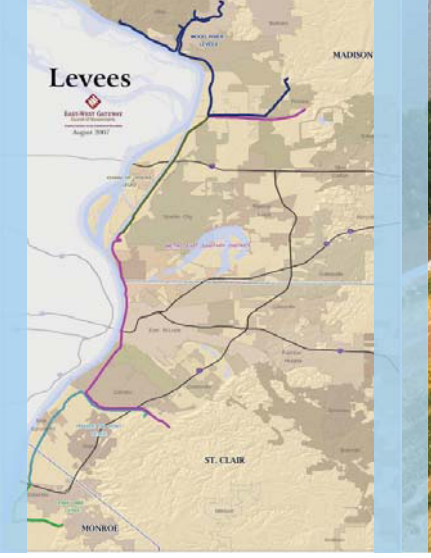

Independent External Peer Review of the Limited Reevaluation Report

Design Deficiency Corrections, Prairie du Pont and Fish Lake St. Clair and Monroe Counties, Illinois

Contract No. W912HQ-11-R-0002

6 September 2012

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For the best of reasons

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List of Acronyms

B/C	benefit-cost
BCR	benefit-cost ratio
COI	conflict of interest
CWA	Clean Water Act
EA	Environmental Assessment
EAD	expected annual damage
EC	Engineer Circular
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
GRR	General Reevaluation Report
HEC-FDA	Hydrologic Engineering Center Flood Damage Reduction Analysis
HTRW	Hazardous Toxic Radioactive Waste
IEPR	Independent External Peer Review
ISO	International Organization for Standardization
LRR	Limited Reevaluation Report
LTA	Land Trust Alliance
MP	Mitigation Plan
NED	National Economic Development
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OMB	Office of Management and Budget
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
PCB	polychlorinated biphenyl
PDF	Portable Document Format
PdP/FL	Prairie du Pont and Fish Lake
RED	Regional Economic Development
SEIS	Supplemental Environmental Impact Statement
SOW	Scope of Work
SVOC	semi-volatile organic compound

TSP	tentatively selected plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WSE	water surface elevation

Executive Summary

Noblis has performed an Independent External Peer Review (IEPR) of the Limited Reevaluation Report (LRR) on Design Deficiency Corrections, Prairie du Pont and Fish Lake (PdP/FL), St. Clair and Monroe Counties, Illinois, for the U.S. Army Corps of Engineers (USACE). The purpose of the IEPR is to perform a technical assessment of the adequacy and acceptability of economic, engineering, and environmental methods, models, data, and analyses performed for the PdP/FL LRR. The LRR identifies flood-related issues in the PdP/FL study area and outlines potential solutions to address the identified issues.

Noblis performed this IEPR in accordance with procedures described in the Department of the Army USACE Engineer Circular (EC) No. 1165-2-209, *Civil Works Review Policy*. The review was conducted by a panel of experts with extensive experience in economics, environmental, and engineering issues associated with structural flood risk management feature design. The panel was "charged" with responding to specific technical questions as well as providing a broad technical (engineering, economic, and environmental) evaluation of the overall project.

Noblis provides impartial, conflict of interest (COI)-free, independent assistance to organizations throughout the federal government and has extensive experience with conducting independent peer reviews, including IEPRs. Noblis and the IEPR panel for this effort have not been involved in any capacity with this PdP/FL LRR Project. In addition, Noblis has not performed or advocated for or against any federal water resources projects and has no real or perceived COI for conducting IEPRs. For these reasons, Noblis was suitable for upholding the principles of independence in all aspects of managing the IEPR.

In general, the panel acknowledged that the LRR adequately identified underseepage issues and design deficiencies associated with PdP/FL levee system and assembled viable alternatives for correcting the design. The LRR presented appropriate analyses, methods, and models used in evaluating each alternative and identifying the tentatively selected plan. However, the implementation of the analyses in certain areas was not clearly identified or discussed in the LRR. The document lacked sufficient detail in certain sections that are essential for providing an adequate assessment of project impacts. A few important considerations were missing in the project analyses that support the justification of the project. The panel raised several issues noting the deficiencies and inconsistencies in the analyses that are important for providing a complete understanding of all considerations in the alternatives analysis and the tentatively selected plan. The recommended changes to the document provide for the development of an appropriate and thorough representation of economic, engineering, and environmental findings that support the justification and implementation of the project.

