Panel Comments by level of significance. Detailed information on each comment is contained in Appendix A of this report.

Table ES-1. Overview of 20 Final Panel Comments Identified by the East St. Louis LRR IEPR Panel

Significance – High	
1	Potential hazardous, toxic, and radioactive waste (HTRW) considerations could affect cost, scheduling, and implementation of the tentative recommended plan and should be addressed prior to construction.
2	All potential modes of levee failure and the transition between various levee system components need to be evaluated in the design.
3	The Chain of Rocks Levee is not included in the Limited Reevaluation Report (LRR), although it is part of the overall levee system protecting the Metro East Area and must be able to be certified as providing 100-year flood protection.
4	Constructability of the clay-filled trench option needs to be reconsidered relative to adverse subsurface conditions as they potentially affect construction risk.
5	The selection of a cement bentonite (CB) wall as compared to other cut-off wall types is not well supported.

Significance – Medium	
6	The assumptions and rationale used to perform the cost analysis for the LRR need to be more specific and detailed to fully understand the basis for their development.
7	The LRR needs to address the rationale for the use of semi-pervious berms or the possibility of using other types of berm fill.
8	The subsurface exploration program supporting the seepage analysis should be expanded prior to final design to supplement the available subsurface information.
9	It is unclear how the benefits were derived for each alternative, and the methods for performing the benefit analysis were not fully described and supported.
10	The cumulative effects analysis has been restricted to the project along with its operation and maintenance; the broader consequences of the project need to be considered.
11	The Finding of No Significant Impact (FONSI) portion of the Environmental Assessment (EA) should be revised to expand on areas requiring further study where environmental effects are not completely understood.
12	The supplemental exploration program should include strength testing of embankment and shallow underlying layers to support slope stability analyses.
13	The relocations and potential relocation conflicts and costs need to be described in greater detail.
Significance – Low	
14	Operations, maintenance, repair, replacement, and rehabilitation (OMRRR) considerations have not been fully described.
15	The project operation manual should include a recommended levee inspection and monitoring plan for local sponsors for periods when there is a high water event.
16	USACE should use the current flood profiles for the hydraulic analysis of the flank levees instead of the Mississippi River backwater curves.
17	The recommended design should be refined prior to construction with regard to relief well penetration and spacing.
18	The plan formulation process should describe the trade-off analysis used to select the tentative recommended plan.
19	Several design assumptions or local conditions need to be resolved during final design.
20	The LRR does not address all real estate interests and requirements and therefore does not allow for full comparison across all alternatives.

The Panel agreed that the East St. Louis LRR and Environmental Assessment (EA) were adequate and acceptable in terms of the planning, economic, engineering, and environmental methods, models, and analyses used. The following statements provide a summary of the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A). The Panel generally agreed that the project is technically sound from a geotechnical engineering and NEPA perspective, and that they provide adequate technical detail for the design with respect to the underseepage analysis. Furthermore, it was apparent and appreciated that a great deal of effort went into data gathering, the soil testing program, and the underseepage analyses. However, the Panel also expressed reservations over potential hazardous waste

contamination, design criteria for other modes of levee failure, including levee through-seepage, cost analysis, and constructability.

Economics:
While the tentative recommended plan can be justified on safety issues alone, the lack of supporting information makes it difficult to have confidence in the analytical techniques used or in the resulting conclusions. The use of non-traditional analytical techniques such as low, medium and high categories of damages or the aggregation of a single stage vs. damage curve needs to be carefully and completely described. The Panel also had concerns relating to the cumulative effects analysis and consideration of reasonably foreseeable future actions. Potentially significant benefits that would have a material effect on the economic justification of the project and on the reporting requirements under NEPA were not discussed.

Engineering:

- **Cost Engineering**
  The basis of this LRR cost estimate as presented is to validate the ultimate costs of the project features. It includes the planning, engineering, design, real estate, relocation, and construction tasks with their projected costs. However, a detailed contingency factor (36%) was used to ensure the estimate was sufficient using gross assumptions. This was in lieu of a systematic analysis of the tasks with anticipated costs corrected for inflation and brought to present value. Inclusion of the details of the cost estimate in the LRR, along with all assumptions would have increased the level of confidence in the estimate. The Panel has reservations about the completeness and sufficiency of the cost estimate. Because the cost estimate used such a large contingency factor without including the assumptions and details to back up the analysis, the Panel has determined the cost estimate is insufficient for the purposes of this study.

- **Civil Engineering:**
  Within the context of this project, the civil engineering review included consideration of interior drainage, HTRW, and levee design elevations, as well as consideration of this and adjacent levees as interdependent flood protection systems. The conclusions regarding interior drainage are based on the assumption that the proposed project will not significantly alter current drainage conditions. This appears to be a sound conclusion. Minor changes that are required in pump stations have been adequately addressed at the LRR level. The Panel did identify significant concerns regarding the extent to which HTRW conditions have been identified and incorporated into the project design and cost analysis. A portion of the site is in an area of high risk of encountering contaminants during construction and in the operation of the system. These risks could affect the cost and timely completion of the project. As such, they could impact the overall goal of timely Federal Emergency Management Agency (FEMA) certification. For this and other reasons enumerated in the Panel comments, the Panel suggests that the HTRW issues be addressed more fully during final design. With regard to levee design elevation, the conclusions appear to be reasonable. However, additional information is required relative to the design flood profiles for the flank levees. A significant concern was identified regarding the lack of information related to the status of the Chain of Rock Levee system relative to USACE certification. While this levee is part of

the overall levee system and its performance is integral to the meeting the flood protection objectives for the Metro East area and hence should be addressed.

- **Geotechnical Engineering:**
  The overall approach to the evaluation of the integrity of the levee system involved a systematic program of subsurface exploration and analyses and design of remedial measures for underseepage conditions. However, the geotechnical explorations and analyses conducted for the project have focused on underseepage as the primary geotechnical levee failure mechanism. The levees themselves have not been characterized nor have evaluations of through-seepage, steady-state seepage slope stability, or flood wall stability been presented. During subsequent design, the Panel suggests additional subsurface exploration be conducted to characterize the levee sections and provide the basis to evaluate levees and all potential failure mechanisms, including through-seepage and levee stability. These new data, along with clear presentation of the existing data, will provide an enhanced characterization of subsurface conditions by which to refine final geotechnical design details. The Panel suggests that refined seepage analyses (with regard to an economic analysis of relief well penetrating/spacing and consideration of alterative seepage berm designs) may provide cost and performance benefits. Alternative cut-off wall types including soil-bentonite and deep soil mix walls may result in cost savings and HTRW risk reduction and should be considered during final design. The Panel also suggests that an inspection plan be developed for both local sponsors and the USACE to provide a design-related basis for future inspection and performance evaluation under high water conditions.

Environmental:
The Panel agreed that the EA serves the NEPA process. Data gaps are identified, which is a normal and customary part of NEPA practice, particularly in the case of time-sensitive or emergency projects. The Panel agreed that the East St. Louis LRR and EA represent a time-sensitive, if not an emergency, project. Both documents (the LRR and the EA) describe the contingencies to be considered as the project moves forward. The Panel expressed concern that conclusions reached regarding cumulative effects in the EA are described only with respect to issues related to the flood damage reduction project (both the current project and future maintenance and enhancement) and do not consider, as required, past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. The EA briefly mentions that a positive effect of the project will be enhanced economic growth and development in the study area because of the reduction of flood risk. The potential environmental effects from this growth and development are not discussed. The EA does not seize the opportunity, in this post-Katrina environment, to describe residual flood damage risks in the study area even with the project in place. The Panel is concerned that the FONSI is too brief, considering the data gaps, and suggests that the FONSI be expanded to discuss risks that could manifest as data collection is completed. Risks include extension of the schedule and increased costs. In particular, risks associated with future determination of the level and extent of subsurface contaminants are concerns.

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LIST OF ACRONYMS

ASCE	American Society of Civil Engineers
ASFE	Associated Soil and Foundation Engineers (formerly; now ASFE, Inc.)
ATR	Agency Technical Review
CB	Cement Bentonite
CPT	Cone Penetration Test
DrChecks	Design Review and Checking System
DSM	Deep Soil Mix
EA	Environmental Assessment
EC	Engineer Circular
EM	Engineering Manual
ER	Engineering Regulation
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
GDM	General Design Memorandum
HEC-FDA	Hydrologic Engineering Center Flood Damage Analysis
HTRW	Hazardous, Toxic, and Radioactive Waste
IEPR	Independent External Peer Review
LIDAR	Light Detection and Ranging
LIS	Levee Inspection System Program
LRR	Limited Reevaluation Report
MESD	Metro East Sanitary District
NTP	Notice to Proceed
O&M	Operations & Maintenance
OMRRR	Operations, Maintenance, Repair, Replacement, and Rehabilitation
PED	Planning, Engineering & Design
PDT	Project Delivery Team
ROW	[Project] Right-of-Way
SAME	Society of American Military Engineers
USACE	United States Army Corps of Engineers
VE	Value Engineering

1. INTRODUCTION

The East St. Louis, Illinois Flood Protection Project was authorized by the Flood Control Act of June 22, 1936. The Energy and Water Development Act of 1988 (P.L. 100-202) provided authorization for the East St. Louis Flood Protection Rehabilitation Project. The original authorization directed the Secretary of the Army to accomplish channel rehabilitation and to repair and rehabilitate 14 pump stations and appurtenant works at the East Side Levee and Sanitary District levee (now Metro East Sanitary District levee) in East St. Louis, Illinois. The U.S. Army Corps of Engineers (USACE) Lower Mississippi Valley Division signed a General Design Memorandum (GDM) outlining work to be performed as a result of this authorization on December 10, 1990. This work included extensive relief well rehabilitation.

Investigations conducted after the GDM was finalized and field observations made during the Mississippi River floods of 1993, 1995, and 2008 found that relief well rehabilitation measures constructed as part of the GDM scope were insufficient and the deficiencies in the original design of the levee were primarily responsible for the seepage problems. As a result, the Limited Reevaluation Report (LRR) was prepared to define the nature of the deficiencies, propose alternatives to address the deficiencies, and present a technically sound and viable solution that would enable the Metro East Sanitary District (MESD) levee to satisfy flood protection criteria it was designed to meet.

The LRR report addresses deficiencies in the Federal design of underseepage and through-seepage controls for the MESD levee. The LRR describes the 2009 geotechnical subsurface information, geotechnical and hydraulics analyses, the reaches along the levee where underseepage problems require additional controls, alternative solutions and any needed archeological and environmental mitigation, and cost estimates. The underseepage analyses used to develop alternative solutions were based on 2009 geotechnical subsurface information and a Mississippi River water surface profile (flood) at 54 ft on the St. Louis gage. Because of the long-term nature of Mississippi River flooding, underseepage problems along the flank levees result from Mississippi flooding rather than from the short-term floods caused by local rainfall. Due to the intense local and regional interest, the LRR report also addresses the deficiencies that would occur during a Mississippi River flood that is 3 feet higher than the theoretical 100-year flood (flood that has a 1 percent chance of occurring in any one given year).

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project (hereinafter referred to as the East St. Louis LRR), in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers Engineer Circular *Civil Works Review Policy* (EC No. 1165-2-209) (USACE, 2010), USACE CECW-CP memorandum *Peer Review Process* (USACE, 2007), and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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 East St. Louis LRR. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the East St. Louis LRR. Detailed information on the Final Panel Comments is provided in Appendix A.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2010) and USACE (2007).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the economic, engineering, and environmental analysis of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the East St. Louis LRR was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2010) and in accordance with USACE (2007) and OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

3.1 Planning and Schedule

After receiving the notice to proceed (NTP), Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 defines the schedule followed in executing the IEPR. Table 1 is based on receipt of approval from the USACE Contracting Officer to begin initial work on the project (i.e., Pre-award funding approval) on May 14, 2010. Note that the work items listed in Task 7 occur after the submission of this report. Battelle will enter the 20 Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle.

Table 1. East St. Louis LRR IEPR Schedule

TASK	ACTION	DUE DATE
1	Pre-Award Funding approval[a]	May 14, 2010
	Notice to Proceed (NTP)	May 26, 2010
	Review documents available	May 14, 2010
	Battelle prepares draft Work Plan[b]	May 28, 2010
	USACE provides comments on draft Work Plan	June 7, 2010
2	Battelle prepares conflict of interest (COI) questionnaire	May 19, 2010
	USACE provides comments on COI questionnaire	May 19, 2010
	Battelle provides list of selected panel members[b]	May 28, 2010
	USACE provides comments on selected panel members	June 2, 2010
	Battelle completes subcontracts for panel members	June 16, 2010
3	Battelle submits draft charge[b]	May 28, 2010
	USACE provides comments on draft charge	June 7, 2010
	Battelle submits final Work Plan, including final charge[b]	June 10, 2010
	USACE approves final Work Plan, including final charge	June 11, 2010
4	Kick-off meeting convened with USACE and Battelle	May 19, 2010
	Battelle sends review documents to panel members	June 17, 2010
	Kick-off meeting convened with Battelle and IEPR Panel	June 18, 2010
	Kick-off meeting convened with USACE, Battelle, and IEPR Panel	June 18, 2010
5	Panel members complete their review	July 2, 2010
	Battelle consolidates comments from IEPR Panel	July 7, 2010
	Convene Panel review teleconference	July 7, 2010
	Panel provides draft Final Panel Comments to Battelle	July 15, 2010
	Battelle submits working draft Final Panel Comments to USACE via e-mail (pdf document)	July 21, 2010
6	Battelle submits final IEPR Report to USACE[b]	August 3, 2010
7[c]	Battelle inputs Final Panel Comments to DrChecks	August 4, 2010
	USACE provides draft Evaluator Responses via e-mail (Word document)	August 10, 2010
	Teleconference convened with USACE, Battelle, and IEPR Panel to discuss Final Panel Comments	August 17, 2010
	USACE inputs final Evaluator Responses to Final Panel Comments in DrChecks	August 24, 2010
	Battelle inputs the Panel's BackCheck Responses in DrChecks	August 30, 2010
	Battelle submits pdf of DrChecks file and closes out DrChecks[b]	August 30, 2010
	Project Closeout	December 8, 2010

[a] Requested to start on recruitment to meet the aggressive schedule

[b] Deliverable

[c] Task occurs after the submission of this report.

3.2 Identification and Selection of IEPR Panel Members

The candidates for the IEPR Panel were evaluated based on their technical expertise in the following key areas: geotechnical engineering, civil engineering, National Environmental Policy Act (NEPA) impact assessment, cost engineering, and economics. These areas correspond to the technical content of the East St. Louis LRR and overall scope of the East St. Louis LRR project.

To identify candidate panel members, Battelle reviewed experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle initially identified more than 16 candidates for the Panel, evaluated their technical expertise, and inquired about potential conflicts of interest. Of these, Battelle chose nine of the most qualified candidates and confirmed their interest and availability. Of the nine candidates, five were proposed for the final Panel and four were proposed as backup reviewers. Information about the candidate panel members, including brief biographical information, highest level of education attained, and years of experience, was provided to USACE for feedback. Battelle made the final selection of panel members according to the selection criteria described in the Work Plan.

The five proposed primary reviewers constituted the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed conflicts of interest, or lack of the precise technical expertise required.

The candidates were screened for the following potential exclusion criteria or conflicts of interest.[1] These COI questions were intended to serve as a means of disclosure, and to better characterize a potential candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the IEPR Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Involvement by you or your firm[2] in the East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report and supporting appendices.
- Involvement by you or your firm[2] in flood control and levee design and evaluation within the East St. Louis, Granite City, and Mississippi River region above the Ohio and Mississippi River confluence.
- Involvement by you or your firm[2] in the East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report related projects.
- Current employment by the U.S. Army Corps of Engineers (USACE).

[1] 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 OMB (2004, 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."

[2] Includes any joint ventures in which your firm is involved.

- Involvement with paid or unpaid expert testimony related to East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report.
- Current or previous employment or affiliation with members of the cooperating agencies or local sponsors, including Metro East Sanitary District (MESD), Madison County Flood Protection District, St. Clair County Flood Protection District, East-West Gateway Council of Governments, U.S. Environmental Protection Agency, and Illinois Environmental Protection Agency (for pay or *pro bono*).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or children related to East St. Louis, Granite City, and Mississippi River region above the Ohio and Mississippi River confluence region.
- Current personal involvement with other USACE projects, including authoring any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the St. Louis District.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the St. Louis District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the St. Louis District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning flood control and levee design and evaluation and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report.
- Participation in relevant prior Federal studies relevant to this project and/or East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report including:
    a. Remedial Investigation/Feasibility Study at the Sauget Area 2 Superfund Site
- Participation in prior non-Federal studies relevant to this project and/or East St. Louis Flood Protection Design Deficiency Correction Limited Reevaluation Report.

- Is there any past, present or future activity, relationship or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

In selecting the final members of the Panel from the list of candidates, Battelle chose experts who best fit the expertise areas and had no conflicts of interest. The five final reviewers were either affiliated with consulting companies or were independent engineering consultants. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of conflicts of interest through a signed Conflict of Interest form. Although the Panel was disclosed to USACE, Battelle made the final decision on selecting the Panel. Section 4 of this report provides names and biographical information on the panel members.

Prior to beginning their review and within 2 days of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication, and other pertinent information for the Panel.

3.3 Preparation of the Charge and Conduct of the IEPR

Battelle drafted a preliminary charge document, including specific charge questions and discussion points. The charge was prepared by Battelle to assist the USACE in the development of the charge questions that will guide the peer review, according to guidance provided in USACE (2010) and OMB (2004). The draft charge was submitted to the USACE for evaluation as part of the draft Work Plan. USACE provided comments and revisions to the draft charge, which were used to produce the final charge. The final charge was submitted to USACE for approval. In addition to a list of 55 charge questions/discussion points, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Battelle planned and facilitated a final kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meeting, the IEPR Panel received an electronic version of the East St. Louis LRR documents and the final charge. A full list of the documents reviewed by the Panel is provided in Appendix B of this report. The Panel was instructed to address the charge questions/discussion points within a comment-response form provided by Battelle.

3.4 Review of Individual Comments

The Panel produced approximately 175 individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle was able to summarize the 175 comments into a preliminary list of 26 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

Battelle facilitated a 4-hour teleconference with the Panel so that the panel experts, many of whom are from diverse scientific backgrounds, could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the IEPR Report and decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to nine specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and all sets of comments were determined not to be conflicting. Each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

At the end of these discussions, the Panel identified 20 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared a summary memorandum for the Panel documenting each Final Panel Comment (organized by level of significance). The memorandum provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the East St. Louis LRR:

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.
- Directive to the Lead: Each lead was encouraged to communicate directly with other IEPR panel members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Comments: Each Final Panel Comment was presented as part of a four-part structure:
    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)

3. Significance (high, medium, low; see description below)
4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
  1. High: Describes a fundamental problem with the project that could affect the recommendation or justification of the project
  2. Medium: Affects the completeness or understanding of the reports/project
  3. Low: Affects the technical quality of the reports but will not affect the recommendation of the project.
- Guidance for Developing the Recommendation(s): The recommendation was to include specific actions that the USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

At the end of this process, 20 Final Panel Comments were prepared and assembled. Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle's Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of primary and backup candidate panel members (which were screened for availability, technical background, and conflicts of interest), and provided it to USACE for feedback. Battelle made the final selection of panel members.

An overview of the credentials of the final five primary members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each panel member and his or her area of technical expertise is presented in the text that follows the table.

Table 2. East St. Louis LRR IEPR Panel: Technical Criteria and Areas of Expertise

	Fowler	Spaulding	Rudolph	Nelson	Crouch
Cost Engineering (one expert needed)	**X**				
Professional Engineer with minimum of 10 years demonstrated experience in preparing cost estimates for civil engineering studies and flood control works	X				
Familiar with the latest version of MCACES (MII) (3.01 version 2.0)	X				
Geotechnical Engineering (one expert needed)		**X**			
Professional Engineer with a minimum 10 years demonstrated experience in geotechnical studies and design of flood control works including:		X	X		
Expertise in levee underseepage and design and construction of relief wells		X	X		
Expertise in slurry wall design and construction		X	X		
Familiar with geotechnical practices used in the Mississippi River Flood Plain		X	X		
Active participation in related professional engineering and scientific societies		X	X		
Minimum M. S. degree or equivalent in geotechnical engineering		X	X		
Civil Engineering (one expert needed)			**X**		
Professional Engineer with a minimum 10 years demonstrated experience in civil engineering studies and design of flood control works including:			X		
Access to work sites			X		
Disposition of excavated contaminated soil material			X		
Design and construction of auxiliary features to relief wells and slurry walls			X		
Experience with hazardous waste			X		
Experience with aquifer protection			X		
M.S. degree or higher in civil engineering			X		
Economics (one expert needed)				**X**	
10 years of economics work experience				X	
Experience performing benefit cost analysis				X	

	Fowler	Spaulding	Rudolph	Nelson	Crouch
Experience with evaluation and comparison of benefit and cost recommendations for deficiency correction studies				X	
M.S. degree or higher in economics					
NEPA Impact Assessment (one expert needed)					**X**
Minimum 10 years demonstrated experience in evaluation and conducting NEPA impact assessments for complex, multi-objective public works projects with competing trade-offs					X
Experience in performing cumulative effects analysis for complex, multi-objective public works projects with competing trade-offs					X
Experiencing determining scope and methodologies for impact assessment and analyses for a variety of projects and programs with high public and interagency interests and having project impact to nearby sensitive habitats					X
Active participation in related professional societies is encouraged					X
Minimum M.S. degree or higher in appropriate field of study					X

C. Deane Fowler, P.E.
Role: Cost Engineering
Affiliation: HDR Engineering, Inc.

Mr. Fowler is a senior program manager specializing in program, project, facilities, and construction contract management. He earned his M.S. in Construction Management from the University of Florida in 1986. He has over 33 years of experience in civil engineering and construction contract management and is a licensed professional engineer in Florida and Virginia. During his active duty with the USACE (1976 –1998) he served as Jacksonville District Deputy Commander and oversaw construction of a thin arched double recurve dam and a major flood control project in a heavily urbanized area. He has experience with large civil works projects, and was the senior officer/project manager on numerous USACE water resource/civil works projects such as the Gulf of Mexico Hurricane protection project and St. Charles Parish Flood Reduction projects. He is familiar with flood control construction practices and the related cost and construction management procedures, and has developed cost estimates for cost estimate studies and general inspection and feasibility studies for water resource, flood control and hurricane protection projects. Mr. Fowler is skilled in the use of many USACE economic and design models, and is familiar with the latest version of MCACES (3.01 version 2.0), having utilized it most recently when reviewing the alternative analysis for the Morganza to the Gulf Hurricane Protection Project. He is also experienced with the disposal of contaminated and non-contaminated soils and dredged material and was the project principal on several Defense Environmental Restoration Program -Formerly Used Defense Sites (DERP-FUDS) in Puerto Rico and the U.S. Virgin Islands. He is experienced with the IEPR process, and has participated on previous team reviews for two USACE Jacksonville District programs as a civil design/cost engineering panelist. He is a Life Member and Fellow of the Society of American Military Engineers (SAME), Life Member of Chi Epsilon, a National Program Management Professional, a National Construction Documents Technologist, and a member of Project Management Institute (PMI).

Douglas Spaulding, P.E.
Role: Geotechnical Engineering
Affiliation: Spaulding Consultants, LLC

Mr. Spaulding is a Principal and geotechnical engineer responsible for dam, levee and floodwall design and inspection, with areas of expertise related to water resource projects. He earned his MSCE from Purdue University, and is a Certified Professional Engineer in Wisconsin, Michigan, and Minnesota. He has over 40 years of experience as a geotechnical engineer and served as Chief of Levee and Channel Design Section for USACE from 1973 and 1978. He has facilitated Potential Failure Mode Analysis for over 50 earth, arch and gravity dams throughout the United States and has served as the principal geotechnical designer for six levee and flood control projects including in the Red River valley. He was responsible for the design of the relief well and seepage control system for the $100 million Mankato Flood Control Project, including the design and installation of seepage berms and over 50 relief wells located in an urban setting. Mr. Spaulding also supervised the design of a seepage collection trench using finite element evaluation for the Winona Flood Control Project. Other recent project experience includes developing embankment stabilization designs for three pervious fill hydroelectric embankments

founded on pervious foundations utilizing finite element seepage techniques requiring correlation of permeability and seepage results with existing piezometer and observation well readings. He is experienced with slurry wall construction, including a recent preliminary design for dewatering of a private hydroelectric project located at three USACE lock and dams in Louisiana, and was involved in the overall review of the slurry trench for the Saylorville Flood Control Dam, Idaho. He is familiar with geotechnical practices in the Mississippi River Flood Plain, having managed the geotechnical design aspects of levee and flood wall construction for projects in Winona, MN and St. Paul, MN, and for the construction of seven miles of emergency levee during "Operation Foresight" at La Crosse, WI. Mr. Spaulding also independently developed the seepage related equations used in the Waterways Experiment Station publication for under-seepage (TM-424),including equations currently used for semi-pervious and impervious berms that are currently included in the USACE Engineering Manual for Seepage. He is a member of the American Society of Civil Engineers (ASCE), the Minnesota Geotechnical Society, SAME, and a member of the American Arbitration Association.