Economics. The LRR included appropriate methods for analyzing economic considerations associated with the alternatives evaluated. The cost-benefit analysis did include a sufficient assessment of reasonable costs and benefits to develop an accurate benefit-cost ratio (BCR). However, some costs and benefits were not included in the LRR that could improve the benefit-cost analysis. Some project benefits and costs were not thoroughly discussed or quantified. Data pertaining to cost-benefit analysis were mentioned but then not used in the detailed analysis. While lack of detailed analysis for these costs and benefits would likely not affect the selection of the preferred alternative, the project analysis would be more complete and reliable if all proper project benefits were considered and adequately evaluated. Also, the discussion in the LRR was not clear and inconsistent in certain locations of the document. The panel understands that

further revisions to the LRR are anticipated that will improve the analysis and present cost-benefit information appropriately.

Engineering. The overall hydrologic and geotechnical principles and methods used in conducting the project analysis and developing the project improvements were adequate and appropriate for evaluating alternatives and supporting the tentatively selected plan. The panel's comments primarily relate to the need for more discussion of important statistical and design procedures that support the design and implementation of the preferred alternative. Some design calculations and analyses were either missing or not adequately discussed. Also, the addition of key tables and figures in the LRR would improve the understanding of the project. Further, some tables in the LRR were either incomplete or were potentially misleading and confusing to the reader. The panel recognizes that the document will be updated to address the identified deficiencies, and additional detailed analyses and other design considerations are expected in future phases of the project.

Environmental. The LRR included appropriate methods for analyzing project impacts and included suitable mitigation approaches for addressing them. However, certain project impacts and aspects of the mitigation important to the justification and implementation of the project were not included or adequately discussed. Particularly, the panel raised issues associated with potential organic contaminants in dredged material that will be used as part of the tentatively selected plan. The documentation did not fully identify potential impacts and management actions from proposed dredged material as well as downstream impacts to human and aquatic populations that might result from project implementation. In addition, issues with the mitigation of project impacts to specific endangered species as well as issues with the long-term management of the project area were not adequately discussed. The panel recognizes that more detailed information to support the assessment of environmental impacts and mitigation approaches, particularly more detailed analysis of the management of potential contaminants in dredged material, will be added to the LRR as well as addressed in other stages of project implementation.

1 Introduction

1.1 Introduction and Report Overview

This Independent External Peer Review (IEPR) Report provides a description of the IEPR conducted of the Limited Reevaluation Report (LRR) for Design Deficiency Corrections, Prairie du Pont and Fish Lake (PdP/FL), St. Clair and Monroe Counties, Illinois, for the U.S. Army Corps of Engineers (USACE). This report includes a description of the IEPR objectives and process, overview of the PdP/FL LRR project, summary of the IEPR panel members' expertise, and discussion of observations and comments by the IEPR panel.

Section 1 of the IEPR Report provides a description of the objectives of this effort and general background information on the IEPR, as well as a brief introduction to Noblis, the contractor managing this effort. Section 2 provides an overview of the LRR project. Section 3 presents the overall process followed in performing the IEPR. Section 4 describes the panel composition and the panel members' expertise. Section 5 discusses the conclusions and observations of the IEPR, including a description of the IEPR comments. References are listed in Section 6. Appendix A of this Final IEPR Report lists the final IEPR comments, as well as editorial comments identified by the IEPR panel. Appendix B provides a description of the IEPR panel and the panel members' résumés. Appendix C includes the "charge" and list of documents provided to the panel for the IEPR of the LRR for PdP/FL.

1.2 IEPR Overview

The USACE lifecycle review strategy for Civil Works products provides for a review of all Civil Works projects from initial planning through design, construction, and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). It provides procedures for ensuring the quality and credibility of USACE decision, implementation, and operations and maintenance (O&M) documents and work products. 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, the validity of the research design, the quality of data collection procedures, the robustness of the methods employed, the appropriateness of the methods for the hypotheses being tested, the extent to which the conclusions follow from the analysis, and the strengths and limitations of the overall product.