R. William Rudolph, P.E.

Role: Civil Engineering
Affiliation: Independent Consultant

Mr. Rudolph is an independent consultant serving as principal engineer and project manager on a wide variety of geotechnical engineering projects. He earned his M.S. degree in geotechnical engineering from Berkley, CA in 1978 and holds both his Civil and Geotechnical Engineering professional licenses in California. He has over 30 years of experience in the geotechnical and civil engineering fields, specializing in port and harbor facilities, flood control, earth-fill dams and levees, water resources, dredging and environmental restoration projects, and mass transit, bridge and highway improvements. Mr. Rudolph has provided consulting services for more than 150 small, earth-fill dam and reservoir projects involving site selection, geologic and seismic assessment, material sources and design alternatives, and supervision of the construction management. Examples include the Galbraith Upland Dredge Material Disposal Facility Port of Oakland, CA; Redwood Shores Levee Evaluation, Redwood City, CA; and Levee Assessment, Bel Marin Keys Unit V, Marin County, CA. His civil engineering projects have included small earth-fill dams, lined and unlined canals, weirs, pump stations, pipelines, flood walls and bulkheads. However, many larger projects sites included difficult work access. For instance, a helicopter was required for site investigation, design and construction of temporary trestles to span sensitive structures and habitats. Other difficult sites, such as marine or riverine works required the use of a boat or barge to access the site.

Mr. Rudolph is experienced with design and construction of auxiliary features to relief wells and slurry wall, having designed levee-top roadways, penetrations through slurry walls, drainage facilities, underdrains, and relief wells. He has extensive experienced in handling hazardous waste, having investigated and characterized soil and groundwater contamination sites for military bases as well as many local, state, and federally regulated sites. His experience includes several projects involving aquifer protection, including the Alameda County Water District Saltwater intrusion Barrier project and the aquifer protection study for the Port of Oakland, CA harbor deepening project. Mr. Rudolph is an active member of ASCE and the Geo-institute, ASFE, and is a corresponding member of the ASCE 7-10 SSC.

Eric Nelson
Role: Economist
Affiliation: Independent Consultant

Mr. Nelson is an independent consultant and study manager specializing in plan formulation and economics. He earned his B.A. in Economics from the University of Tennessee in 1975 and has over 25 years of experience in water resources planning with a focus on flood damage reduction. He was a USACE plan formulator/economist for 27 years (1979 –2006), and is experienced with all phases of the USACE plan formulation standards. His primary field of expertise is in flood damage reduction projects and he is familiar with the USACE ER 1105 Series regulations. His experience includes comprehensive water resource planning, deep draft navigation, and environmental restoration and he has served as both an economist and plan formulator for a number of diverse projects for state, local and international clients. Mr. Nelson's expertise in benefit cost analysis is reflected in his experience as lead economist on the Pearl River Flood Damage Reduction Study in Jackson, MS and the Village Creek Flood Damage Reduction Study in Birmingham, AL. His knowledge and experience in ecosystem restoration and multipurpose planning cumulative effects analyses, and multipurpose planning is reflected in his role as plan formulator and contract manager of the multi-state project Comprehensive Water Resource Planning for the Apalachicola, Chattahoochee and Flint River Basins and the Alabama, Coosa, Tallapoosa River Basins in Alabama, Georgia, and Florida. Every major category of benefits associated with the regulated flows of both basins – navigation, flood control, hydropower, low flows for endangered species, and recreation – was analyzed for this project. Among the project's requirements were the planning of water resource demand for inland navigation, hydropower production, municipal and industrial water supply, endangered species, and other economic and social needs. He also is familiar with USACE hydrologic models and is experienced in the use of HEC-FDA. Mr. Nelson is a graduate of the 1986-87 class of Planning Associates from the Board of Engineers for Rivers and Harbors.

Kay Crouch
Role: NEPA Impact Assessment
Affiliation: Crouch Environmental Services, Inc.

Ms. Crouch is president of Crouch Environmental Services, Inc. She specializes in NEPA analysis and document preparation, wetlands permitting and mitigation, environmental site assessments, and public involvement for projects with high public and interagency interests. She earned her M.S. in biology/ecology in 1978 from Steven F. Austin State University and received additional academic training in the NEPA process from the Duke University Nicholas School of the Environment (2004-05). Ms. Crouch has 32 years of nationwide experience in environmental site assessment and inventories, permitting, and evaluation and conducting NEPA impact assessments for complex multi-objective public works projects with competing trade-offs. Her NEPA-related experience includes the development of the Environmental Impact Statement (EIS) for the Bayport Container Terminal; public involvement for the Sabine Neches Waterway Expansion and the Clear Creek Flood Damage Reduction Project; and NEPA documentation for dozens of transportation projects, liquefied natural gas facilities, parks, container terminals, and other facilities, many having potential impacts to nearby sensitive environments. Ms. Crouch routinely performs cumulative effects analyses on public works

projects with high public and interagency interests as part of her extensive NEPA practice. She recently drafted an expanded EA for the Port of Houston Authority and the USACE for a dredged material placement area on the north side of the Houston Ship Channel in Harris County, TX. She has substantial experience working with USACE on flood damage reduction and dam safety projects as well as for local sponsors (e.g., the Harris County Flood Control District, Galveston County, the Brazoria County Drainage District #4, and the City of Alvin, TX). Specific projects include the Clear Creek Flood Damage Reduction Project and the Greens Bayou Flood Damage Reduction Project. Recently, Ms. Crouch planned, organized and executed a public outreach plan for the Addicks and Barker Dam Safety Program (Houston, TX). This effort was declared a "Best Practice" by USACE, and Ms. Crouch and her staff received a written commendation from the Commander of the Galveston District. Ms. Crouch is a member of the Society of Wetland Scientists and Women in Transportation (WTS), and she is the founder and president of fundmyresearch.org.

5. SUMMARY OF FINAL PANEL COMMENTS

The Panel agreed that the East St. Louis LRR and EA were adequate and acceptable in terms of the planning, economic, engineering, and environmental methods, models, and analyses used. The following statements provide a summary of the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A). The Panel generally agreed that the project is technically sound from a geotechnical engineering and NEPA perspective, and that the Limited Reevaluation Report and Environmental Assessment provide adequate technical detail for the design with respect to the underseepage analysis. Furthermore, it was apparent and appreciated that a great deal of effort went into data gathering, the soil testing program, and the underseepage analyses. However, the Panel also expressed reservations over potential hazardous waste contamination, design criteria for other modes of levee failure, including levee through-seepage, cost analysis, and constructability.

Economics:
While the tentative recommended plan can be justified on safety issues alone, the lack of supporting information makes it difficult to have confidence in the analytical techniques used or in the resulting conclusions. The use of non-traditional analytical techniques such as low, medium and high categories of damages or the aggregation of a single stage vs. damage curve needs to be carefully and completely described. The Panel also had concerns relating to the cumulative effects analysis and consideration of reasonably foreseeable future actions. Potentially significant benefits that would have a material effect on the economic justification of the project and on the reporting requirements under the National Environmental Policy Act were not discussed.

Engineering:

- **Cost Engineering**
  The basis of this LRR cost estimate as presented is to validate the ultimate costs of the project features. It includes the planning, engineering, design, real estate, relocation, and construction tasks with their projected costs. However, a detailed contingency factor (36%) was used to ensure the estimate was sufficient using gross assumptions. This was in lieu of a systematic analysis of the tasks with anticipated costs corrected for inflation and brought to

present value. Inclusion of the details of the cost estimate in the LRR, along with all assumptions would have increased the level of confidence in the estimate. The Panel has reservations about the completeness and sufficiency of the cost estimate. Because the cost estimate used such a large contingency factor without including the assumptions and details to back up the analysis, the Panel has determined the cost estimate is insufficient for the purposes of this study.

- **Civil Engineering:**
  Within the context of this project, the civil engineering review included consideration of interior drainage, HTRW, and levee design elevations, as well as consideration of this and adjacent levees as interdependent flood protection systems. The conclusions regarding interior drainage are based on the assumption that the proposed project will not significantly alter current drainage conditions. This appears to be a sound conclusion. Minor changes that are required in pump station capacity have been adequately addressed at the LRR level. The Panel did identify significant concerns regarding the extent to which HTRW conditions have been identified and incorporated into the project design and cost analysis. A portion of the site is in an area of high risk of encountering contaminants during construction and in the operation of the system. These risks could affect the cost and timely completion of the project. As such, they could impact the overall goal of timely Federal Emergency Management Agency (FEMA) certification. For this and other reasons enumerated in the Panel comments, the Panel suggests that the HTRW issues be addressed more fully during final design. With regard to the riverfront levee design elevation, the conclusions appear to be reasonable. However, additional information is required relative to the design flood profiles for the flank levees. A significant concern was identified regarding the lack of information related to the status of the Chain of Rock east levee portion of the overall levee system relative to FEMA certification. Since this levee is part of the overall levee system, its performance is integral to the meeting the flood protection objectives for the Metro East area and hence should be addressed.

- **Geotechnical Engineering:**
  The overall approach to the evaluation of the integrity of the levee system involved a systematic program of subsurface exploration, analyses and design of remedial measures for underseepage conditions. However, the geotechnical explorations and analyses conducted for the project have focused on underseepage as the primary geotechnical levee failure mechanism. The levees themselves have not been characterized nor have evaluations of through-seepage, steady-state seepage slope stability, or flood wall stability been presented. During subsequent design, the Panel suggests additional subsurface exploration be conducted to characterize the levee sections and provide the basis to evaluate all potential failure mechanisms including through-seepage and levee stability. These additional data, along with a clear presentation of the existing data, will provide an enhanced characterization of subsurface condition and allow refinement of the final geotechnical design details. The Panel suggests that additional design procedures be employed to provide an economic analysis of relief well penetrating/spacing and consideration of alternative seepage berm designs. These procedures may provide cost and performance benefits. Alternative cut-off wall types including soil-bentonite and deep soil mix walls may result in cost savings and HTRW risk reduction and should be considered during final design. The Panel also suggests that an

inspection plan be developed for both local sponsors and that the USACE provide a design related basis for future inspection and performance evaluation under high water conditions.

Environmental:
The Panel agreed that the EA serves the NEPA process. Data gaps are identified, which is a normal and customary part of NEPA practice, particularly in the case of time-sensitive or emergency projects. The Panel agreed that the East St. Louis LRR and EA represent a time-sensitive, if not an emergency, project. Both documents (the LRR and the EA) describe the contingencies to be considered as the project moves forward. The Panel expressed concern that conclusions reached regarding cumulative effects in the EA are described only with respect to issues related to the flood damage reduction project (both the current project and future maintenance and enhancement) and do not consider, as required, past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. The EA briefly mentions that a positive effect of the project will be enhanced economic growth and development in the study area because of the reduction of flood risk. The potential environmental effects from this growth and development are not discussed. The EA does not seize the opportunity, in this post-Katrina environment, to describe residual flood damage risks in the study area even with the project in place. The Panel is concerned that the FONSI is too brief, considering the data gaps, and suggests that the FONSI be expanded to discuss risks that could manifest as data collection is completed. Risks include extension of the schedule and increased costs. In particular, risks associated with future determination of the level and extent of subsurface contaminants are concerns.

Table 3 lists the 20 Final Panel Comment statements by level of significance.

Table 3. Overview of 20 Final Panel Comments Identified by the East St. Louis LRR IEPR Panel

Significance – High	
1	Potential hazardous, toxic, and radioactive waste (HTRW) considerations could affect cost, scheduling, and implementation of the tentative recommended plan and should be addressed prior to construction.
2	All potential modes of levee failure and the transition between various levee system components need to be evaluated in the design.
3	The Chain of Rocks Levee is not included in the Limited Reevaluation Report (LRR), although it is part of the overall levee system protecting the Metro East Area and must be able to be certified as providing 100-year flood protection.
4	Constructability of the clay-filled trench option needs to be reconsidered relative to adverse subsurface conditions as they potentially affect construction risk.
5	The selection of a cement bentonite (CB) wall as compared to other cutoff wall types is not well supported.
Significance – Medium	
6	The assumptions and rationale used to perform the cost analysis for the LRR need to be more specific and detailed to fully understand the basis for their development.
7	The LRR needs to address the rationale for the use of semi-pervious berms or the possibility of using other types of berm fill.
8	The subsurface exploration program supporting the seepage analysis should be expanded prior to final design to supplement the available subsurface information.
9	It is unclear how the benefits were derived for each alternative, and the methods for performing the benefit analysis were not fully described and supported.
10	The cumulative effects analysis has been restricted to the project along with its operation and maintenance; the broader consequences of the project need to be considered.
11	The Finding of No Significant Impact (FONSI) portion of the Environmental Assessment (EA) should be revised to expand on areas requiring further study where environmental effects are not completely understood.
12	The supplemental exploration program should include strength testing of embankment and shallow underlying layers to support slope stability analyses.
13	The relocations and potential relocation conflicts and costs need to be described in greater detail.
Significance – Low	
14	Operations, maintenance, repair, replacement, and rehabilitation (OMRRR) considerations have not been fully described.
15	The project operation manual should include a recommended levee inspection and monitoring plan for local sponsors for periods when there is a high water event.
16	USACE should use the current flood profiles for the hydraulic analysis of the flank levees instead of the Mississippi River backwater curves.

17	The recommended design should be refined prior to construction with regard to relief well penetration and spacing.
18	The plan formulation process should describe the trade-off analysis used to select the tentative recommended plan.
19	Several design assumptions or local conditions need to be resolved during final design.
20	The LRR does not address all real estate interests and requirements and therefore does not allow for full comparison across all alternatives.

6. REFERENCES

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USACE (2007). Peer Review Process. Department of the Army, US Army Corps of Engineers, Washington, DC. CECW-CP Memorandum. March 30.

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APPENDIX A

Final Panel Comments

on the

Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

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Comment 1:

Potential hazardous, toxic, and radioactive waste (HTRW) considerations could affect cost, scheduling, and implementation of the tentative recommended plan and should be addressed prior to construction.

Basis for Comment:

Section 4.6 and Appendix H of the Limited Reevaluation Report (LRR) identify potential HTRW contamination issues that have been identified between Decision Segments 1110+00 and 1312+60. These include two U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (Superfund) sites and one EPA Resource Conservation and Recovery Act site, a pipeline, and a large petroleum storage facility. These sites are adjacent to and upgradient from the project levee alignment. According to the LRR and Appendix A, contaminated soil and groundwater may well be present at the location of the proposed new relief wells, cutoff walls, and seepage berms due to the disposal of hazardous material along the alignment and the migration of contaminants from adjacent upgradient sites.

Appendix H summarizes the adjacent contamination issues and regulatory actions but provides no specific assessment of soil or groundwater contamination that may be encountered during construction or operation of the improvements detailed in the LRR. A limited Phase II Environmental Site Assessment is proposed during an initial phase of construction to evaluate these HTRW issues. However, it is the Panel's opinion that waiting to characterize the HTRW issues until construction may result in significant cost overruns and schedule delays. The identification of contamination from HTRW sites during construction could impact planned construction methods, details, and soil/water disposal options. Currently unresolved HTRW issues impact the completeness and understanding of key project requirements. Unrecognized HTRW issues also potentially affect worker safety during construction.

By addressing this issue prior to construction, the USACE can:

- More accurately identify which segments of the project are affected.
- Refine estimates of the quantity and characteristics of waste that will be generated and required disposal during construction activities.
- Evaluate appropriate and cost-effective disposal options.
- Evaluate HTRW design considerations for project elements, including relief well and cutoff wall details.
- Evaluate potential water quality during flood stage relief well operation and discharge requirements.
- Reduce the risk of worker exposure to undiscovered contaminants.
- Reduce contractor liability and potential USACE liability for worker exposure.
- Provide substantive information for a site-specific Health and Safety Plan for construction.

Significance – High:
If the HTRW issues are left unresolved until construction, unanticipated HTRW conditions may impact both project costs and the schedule for project completion and levee certification.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. A description of studies that would be done prior to preparation of plans and specifications. The description would need to address the following: a. Investigation of soil and groundwater contamination along the potentially affected portion of the alignment during the design phase. b. Identification of specific disposal options for contaminated soil and groundwater. c. Design of HTRW details. d. A framework to obtain EPA and other regulatory agency concurrence prior to construction.

Comment 2:

All potential modes of levee failure and the transition between various levee system components need to be evaluated in the design.

Basis for Comment:

The geotechnical evaluation of the levees has focused primarily on underseepage as the potential mode of failure. However, it is the Panel's opinion that other potential failure modes, including through-seepage and steady-state seepage stability, have not been considered. The limited description of previous levee distress during historical flood events suggests that some of the past distress has included inboard slumps, further suggesting that through-seepage (and the resulting slope instability) may also be contributing to the levee failure mechanism.

EM 1110-2-1913 "Design and Construction of Levees" states that levees need to be analyzed for underseepage and through-seepage, slope stability, settlement, and trafficability (i.e., appropriate surface for anticipated traffic) of the levee surface. While settlement and trafficability may be secondary issues in this case, through-seepage and slope stability issues may impact the final design requirement and costs.

In addition, no details or analyses of the "I-walls" floodwall, which is a water-retention element within the levee system, are provided in the LRR. Floodwall failures and the transitions between flood walls and levee embankments have been a significant cause of levee system failures, most notably in New Orleans during Hurricane Katrina. EM 1110-2-2502 "Retaining Wall and Flood Walls" provides guidance for evaluating such systems.

Significance – High:

A complete analysis of levee failure mechanisms, including through-seepage, slope stability, and flood walls, is needed to confirm that levees meet USACE standards for levee design and can be certified by the Federal Emergency Management Agency (FEMA).

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A description of how the following items would be addressed prior to development of plans and specifications:
   a. Potential levee through-seepage.
   b. Levee slope stability, particularly for steady-state seepage conditions.
   c. The stability and seepage cutoff design of the "I-walls."
   d. The transitions between "I-wall" and embankment levee sections as well as the transitions between other levee details.
2. Identification of any additional remedial measures required to satisfy seepage or stability design criteria. These measures should be included in plan formulation.

Comment 3:
The Chain of Rocks levee is not included in the Limited Reevaluation Report (LRR), although it is part of the overall levee system protecting the Metro East Area and must be able to be certified as providing 100-year flood protection.
Basis for Comment:
The LRR states in paragraph 3.1.1, Location that, "The 9-mile long Chain of Rocks levee and the Metro East Sanitary District (MESD) levee are part of the same levee system." Nowhere else in the report or in the appendices is there mention of any investigation or description of any problems during flooding events with the Chain of Rocks east levee. This discrepancy needs to be fully clarified, particularly as it may apply to completeness of planning, levee certification, and/or the level of protection provided by both portions of the levee system. The report needs to summarize the design, construction, and operation and maintenance of the Chain of Rocks levee system relative to USACE and FEMA criteria to assure relatively uniform compatibility of the levee system. The rationale for excluding the Chain of Rocks east levee needs to explain why this exclusion does not impact project planning. Any coordination with FEMA and/or the sponsor(s) regarding this issue needs to be included.
Significance – High:
Unless it can be unequivocally shown that the Chain of Rocks east levee equals or exceeds the level of protection sought for the MESD levees, it may not be possible to achieve the stated objectives of levee certification or the level of protection afforded by the tentative recommended plan.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. A section explaining how the Chain of Rocks east levee fits into the overall East St. Louis Flood Protection Project system.

Comment 4:

Constructability of the clay-filled trench option needs to be reconsidered relative to adverse subsurface conditions as they potentially affect construction risk.

Basis for Comment:

As stated in Section 4.10 (Plan Formulation Approach), the Value Engineering (VE) team suggested using a clay-filled trench to cut off seepage through an 8-foot-thick sand lens from Station 824+20 to 860 +60 instead of a slurry trench cutoff at the levee centerline (the original recommendation). The VE recommendation was made due to the presence of large gas lines near the levee.

The geotechnical cross sections from this levee segment show standing surface water at the outboard toe of the levee in the area where the clay-filled trench is planned. Excavation of the trench will penetrate the saturated sand layer, which will be exposed in the trench wall. It is the Panel's opinion that significant seepage, erosion, and slope instability would likely occur within these saturated sands. As a result, the temporary slopes associated with clay-filled trench construction may need to be reduced to relatively flat slopes, thereby encroaching on the levee crest. Shoring may be needed to provide adequate temporary stability and cutoff groundwater during construction. In addition, the soils below the sand layer are generally soft saturated clays and may be weak and unstable at the excavation base. The use of a slurry cutoff trench would mitigate the construction risk associated with placing and compacting clay in an open trench and hence may be a preferred method of construction.

Given the anticipated subsurface soil and groundwater conditions, significant dewatering and construction slope instability are likely with the proposed open-cut construction method. It may also be difficult to properly compact the clay trench fill over the soft trench subgrade.

Significance – High:

Use of the clay-filled trench construction method could impact project cost, schedule, and the quality/feasibility of the cutoff in the affected reach.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A section addressing the constructability of the proposed clay-filled trench alternative.
2. Temporary slope stability analysis to consider seepage and the soft soil strengths.

Comment 5:

The selection of a cement bentonite (CB) wall as compared to other cut-off wall types is not well supported.

Basis for Comment:

The LRR states that three slurry cutoff walls were considered during the study: CB, soil-bentonite (SB), and soil-cement-bentonite walls. The LRR then indicates that CB walls were selected for the project due to concerns about the wall depth and global stability. A different wall type may reduce wall stability risks and may minimize costs associated with handling and disposal of contaminated soils.

Review of Appendix H (HTRW Considerations Section 3.2.4.1 Site R) indicates that a SB wall was successfully used to depths of up to 143 feet in the project area. The SB wall has a significant cost advantage that substantially reduces soil disposal.

Additional consideration should be given to conventional SB walls. In addition, where trench stability and/or limited working space concerns exist, deep soil mix (DSM) walls should also be evaluated, particularly where soil and groundwater contamination is known or thought to exist. The Panel believes that DSM walls will eliminate trench stability issues and maximize soil reuse. While the DSM method may be more costly than a CB wall, this cost increase may offset a reduction in costs associated with handling and disposal of contaminated soil/groundwater.

Both the SB and DSM methods are currently being used for the Natomas Levee Improvement Program, which is part of the federally authorized American River Common Features project within the USACE Sacramento District. As part of the Natomas project, DSM walls are being used to facilitate the construction of deep cutoffs where the risk of SB trench walls collapse is considered high. There are numerous examples throughout world where DSM cutoff walls have been used at landfill and HTRW sites to form cutoffs with minimal exposure and to meet project objectives regarding the disposal of contaminated soils.

Significance – High:

Providing a more detailed evaluation of all possible cutoff wall types, including consideration of HTRW disposal, will explain why CB walls were selected.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. Re-evaluate the use of SB walls based on the experience at Site R.
2. Consider constructability, including working space and levee access, in the evaluation of wall alternatives.
3. Evaluate trench stability to assess the viability of various methods.
4. Evaluate the use of DSM walls as a possible wall alterative.
5. Consider the potential costs of handling and disposing of contaminated soil and groundwater for the wall selection.

Comment 6:

The assumptions and rationale used to perform the cost analysis for the LRR need to be more specific and detailed to fully understand the basis for their development.

Basis for Comment:

Section 5.5 (Cost Estimates), Section 5.7 (Summary of Economic, Environmental and Other Social Effects – Project Cost and Benefits), and Appendix I (Cost Estimates) of the LRR contain detailed discussions on contingencies at an 80% confidence level using statistical analysis of probabilities of risk (Monte Carlo simulation). However, the discussion of the assumptions used to develop those cost analyses is extremely limited. A short discussion in Section 5 (Key Assumptions in Appendix I) assumed that Planning, Engineering & Design (PED) would last 2 years. Yet, there was no mention of the costs of engineering during construction. Section 5 stated that the cost estimate and risk analysis have not undergone an Agency Technical Review (ATR) (p. ES-9). It could be assumed that an ATR would stipulate that the basic assumptions must be specified.

USACE has spent considerable effort proving the need for contingency cost inclusion; however, if the documentation used to estimate the costs and list the assumptions were included in the LRR, it would have aided the Panel in accepting the USACE's cost assessment. The cost analysis and estimate would have been improved if less statistical analysis, and more real-world analysis, had been performed and included.

The Panel applauds the use of a sensitivity analysis to validate the cost contingency results. However, while the contingency range is projected to be from just over negative $4.9 million to $45.6 million, a final selection of $30.8 million is made without stating the assumptions used in making that selection and without demonstrating why the final selection is valid. Without further discussion of the assumptions and reasoning behind the final recommendation, there is a basic misunderstanding as to the cause and effect of the costs under the tentative recommended plan. With a contingency factor of greater than one–third the projected cost of the project, and with an 80% confidence in the overall cost estimating process without additional explanation, the LRR may not meet the stated objectives of the project.

The LRR outlined the development of a schedule risk analysis (# ES-14) that has a broad and sweeping range, making it difficult to understand the rationale for selecting this approach as a valid method for analyzing risk. Further, the estimate is not consistent with Plate 20 of the LRR, which depicts a Primavera schedule with an approximate duration of 113 months. It is not clear why 87 months was selected as the recommended contingency schedule length with a contingency cost of $30.8 million without any stated assumptions or justification for such a selection other than professional judgment.

Although the Panel understands that professional judgment is used to develop the LRR cost estimates, a detailed project-specific list of engineering and cost-estimating assumptions is standard protocol within USACE and is considered "the industry standard" for supporting the estimating process in the industry. Without those

assumptions, the ability to audit "the numbers" is compromised, and it becomes difficult to ensure that one cost comparison category does not have overlap with another category.

Most of the major costs for the project features, operational costs, and design requirements were identified; however, their detailed assumptions and explanations were not covered in the LRR, and the LRR did not clearly identify the reasoning for the recommended selection.

By codifying the assumptions, the process can be repeated and reproduced.

Significance – Medium:

It is not possible to verify the validity of the cost estimate supporting the LRR.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A project-specific detailed list of civil engineering and cost-estimating assumptions (for example, the assumed haul distance for borrow, type of equipment to be used, compaction factors for soil, etc.).
2. Coordinate the Primavera schedule (Plate 20) with the risk analysis schedule estimates.
3. A list describing the rationale for selecting the risk analysis and cost contingency projections.

Comment 7:

The LRR needs to address the rationale for the use of semi-pervious berms or the possibility of using other types of berm fill.

Basis for Comment:

Section 4.9, p. 15, of the LRR focuses solely on the use of semi-pervious berms. USACE's design manuals for seepage and underseepage control allow the use of different types of berms. These include impervious berms, semi-pervious berms, sand berms, and free-draining berms. Each type of berm has different characteristics. In general, a berm constructed of a more pervious material will be shorter and have a smaller footprint than a more impervious berm. The LRR does not provide a basis for the selection of the semi-pervious berm, nor does it discuss the potential use of other types of berm fill material. The use of other types of berms could affect real estate requirements, costs, and borrow sources for this material. The LRR also does not discuss the permeability criteria to be used for new semi-pervious berms. The permeability requirements could affect the selection of sources for appropriate borrow material, the haul distance, and the resulting costs. For instance, a silty sand material could be obtained from dredge spoils, while a silt/clay mixture would require an upland borrow source.

Significance – Medium:

A discussion related to alternative berm designs is required as part of the documentation of the overall design process and alternative evaluation.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A discussion of alternative berm types (e.g., sand berm, free-draining berms, and impervious berms) and their applicability to the project.
2. A discussion of the permeability requirements for semi-pervious berm fill and the potential borrow sources for this material.

Comment 8:

The subsurface exploration program supporting the seepage analysis should be expanded prior to final design to supplement the available subsurface information.

Basis for Comment:

The overall analysis and evaluation of the subsurface seepage conditions for the levee system provided a systematic and comprehensive evaluation of the measures needed to upgrade the integrity of the flood protection barrier. The Panel concludes that, because no other explanation was provided, the selection of the 330-foot interval (Section 4.10, page 17 of the LRR) for obtaining subsurface information was a judgment call based upon experience and the anticipated variations and subsurface conditions. This spacing falls within the general requirements provided in EM 1110-2-1913, *Engineering and Design - Design and Construction of Levees* (USACE, 2000). As described in the manual, this represents a Phase 1 type subsurface exploration and should be supplemented by a Phase 2 investigation. The level of subsurface exploration and related analysis contained in the LRR appears to represent a comprehensive feasibility-level evaluation of the project area. This level of detail unavoidably resulted in areas of uncertainty where assumptions were required to perform the analysis for both uplift potential and remedial design of berms, relief wells, and slurry trenches. Supplemental subsurface information should be obtained as needed to verify uncertainties and assumptions made during the analysis.

The interpretation of the boring data could be enhanced by considering the geomorphology of the project area. Mapping of the geology and geomorphology could help identify the extent of clay-filled sloughs, historic meanders, and other features. This information could be used to inform the assessment of the extent of various conditions and seepage remediation alternatives.

Insufficient boring data were obtained from within the embankments comprising the Mississippi River levees. As a result, potential levee through-seepage, steady-state seepage slope stability mechanisms, and floodwall integrity have not been thoroughly evaluated at this time. Existing borings within the Cahokia Creek Diversion Channel and Prairie Du Pont Creek levees can serve as the basis to assess such mechanisms. Additional exploration of the levee embankments should be conducted.

The location of additional borings should be determined based upon considerations of geomorphology and uncertainties related to the analysis of various cross sections. The additional information should be directed at verifying the subsurface profile transverse to the levee center line.

The overall analysis and evaluation of the subsurface seepage conditions for the levee system provided a systematic and comprehensive evaluation of the measures needed to upgrade the integrity of the flood protection barrier.

Significance: Medium
Prior to final design, the overall seepage analysis needs to be supplemented with additional subsurface information to provide a more complete and comprehensive design.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. A general discussion of the future design process for development of plans and specifications, including a general identification of the need for additional subsurface information in areas where there is uncertainty regarding subsurface conditions. Such exploration should include geotechnical characterization of levee embankments along the Mississippi River.

Literature Cited:

USACE (2000). Engineering and Design - Design and Construction of Levees. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Manual No. EM 1110-2-1913. April 30.

Comment 9:

It is unclear how the benefits were derived for each alternative, and the methods for performing the benefit analysis were not fully described and supported.

Basis for Comment:

The description of the economic analysis in this version of the LRR does not provide sufficient detail to support the analysis and the calculations of the National Economic Development benefits. Although non-traditional techniques can be used in this analysis, a more detailed explanation would materially assist the Panel in its understanding of the rationale used to support the economic analysis of the tentative recommended plan.

The following are specific details keyed to Appendix J - Economics in the order in which each topic appears:

- Statements in the LRR should be based upon information presented in the appendices. Assumptions #2 and #5, project discount rate and project life, are normally provided by headquarters or defined by regulation. This caveat should be added. For the project discount rate, the statement appears in the LRR, but not in the appendix. For the project life, the appendix should provide the project life used in the original authorizing document and/or explain why a 50-year project life instead of a 100-year project life is appropriate.
- Acronyms such as PNP/PFP (example: p. 3) need to be defined.
- Given the large number of structures located behind these levees, the data used from each listed source need to be explained more fully. Starting on p. 3, more specifics are needed as to what data were provided by communities and industrial concerns and how the data were incorporated into the analyses. If data were used from the original authorizing document or the more recent General Design Memorandum (GDM), the appendix should specify what data were used, from which source, and should describe how they were used. The same applies to the data from the "Great Flood of 1993" and the FEMA data. For these data, the appendix should note whether they were used directly or whether adjustments were needed.
- There is no mention of first floor elevations used in this analysis. More information on how such information was obtained and how it was used is needed.
- As noted on p. 3, depth damage tables were also used to compute inundation damages to structures and their contents. For both the structure and contents of industrial entities, more details are needed on how these depth damage relationships were developed. It is assumed that after development, these relationships were input into the USACE's Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA).
- In the last paragraph on p. 3, more information is needed on what data were used to compute the miscellaneous damages associated with individual structures and the source of such data.

- For the miscellaneous damages associated with infrastructure (p. 4), additional information is needed on what data were used and what adjustments were needed. This may be FEMA data or data obtained from the various communities; however, the source of the information should be stated. The appendix should provide information on the difference between the "without project" and "with project" conditions for items such as flood fighting.
- The 20+ feet of flooding depth across the protected area (p. 6) seems to imply that there is little if any relief in ground elevations or structure first-floor elevations across the area. The LRR does not contain a map or plate that displays contour information to support this conclusion. A caveat should be added to indicate that this may be the greatest depth of flooding for the rarest event and that it could be applicable to x percent or number of structures.
- The analytical framework references an interior drainage study; however, the LRR states that an interior drainage study was not done. It appears that one was done in the past and that some of that information was incorporated into the analysis. The appendix should provide details on the information used, the age of the study, and the manner in which the information was incorporated.
- The development of a single aggregate stage vs. damage relationship needs to be fully explained. The contribution of each category of damages (residential, commercial, industrial and institutional structures and their contents, flood fighting, other infrastructure) to the total needs to be presented prior to the presentation of analyses in Table 1.
- There are considerable agricultural lands behind the line of protection. However, there is no mention of the potential for substantial damages to such assets. If information on the types of benefits used for original project justification is readily available, it should be presented; for example, the levee was originally justified by x% for urban type damages and y% for rural type damages. This should be provided prior to the presentation of the results of the analyses performed.
- The appendix should present the justification concerning the consequences of decertification of the levee. Further discussion of the potential for future development is needed. This should include consideration of redevelopment within existing categories as well as conversion of land uses from one category to another.
- A brief explanation of how risk and uncertainty was accomplished for probabilities of unsatisfactory performance (p. 12) needs to be provided.
- The broad classes of potential outcomes (low, medium, and high) (p. 12) seem an appropriate simplification of computations; however, these classes deviate from standard practice. Provide the basis for delineating the classes and any prior approval obtained.
- The examples of the calculation of high, medium, and low consequences (p. 13) need to be examined for accuracy.

- The value shown for "Water Elevation" for the Return Periods 1 and 2 shown on Tables 1, 2 and 3 needs to be verified. The heading of Table 2 should be the "with project" conditions.
- In Table 3, the high economic costs associated with the 50-year and rarer events approach and then exceed the aforementioned property asset value of $2.5 billion. The appendix needs to explain how $3.6 billion worth of damages was computed for $2.5 billion worth of property.
- On Tables 1 and 2, further explanation is needed for the term "probability of consequences," the calculations were derived, for what purposes it was used, and how it differs from the term "probability of unsatisfactory performance." The same should be done for the term "conditional probabilities of non-excellence" on Table 5 and for the term "distributed" on Tables 6 and 8.

Significance – Medium:

Provision of detail in the Economics analytical framework is needed to support the justification of the tentative recommended plan.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. Provide a detailed explanation of the three "classes" of potential outcomes (high, medium, and low).
2. Detail the critical steps or data omitted (first-floor elevation, inventory of property by category).
3. Establish the relationship of depth of flooding to percent of value damaged for unique structure (principally industrial). Provide further explanation of the steps taken to construct an aggregate stage vs. damage relationship.
4. Explain the omission of categories of potentially significant damages (agriculture and future development).
5. Provide further explanation of terms, their resulting development or intended purposes (probability of consequences, conditional probabilities of non-excellence, and distribution).

Comment 10:

The cumulative effects analysis has been restricted to the project along with its operation and maintenance; the broader consequences of the project need to be considered.

Basis for Comment:

Cumulative effects are defined by 40 CFR 1508.7 as: "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions." Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.[1]

The primary purpose of the cumulative effects analysis in the National Environmental Policy Act (NEPA) process is to ensure that federal decisions consider the full range of consequences. There is increasing evidence that ecosystem degradation and unexpected effects on humans are resulting from combinations of individually minor effects of multiple actions over time. The range of actions that must be considered includes not only the project proposal but all connected and similar actions that could contribute to cumulative effects.

Conclusions reached in the environmental assessment (EA) with respect to cumulative effects seem to be based only on issues related to the flood damage reduction project (both the current project and future maintenance and enhancement) and do not consider, as required, past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. The cumulative effects analysis conducted for this project should include an inventory of reasonably foreseeable future actions in the project area that are unrelated to but are affected by the project.

The EA briefly mentions that a positive effect of the project will be enhanced economic growth and development in the study area as a result of the reduction of flood risk. This is reasonably foreseeable, but the potential environmental effects from the growth and development are not discussed.

Economic growth and development can also be an adverse cumulative effect if not handled properly and thus should be identified in the EA as such. Restoring the area to a "100-year protection" level does not eliminate flood risk. Estimated potential damages from a 100-year flood could increase over time with an increase in economic development. Perceived protection from flood risk could also result in redevelopment and gentrification of low-income areas. Continued or enhanced development in the study area will also have environmental effects simply as a result of the development itself (e.g., habitat loss, reduction in air quality, increased noise, etc.). These effects should be considered as part of the overall cumulative effects analysis.

Significance – Medium:
The discussion of cumulative effects in the EA lacks the detail required to meet the requirements of NEPA.
Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. A more detailed description of the types of enhanced economic development that could reasonably be expected to occur or continue once the 100-year level of protection is restored. 2. A discussion of ordinances, if any, enforced by local municipalities that guide development within the 100-year floodplain so that future development possibilities are better understood. 3. A discussion of the potential adverse impact of reducing flood risk, which could foster the incorrect public perception that the project eliminates flood risk and therefore fully protects their health, safety, and property from flooding. This discussion would need to describe a 100-year flood (1% flood) (i.e., that such a flood could occur every year or even more than once per year), explain that the USACE does not have jurisdiction over building and planning ordinances and thus does not control what may be developed within the 100-year floodplain, and clarify that there is still a significant risk of flooding in the study area even with the project in place. 4. A discussion explaining that increased or continued development is an expected consequence of the project and that, for any project, development has environmental effects. Such effects include, but are not limited to, habitat loss, changes in air quality, changes in local aesthetics, changes in noise, and changes in the socioeconomic environment that may be positive for some people, but negative for others. [1.] The terms “impacts” and “effects” are used interchangeably in NEPA practice.

Comment 11:

The Finding of No Significant Impact (FONSI) portion of the Environmental Assessment (EA) should be revised to expand on areas requiring further study where environmental effects are not completely understood.

Basis for Comment:

The very brief FONSI concludes that potential adverse effects are not significant. However, data gaps are identified in the EA, and some conclusions reached in the EA are based on professional judgment, with their environmental consequences (such as potential cross-contamination of groundwater resources, disturbance of cultural resource sites, and potential effects of hydrologic changes on wetlands and surface drainage) evaluated in the absence of scientific data.

Data gaps include the absence of detailed information regarding subsurface soil and groundwater contamination and potentially affected cultural resource sites. The EA provides limited hydrology/hydraulics, drainage, and well flow data and provides no valuable light detection and ranging (LIDAR) data for areas outside of 700 feet from the levee toe.

Significance – Medium:

The FONSI does not describe what is unknown about the project and the existing environment and therefore could be construed to be somewhat misleading.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A description of the data gaps.
2. A description of the steps that are being or will be undertaken to fill the data gaps.
3. A description of how new information gathered during construction to fill these gaps will be evaluated with respect to NEPA.
4. A contingency plan describing how the NEPA process may or will continue if new information leads to the conclusion that one or more environmental effects may indeed be significant.
5. A discussion of how unexpected and unaccounted for potential negative environmental effects that manifest after construction has commenced will be mitigated (especially with respect to the HTRW issues but including air quality, cultural resource, and hydrologic issues).

Comment 12:

The supplemental exploration program should include strength testing of embankment and shallow underlying layers to support slope stability analyses.

Basis for Comment:

The soil testing program conducted for the LRR is well done; however, there are additional data that should be included in the LRR. The results of the soil testing program are presented on Plate D-2 "2008 Subsurface Exploration Boring Logs" and in a pdf document with the filename "estlgeotechcrosssections.pdf." Plate D-2 is quite complete and presents the results of extensive geotechnical index property testing conducted on the soils, including Atterberg Limits, water content, and sieve analyses.

The presentation of the geotechnical data is somewhat incomplete and difficult to interpret for several reasons:

- Plate D-2 references the boring and cone penetration test (CPT) location by coordinates and not by levee station. This makes it difficult to locate a boring relative to its position along the levee alignment.
- The CPT data on Plate D-2 are presented as profiles of interpreted soil behavior type. Tip bearing, sleeve friction, friction ratio, and pore pressure measurements are not provided. Without these data, it is not possible to correlate the CPT data to soil properties such as shear strength.
- Appendix D references limited strength testing conducted by URS Corporation; however, these data are not presented.
- The geotechnical cross sections are of poor quality. In some instances, the graphics are out of order as they occur along the alignment, and much of the data are unreadable. In addition, the cross sections present the boring and CPT data without interpretation to characterize various significant strata. Furthermore, the proposed improvements are not shown on the cross sections, so it is difficult to judge how the proposed mitigation measures relate to the subsurface conditions.
- There are no longitudinal cross sections by which to evaluate the continuity and variation of significant strata along the alignment.

A supplemental exploration program is suggested to evaluate the embankment material comprising the riverside levees. As part of this exploration, additional testing should be considered to characterize the strength and permeability of the embankment and shallow underlying soils.

Significance – Medium:

This issue affects the completeness and understanding of the geotechnical aspects of the project design. More complete geotechnical interpretations may lead to changes in the extent and design of various project elements, such as cutoff wall, seepage berms, and relief wells.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. Revise Plate D-2 to include approximate boring and CPT stationing.
2. Provide the CPT data along with standard density and strength correlations.
3. Provide a more compete interpretation of the transverse geotechnical cross sections to include significant strata, entrance distances used in underseepage calculations, interpreted top layer thicknesses, and conceptual location of various remedial alternatives (including relief wells, shallow and deep cutoffs, and seepage berms).
4. Provide longitudinal interpretive geotechnical sections.
5. Conduct strength testing on embankment and shallow underlying strata during supplemental geotechnical explorations.

Comment 13:

The relocations and potential relocation conflicts and costs need to be described in greater detail.

Basis for Comment:

Appendix G (Relocations) does not include sufficient information to understand and effectively evaluate relocation conflicts and their associated market-driven costs as currently presented in the LRR. The discussion is limited to a one-page review of utility relocations, residential or commercial impacts, temporary construction requirements, or other challenges.

Relocation conflicts can result in disputes that can result in disputes that lead to unaccounted-for impacts to the project schedule. At present, 1 year for the identification, acquisition, and certification by the local sponsor of project right-of-way (ROW) may be an underestimate unless this information is known and was simply not included in the LRR.

This work remains to be accomplished during the plans and specifications phase. Flood protection projects of this nature have conflicts and local issues that may not be identified until right of-way (ROW) maps have been created and extensive contact with the local sponsor and property owners have been made.

Significance – Medium:

Additional detail in the LRR would assist in understanding potential relocation conflicts and would address scheduling concerns.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. An up-to-date description of affected properties.
2. More detailed cost estimates on relocations so that this information can be conveyed to the sponsor.
3. A greater degree of review and analysis of the impacts of the relocation requirements.
4. An evaluation of the costs of relocation and a comparison of that effort with a duration/time estimate for inclusion in the project schedule.

Comment 14:

Operations, maintenance, repair, replacement, and rehabilitation (OMRRR) considerations have not been fully described.

Basis for Comment:

As referenced in Section 5.4 – OMRRR Considerations, the impact and cost of maintaining the project once local sponsors take control are very significant, and the required roles, responsibilities, costs, and reporting needs should be detailed. These requirements were not addressed adequately in the LRR. The Operations & Maintenance (O&M) Manual should include the process, procedures, roles, and responsibilities concerning the maintenance of the project with specific discussions on storm (i.e., high water) and seismic events, ways to keep life cycle costs low, and strategies for prolonging the life of the project for the local sponsor. The Panel has specific concerns that OMRRR considerations were not addressed for the period during and after a storm or seismic event. As such, the LRR should include more details to instruct the local sponsor:

- The St. Louis District is in a seismic area that can experience relatively large, but infrequent, earthquakes. The sands at the site are loose and may be susceptible to liquefaction and lateral deformation because of ground movement during a seismic event. OMRRR plans should include procedures and reporting requirements for inspecting the levees, flood walls, relief wells, seepage berms, and conveyances following any significant earthquake event.
- Relief wells in the HTRW area could potentially discharge contaminated water during flood events. The potential need to monitor water quality and to control/treat the water prior to discharge should be considered.
- The functional capabilities of the project during periods of high water will be the responsibility of the local sponsors. The LRR should discuss the operation manual to be provided with the project. The O&M Manual should include a recommended levee inspection and monitoring plan for periods when there is water against the levee system based on St. Louis District criteria. This inspection program should define areas where the potential for harmful underseepage is unknown. This plan should also be based upon the original analysis performed by the designers so that it is captured in an inspection guideline (design criteria vs. current levee conditions to include slope stability analysis) for the local sponsor. This plan should be coordinated with the USACE Levee Inspection System (LIS) program, which is currently being implemented USACE-wide.

Significance – Low:

In order to be effective, all OMRRR issues and concerns should be documented in an O&M Manual.

Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. Roles and responsibilities with specific requirements for inspections by the local sponsor during storm and seismic events. 2. A discussion of the need to coordinate with USACE staff on inspection requirements so the project is included in the USACE LIS Program.

Comment 15:

The project operation manual should include a recommended levee inspection and monitoring plan for local sponsors for periods when there is a high water event.

Basis for Comment:

The critical period for any water-retaining structure is during the period of initial filling. For levee structures, this may not occur for many years, long after the original designers are no longer involved. The operation of the project during periods of high water will be the responsibility of the local sponsors. The Panel recommends that the project operation manual include a levee inspection and monitoring plan for periods when there is water against the levee system. The basis for this inspection program should be a general documentation of the design and identification of areas of more uncertainty where harmful underseepage could occur. This plan should be based upon the knowledge that the designers have at the end of the design process and should be documented in an inspection guideline for local sponsors.

In addition, USACE should develop an internal document that requires inspection by geotechnical staff during high water conditions. This document should also identify various design considerations and assumptions that should be used to verify the performance of the levee and seepage control systems.

Significance – Low:

The need for documentation of high water inspection procedures is an important element in the successful future operation of the project but does not affect the justification of the project.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A description of the high water inspection plan that would be developed for the project operational manual. The plan should be directed at a level for working level members of the local sponsors staff and should be focused on conditions/areas that are identified as potential failure modes based upon design considerations.
2. Implement a procedure that documents the need for USACE geotechnical engineers to inspect the project during high water conditions to verify design assumptions. The procedure should be developed by design engineers and should focus on areas of uncertainty in the design that should be verified during high water events. These inspections should be documented by written memorandums that can be maintained by the USACE to provide a basis for evaluating the ongoing performance of the levee system.

Comment 16:

USACE should use the current flood profiles for the hydraulic analysis of the flank levees instead of the Mississippi River backwater curves.

Basis for Comment:

The Panel believes that the LRR Appendix C indirectly states that the tentative recommended plan uses the 52 + 2 foot flood stage at the Mississippi River, plus a projected backwater profile for the flank levees. Using Table C-1, this is on the order of 9 feet higher than the 100-year flood level. While the actual 1% flood profiles for the flank levee are out of date, they are very conservative relative to the design assumptions. Therefore, it is unlikely that once the flank levee profiles are updated that this will impact the adequacy of the levee height for the 100-year event.

Section C.4 notes that the project sponsor plans to secure FEMA certification of these project features (levees) for insurance purposes (100-year flood protection). The basis for the certification will have to be submitted by USACE. Without the hydraulic analysis, the certification process will be severely impacted. The LRR included a requirement that an independent expert provide certification to FEMA that the levee meets or exceeds the criteria for protection against a 100-year event. The tentative recommended plan states that it strives for protection equal to or greater than the original design of an approximately 500-year event. The LRR must provide detailed information to support the claim that the tentative recommended plan will meet those objectives. This includes the cross-section design of the levees and structures, as well as the heights of the levees and structures. The Panel does not believe that the data are available to verify that the levee heights along both flanks and the riverfront meet the recommended minimum heights, as the LRR states that the 1954 profiles are out of date because of urban development and changes in hydrology and hydraulic design methodologies.
The USACE must unequivocally state that the levee heights do reach the minimum (100-year) heights throughout the levee system (to include Chain of Rocks) to fulfill the planning objectives.

The analytical framework for the LRR references an interior drainage study. In other locations of the LRR, it was stated that an interior drainage study was not accomplished. With the suggestion that the interior drainage study was performed before the LRR was prepared, details as to what information was incorporated into the LRR would help in the understanding of the rationale used.

Significance – Low:

An explanation that supports the use of backwater curves in lieu of current flood profiles and a validation of the levee heights would significantly improve the technical quality of the LRR analysis and the tentative recommended plan

Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. Provide details and further explanations of the analysis and reasoning behind the use of Mississippi River backwater curves over the current flood profiles in the LRR. 2. Develop current flood profiles for the flank levees to fully evaluate levee heights. 3. Validate that the levee heights exceed the 100-year flood protection planning requirements. 4. Clarify the basis of the design criteria relative to net levee grades for all levees within the system. 5. Provide a summary of the required net grades by levee segment or station. 6. Verify that the levees meet or exceed the required grade by levee segment or station

Comment 17:

The recommended design should be refined prior to construction with regard to relief well penetration and spacing.

Basis for Comment:

The LRR does not discuss the optimization of well spacing and aquifer penetration. The Panel assumes that a 50% penetration was utilized for all areas where relief well design was performed. USACE design guidance EM-1110-2-1914, *Design, Construction, and Maintenance of the Relief Wells* (USACE, 1992), indicates that an optimization procedure should be performed for relief well systems. As indicated in Section 7-11 of this guidance, the design of well systems should include an economic optimization process that addresses variations of aquifer penetration and spacing. The procedure requires that all related costs, including construction and maintenance costs, be included in this evaluation. The LRR does not indicate that this type of analysis has been performed, nor does it indicate that this procedure will be employed in the future.

Simplified methods for relief well evaluation have been utilized by the USACE to date. While these methods are appropriate for uniform subsurface conditions, they may be less reliable where more complex stratigraphy exists and in transitions between various remedial alternatives. More advanced finite element analyses that are capable of a more general solution should be considered to verify or supplement the analyses used for well optimization. For example, use of the plan view simulation in the program Seep/W can effectively be used to evaluate the relative effects of well spacing and penetration on seepage and pore pressures.

Significance – Low:

The future implementation of a relief well optimization procedure could reduce project construction costs and increase the benefit/cost ratio.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A description of the optimization procedure for each area where relief wells would be employed. This procedure should conform to the requirements of the EM-1110-2-1914 and should be done prior to final design of the relief well system.

Literature Cited:

USACE (1992). Design, Construction, and Maintenance of Relief Wells. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Manual No. EM-1110-2-1914. May 29.

Comment 18:

The plan formulation process should describe the trade-off analysis used to select the tentative recommended plan.

Basis for Comment:

In general, the Panel agrees with the plan formulation process used to develop the tentative recommended plan. The process as described in the LRR seems to be well organized and presents a systematic approach to problem solving. A trade-off analysis, however, is typically required in selecting a recommended plan. The report clearly shows which option was selected but does not explain the thought process resulting in its selection.

The Panel expects to see information for each decision segment concerning (a) the general effectiveness of each design option considered; (b) some indication of the severity and/or nature of the design deficiency that is being corrected (e.g., underseepage or through seepage or inadequate relief wells); and (c) cost. This information could be presented in either the plan formulation appendix or the main report.

Given the amount of work left to be accomplished during the plans and specifications phase, the Panel believes that the appropriateness of the resolution for each decision segment needs to be validated.

Significance – Low:

The technical quality of the report will be improved by providing more information on the process to identify the tentative recommended plan.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A table or list of pertinent information that shows, for each decision segment, the correlation between the identified problems/opportunities and the appropriateness of the resolution to each.

Comment 19:

Several design assumptions or local conditions need to be resolved during final design.

Basis for Comment:

The LRR documents several areas of uncertainty but does not recommend any future methods of investigation or resolution. These include the following sections of the LRR:

- Paragraph D.5 indicates that a industrial plant is located on an existing seepage berm from station 1165+00 to 1210+00. The impervious nature of this plant may impact the function of the semi-pervious berm and should be evaluated.
- On p. D.15, the LRR states:

  "Landside surface depressions manifested themselves during the 1993 flood along Mobile Avenue (near the old Monsanto Pump Station) between stations 1140+00 to 1154+00. There are four abandoned wastewater box culverts and pipes which exist within 300 feet of the levee toe, and one goes under the levee footprint. Large quantities of water from undetermined sources were reported to be entering into the American Bottoms wastewater treatment plant. Mobile Avenue pavement collapsed into two culverts due to the foundation eroding away. The owners of the pipes were contacted to ascertain the condition of the abandoned pipes and active lines. Little is known as to the conditions of the abandoned culverts and pipes."

  This uncertainty in the conditions of the abandoned culverts and pipes may impact the reliability of the levee system. Comment 8 on p. D-30 brings up issues related to the use of the seepage equations in TM-424 as related to the cross section geometry. In areas where there is more complex subsurface and surface geometry, finite element analysis may provide an alternate means to verify the results based on TM-424.
- In several parts of the report, reference is made to flood walls located on the top of the levee section. No details were provided. The failure modes that caused I-wall failures in the New Orleans levees should be investigated.

Significance – Low:

The identification and description of procedures required in the future to address specific site uncertainties are important elements in the completeness of the LRR.

Recommendation(s) for Resolution:

To resolve these concerns, the report would need to be expanded to include the following:

1. A more detailed description of any work done to date to address these site uncertainties, or descriptions of how each condition will be evaluated in the future prior to construction.

Comment 20:

The LRR does not address all real estate interests and requirements and therefore does not allow for full comparison across all alternatives.

Basis for Comment:

The tentative recommended plan did not compare the real estate interests and requirements of all alternatives to a sufficient level of detail. Having this added level of detail would allow the Panel to understand all of the real estate requirements that the local sponsor will be required to perform as presented in the LRR and Appendix F. It was difficult to identify all of the real estate issues from the presentation of the cost spreadsheet. This issue has impacts on the cost sharing, project schedule, and life-cycle budget for the project.

Specifically, the cost comparison of real estate issues for seepage berms, relief wells, and slurry trench cutoffs would have been easier to understand if presented in a summary table/chart with side-by-side comparison of these categories. The LRR did present a good technical evaluation of these alternatives for each of the design reaches.

Further, a summary, or roll-up, of all costs in levee segments by alternative would have aided the Panel in its understanding of the projected real estate costs. The Primavera schedule in Plate 20 used a universal standard of 1 year for the local sponsor to acquire ROW. The same activity duration was used for each real estate task, even though real estate costs varied significantly by reach. Because details regarding the number and difficulty of private and public ownership of the ROW segments were not included in the LRR, the effort to acquire the appropriate ROW in a timely fashion must be considered as a gross estimate in time, which may help explain the large cost and schedule contingency. This gross estimate in time and cost could materially impact the project cost and schedule projections if not accounted for in the project contingency.

Finally, Appendix F – Real Estate, Section 11 - Relocation Assistance Benefits under Public Law 91-646 (p. 5) states that "No persons, farms, or businesses will require relocation assistance as a result of this project." However, the cost estimate highlights a projected cost for Supplemental Replacement Housing and Resident Moving Expenses for Section 207+30 to 213+90 under the 52+2 and 100-year protection alternatives on the North Flank area and Business Moving Expenses for the first and third Decision Areas of the Main Stem (Riverfront).

Appendix F does not identify any borrow sources for semi-pervious berm fill.

Significance – Low:

Real estate costs and related contingencies not identified during the analysis of alternatives clouds the process of selecting the tentative recommended plan. A clear delineation of the detailed real estate costs would validate the selection of the tentative recommended plan vs. the other alternatives.

Recommendation(s) for Resolution:
To resolve these concerns, the report would need to be expanded to include the following: 1. A summary (roll-up) document of major regions that shows a side-by-side comparison of all of the alternatives with all the related cost categories clearly identified. For clarity, footnotes explaining in detail the cost categories should be included. 2. A coordinated schedule with the RE costs to ensure that the RE effort matches time projections for the project. 3. Correlation of the RE cost projections with the statements in Appendix F, Section 11 to ensure consistency in presentation.

APPENDIX B

Final Charge to the Independent External Peer Review Panel

as

Submitted to USACE on June 10, 2010

on the

Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

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Final Charge Guidance and Questions to the Peer Reviewers for the Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

BACKGROUND

The East St. Louis, Illinois Flood Protection Project was authorized by the Flood Control Act of June 22, 1936. The Energy and Water Development Act of 1988 (P.L. 100-202) provided authorization for the East St. Louis Flood Protection Rehabilitation Project. The original authorization directed the Secretary of the Army to accomplish channel rehabilitation and to repair and rehabilitate 14 pump stations and appurtenant works at the East Side Levee and Sanitary District levee (now Metro East Sanitary District levee) in East St. Louis, Illinois. The U.S. Army Corps of Engineers (USACE) Lower Mississippi Valley Division signed a General Design Memorandum (GDM) outlining work to be performed as a result of this authorization on December 10, 1990.

Investigations conducted after the GDM was finalized and field observations made during the Mississippi River floods of 1993, 1995, and 2008 found that relief well rehabilitation measures constructed as part of the GDM scope were insufficient and the deficiencies in the original design of the levee were primarily responsible for the seepage problems. As a result, the Limited Reevaluation Report (LRR) was prepared to define the nature of the deficiencies, propose alternatives to address the deficiencies and present a technically sound and viable solution that would enable the Metro East Sanitary District (MESD) levee to satisfy flood protection criteria it was designed to meet.

The MESD levee is located on the left descending bank between Mississippi River Miles 175 and 195, above the confluence with the Ohio River. It protects a large part of the East St. Louis, Illinois metropolitan area in Madison and St. Clair Counties in southwestern Illinois. The Federally owned Chain of Rocks levee and the MESD levee form a single levee system that provides flood protection for the cities of East St. Louis, Granite City, and numerous other municipalities. The MESD and Chain of Rocks levees are part of a larger Metro East set of levee systems that includes the Wood River levee system to the north and Prairie du Pont and Fish Lake levee system to the south.

The LRR report addresses deficiencies in the Federal design of underseepage and through-seepage controls for the MESD levee. The LRR describes the 2009 geotechnical subsurface information, geotechnical and hydraulics analyses, the reaches along the levee where underseepage problems require additional controls, alternative solutions and any needed archeological and environmental mitigation, and cost estimates. The underseepage analyses used to develop alternative solutions were based on 2009 geotechnical subsurface information and a Mississippi River water surface profile (flood) at 54 ft on the St. Louis gage. Because of the long-term nature of Mississippi River flooding, underseepage problems along the flank levees result from Mississippi flooding rather than from the short-term floods caused by local rainfall. Due to the intense local and regional interest, the LRR report also addresses the deficiencies that

would occur during a Mississippi River flood that is 3 feet higher than the theoretical 100-year flood (flood that has a 1 percent chance of occurring in any one given year).

Work for correction of these deficiencies will be performed under the original authorization of the project.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection in accordance with the Department of the Army, U.S. Army Corps of Engineers, Water Resources Policies and Authorities' *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010 and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

This purpose of the IEPR is to assess the adequacy and acceptability of economic, engineering, and environmental methods, models, and analyses used for the East St. Louis LRR. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in engineering, economics, and environmental issues relevant to the project.

The panel members will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-209, Appendix D, reviews should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents and reference materials that will be provided for the review. **The documents and files presented in bold font are those which are to be reviewed**. All other documents are provided for reference.

- **Preliminary Draft- Limited Reevaluation Report and Environmental Assessment On Design Deficiency Corrections for East St. Louis, Illinois Flood Protection Project**

- **Main Report**
- **Appendix A: Environmental Assessment with Draft Finding of No Significant Impact**
- **Appendix B: Plan Formulation**
- **Appendix C: Hydrology and Hydraulics**
- **Appendix D: Geotechnical Engineering**
- **Appendix E: Design**
- **Appendix F: Real Estate Including Real Estate Plan**
- **Appendix G: Relocations**
- **Appendix H: Hazardous and Toxic Waste Considerations**
- **Appendix I: Cost Estimates**
- **Appendix J: Economics**

- USACE guidance *Civil Works Review Policy* (EC 1165-2-209) dated January 31, 2010
- CECW-CP Memorandum dated March 31, 2007
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

SCHEDULE

TASK	ACTION	DUE DATE
Conduct Peer Review	Review documents sent to panel members	6/17/2010
	Battelle/IEPR Panel Kick-off Meeting	6/18/2010
	USACE/Battelle/Panel Kick-off Meeting with panel members	6/18/2010
	IEPR panel members complete their review	7/2/2010
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members merged individual comments and talking points for panel review teleconference	7/7/2010
	Convene IEPR Panel review teleconference (1 to 5 pm ET)	7/7/2010
	Battelle provides Final Panel Comments directive to IEPR Panel	7/8/2010
	Panel members provide draft Final Panel Comments to Battelle	7/15/2010
	Battelle provides feedback to panel members on draft Final Panel Comments; IEPR Panel provides revised draft Final Panel Comments per Battelle feedback (iterative process)	7/19/2010
	Battelle submits working draft Final Panel Comments to USACE	7/21/2010
	Battelle provides Final IEPR Report to Panel for review	7/31/2010
	Panel provides comments on Final IEPR Report	8/2/2010
	*Battelle submits Final IEPR Report to USACE	8/3/2010
Comment/ Response Process	Battelle inputs FPCs to DrChecks; Battelle provides FPC response template to USACE	8/4/2010
	USACE provides draft Evaluator responses and clarifying questions to Battelle	8/10/2010
	Battelle provides panel members the draft Evaluator responses and clarifying questions	8/11/2010
	Panel members provide Battelle with draft BackCheck responses	8/16/2010
	Teleconference with Battelle and Panel members to discuss Panel's draft BackCheck responses	8/16/2010
	Final Panel Comment Teleconference between Battelle, IEPR team, and PDT to discuss FPCs, draft responses and clarifying questions	8/17/2010
	USACE inputs final Evaluator responses in DrChecks	8/24/2010
	Battelle provides Evaluator responses to panel members	8/25/2010
	Panel members provide Battelle with BackCheck responses	8/27/2010
	Battelle inputs BackCheck responses in DrChecks	8/30/2010
	*Battelle submits pdf printout of DrChecks to USACE	8/30/2010

Deliverables are noted with an asterisk (*)

CHARGE FOR PEER REVIEW

Members of this peer review panel are asked to determine whether the technical approach and scientific rationale presented in the Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project are credible and whether the conclusions are valid. The reviewers are asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, and plan formulation. The reviewers are not being asked whether they would have conducted the work in a similar manner.

Specific questions for the panel members (by report section or Appendix) are included in the general charge guidance, which is provided below.

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the East St. Louis LRR. Please focus on your areas of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-209; Appendix D).

1. Your response to the charge questions should not be limited to a "yes" or "no." Please provide complete answers to fully explain your response.
2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.
3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluation of economic or environmental impacts of the proposed project.
4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable
7. Please focus the review on assumptions, data, methods, and models.

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also please **do not** comment on or make recommendations on policy issues and decision-making.

Comments should be provided based on your professional judgment, **not** the legality of the document.

1. If desired, Panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Independent Technical Review.
2. Please contact the Battelle deputy project manager (Lauren Baker-Hart, bakerhartl@battelle.org) or project manager (Karen Johnson-Young, johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle project manager immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Lauren Baker-Hart, bakerhartl@battelle.org, no later than COB July 2, 2010 EDT.

Independent External Peer Review
Engineering, Economic, and Environmental Review of the Limited Reevaluation Report and Environmental Assessment on Design Deficiency Corrections, East St. Louis, Illinois Flood Protection Project

Final Charge Questions

GENERAL QUESTIONS

1. To what extent has it been shown that the project is technically sound, environmentally acceptable, and economically justified?

2. Are the assumptions that underlie the economic, engineering, and environmental analyses sound?

3. Are the economic, engineering, and environmental methods, models, and analyses used adequate and acceptable?

4. In general terms, are the planning methods sound?

5. Are the interpretations of analysis and conclusions based on the analysis reasonable?

SECTION 1.0 – General Information

No questions.

SECTION 2.0 – Description of Problems

6. Please comment if the potential deficiencies in the existing design have been appropriately identified and described.

2.1 Underseepage Problems

7. To what degree do you concur that the full extent of the underseepage problems have been identified and characterized?

2.2 Through-Seepage Problems

8. To what extent are actual and potential through-seepage problems identified and characterized?

2.3 Hazardous and Toxic Wastes

9. To what degree are the potential problems considered that are associated with hazardous, toxic, and radioactive wastes (HTRW) to be identified and characterized with respect to the design deficiency correction project?

10. Have sufficient studies been conducted to reveal any hidden HTRW issues that could affect the cost or implementation of the design deficiency correction project during construction? If not, what additional studies would you suggest be carried out?

SECTION 3.0 – Design Deficiencies and Engineering Analysis

3.1 Design Criteria

11. Are there any additional design criteria that should be taken into account?

3.2 Underseepage and Through-Seepage Design Deficiencies

12. Have all issues regarding the past non-performance of the existing underseepage control measures been considered?

3.3 Recent Underseepage Analysis

13. To what extent have the following assumptions used to define the underseepage design parameters been supported by information presented in the LRR?

    - Existing relief wells are beyond their design life and should be abandoned.
    - Proposed relief wells will be less susceptible to fouling than the existing system of relief wells.
    - The long-term operation, maintenance, repair, replacement, and rehabilitation (OMRRR) associated with the proposed relief wells will be less costly than currently experienced with the existing system, and within the technical and financial capabilities of the local levee and drainage districts.
    - The selection of the cement-bentonite walls using the panel method instead of soil-cement-bentonite using continuous method.

SECTION 4.0 – Plan Formulation

4.1 Plan Formulation Approach

14. To what extent do you agree with the general plan formulation to develop the recommended design deficiency correction project?

15. Please comment on the conclusions of the March 2010 Value Engineering study and the proposed segment design revisions.

16. Is the linear interval (330 ft) for obtaining new subsurface information along the entire levee appropriate?

17. How reasonable do you consider the assumptions about how the project is affected by hazardous, toxic, and radioactive waste (HTRW), and how the proposed project

impacts ongoing HTRW cleanup operations?

18. Based on your experience, comment on whether sufficient geotechnical data and design criteria have been taken into account in selecting alternatives for decision segments.

4.2 No Action Alternative

No questions.

4.3 Underseepage and Through-Seepage Control Alternatives

No questions.

4.4 Tentative Recommended Plan

19. To what extent do the assumptions used in the down-screening process support the tentative recommended plan?

SECTION 5.0 – Tentative Recommended Plan

5.1 Components of Tentative Recommended Plan

No questions.

5.2 Real Estate Acquisition Plan

No questions.

5.3 Construction Acquisition Plan

No questions.

5.4 Design, Real Estate Acquisition and Construction Schedule

20. Are the timeframes/deadlines in the timeline presented for the project schedule reasonable?

5.5 Operation, Maintenance, Repairs, Replacements, and Rehabilitation

21. Are there any other operations, maintenance, repair, replacement, and rehabilitation (OMRRR) considerations that should be discussed?

5.6 Cost Estimates

22. Have the significant project design, construction, and operational costs been adequately identified and described?

23. To what extent are the costs consistent with and justified by the detailed analysis found in Appendix I?

5.7 Project Accomplishments

No questions.

5.8 Environmental Effects

No questions.

5.9 Economics

24. Does the economic analysis adequately account for all costs and benefits?

25. Was adequate consideration given to the interest rates used and years of evaluation?

5.10 Design Deficiency Correction Under Original Authorization

No questions.

5.11 Implementation

No questions.

5.12 Sponsor responsibilities

No questions.

5.13 Project Partnership Agreement

No questions.

SECTION 6.0 – Reviews, Coordination, Public Comments

No questions.

SECTION 7.0 – Findings and Conclusions

No questions.

SECTION 8.0 – Recommendations

No questions.

Appendix A: Environmental Assessment/Finding of No Significant Impact

26. Were all environmental resources addressed?

Appendix B: Plan Formulation

27. Was the formulation and evaluation of alternatives appropriate?

Appendix C: Hydrology and Hydraulics

28. Are the design flood event, design levee height, and interior drainage assumptions used in the hydraulic analysis study adequately supported?

29. Please comment on the decision to use Mississippi backwater and not the current flood profiles for the flank levees hydraulic analysis.

Appendix D: Geotechnical Engineering

30. Does the soil sampling program conducted for the LRR, including types, locations, and frequencies of sampling, provide sufficient subsurface data to support the proposed design parameters?

31. Does the soil testing program conducted for the LRR provide subsurface design information to support the proposed design?

32. What, if any, additional soil sampling and testing should be conducted?

33. Based on your experience, have all geotechnical characteristics, conditions, and scenarios leading to failure, along with the potential consequences, been identified?

34. In your professional judgment, have sufficient data been gathered to support the seepage entrance distances, aquifer thickness, top strata thickness, and aquifer permeability associated with the seepage berms and relief wells? What, if any, additional data should be collected?

35. To what extent does the LRR provide support for the following assumptions?

    - Any effect from the existing wooden stave relief wells was ignored since they are considered to be beyond their design life and are to be abandoned.
    - Relief wells and landside seepage berms were considered as the first solution in each reach; slurry trench cutoff walls were considered in areas where relief wells did not satisfy design criteria.
    - Riverside clay blankets were not generally considered to be a feasible alternative.

36. To what extent do you concur with the selection of input parameters used in the analysis?

37. To what degree is analysis methodology used likely to result in a workable long-term solution that meets the design criteria given past seepage control measure performance during times of flood?

38. In your opinion, will the recommended groundwater monitoring systems provide continuing information on the performance of the proposed seepage control systems?

Appendix E: Design

39. Were the technical assumptions used to determine the design parameters for proposed relief wells, seepage berms, and authorized net levee grade design valid?

40. Are there any other objectives or constraints that should be considered as part of the project design and construction that will be important to reaching the project's final goal?

Appendix F: Real Estate, Including Real Estate Plan

41. Does the plan adequately address all real estate interests and requirements allowing for appropriate comparisons across all alternatives?

42. Do the values used in the real estate analysis represent current market conditions?

Appendix G: Relocations

43. Have all potential relocation conflicts or issues been identified?

Appendix H: Hazardous and toxic Waste Considerations

44. Is the relationship between the design deficiency correction project components and the nature and extent of the HTRW sites clearly known and understood?

45. Please comment on the scope and timing of the proposed Phase II Environmental Site Assessment relative to the design and construction of the proposed project components.

46. Based on your experience, have all of the necessary factors been taken into account concerning the proximity of the HTRW sites?

47. In your professional judgment, has sufficient study been performed to determine whether the project components associated with the Tentatively Selected Plan are viable given the proximity of the HTRW sites?

48. Is there potential for the HTRW sites to affect the proposed project cost and schedule during construction?

49. Is it advisable to have contingency plans in place should unexpected HTRW discoveries be made during construction in order to minimize potential delays?

Appendix I: Cost Estimates

50. Based on your experience, have all engineering and construction assumptions been incorporated into the development of the project cost estimate?

51. Comment on the length of the estimated time for construction. In your expert opinion, have all the significant issues been taken into consideration in estimating construction timeframe?

Appendix J: Economics

52. Are you in agreement with how the benefits and costs were derived for each alternative? Were all factors considered?

53. Was the project life used in the analysis appropriate for the alternative? Please explain.

54. Were the methods for performing the benefit-cost analysis, including the use of discount rates, adequately described and justified?

55. Specifically address any other economic element of the analysis that may be inadequate, inappropriate, or incorrect.