1.3 IEPR Objective

The objective of the work was to conduct an IEPR of the LRR for PdP/FL, in accordance with procedures described in the Department of the Army USACE Engineer Circular (EC) No. 1165-2-209, *Civil Works Review Policy*, dated 31 January 2012, and the Office of Management and Budget's (OMB's) *Final Information Quality Bulletin for Peer Review*, released 16 December 2004. The PdP/FL IEPR involved conducting an independent technical peer review to analyze the adequacy and acceptability of environmental and engineering methods, models, data, and analyses. The independent review was limited to a technical review of the LRR and was not involved in policy issues. The peer review was conducted by experts with extensive experience in biology/National Environmental Policy Act (NEPA) impact assessment, civil/geotechnical engineering, and economics. The experts were "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the LRR.

The independent expert reviewers identified, recommended, and commented upon assumptions underlying the analyses as well as evaluated the soundness of models and planning methods. They evaluated data, the use of models, analyses, assumptions, and other scientific and engineering methodologies. The reviewers offered opinions as to whether there are sufficient technical analyses upon which to base the ability to implement the project.

1.4 Noblis is Conflict-of Interest Free (COI) in Water Resources Projects

Noblis, the contractor leading this effort, is a nationally recognized leader in systems analysis and analytical support to the federal government. As a nonprofit science, technology, and strategy organization, Noblis solves complex systems, process, and infrastructure problems in ways that truly benefit the public. Noblis staff includes accomplished engineers, scientists, analysts, researchers, technical specialists, and management experts with extensive multi-disciplinary and multi-sector experience. Since Noblis has no commercial interests to advance, no vendor alliances to protect, and no sponsors or shareholders to represent, it is fully independent. Noblis provides impartial, COI-free, independent assistance to organizations throughout the federal government. Noblis has documented experience with peer review oversight. Noblis and the selected IEPR panel have not been involved in any capacity with the PdP/FL Flood Protection Project or the PdP/FL LRR. In addition, Noblis has not performed or advocated for or against any federal water resources projects.

Noblis has been recognized, for the fourth time, as one of the World's Most Ethical Companies by the Ethisphere Institute. This award honors companies that demonstrate "real and sustained ethical leadership in their industries." Noblis was one of five companies worldwide to be listed in the Business Services category. Ethisphere Institute, a think-tank dedicated to the creation, advancement, and sharing of best practices in business ethics, corporate social responsibility, anti-corruption, and sustainability, reviewed nominations from companies in more than 100 countries and 36 industries before naming 145 companies including Noblis to their 2012 list.

Noblis clients and the public deserve nothing less than work that meets the highest standards of excellence, conducted in an environment where objectivity and integrity are the hallmarks. Noblis achieves this through the development, implementation, maintenance, and continual improvement of its International Organization for Standardization (ISO) 9001:2008 Compliant Quality Management System.

2 Prairie du Pont and Fish Lake LRR Project Description

The purpose of the LRR is to identify flood-related issues in the PdP/FL study area. The study area is located on the east bank of the Mississippi River between river miles 166 and 175 above the Ohio River in St. Clair and Monroe Counties, Illinois, across from St. Louis County, Missouri. The area is protected by an urban design levee, completed in 1951, which consists of a 15.2 mile levee system with relief wells, gravity drains, and four pumping stations to evacuate interior drainage. The flood of 1993 revealed serious underseepage problems within this system including sand boils, quick soil conditions, and serious piping conditions.

Potential solutions that are investigated and outlined in the report include replacement of existing relief wells, construction of new relief wells, seepage berms, barrier walls, ditching, pumping stations, and levee height adjustments. The project area is a mixture of urban and agricultural

development. The levee system also provides protection to the Jefferson Barracks Bridge—a major bridge crossing the Mississippi River via Interstate Highway 255. Figure 1 shows a map of the project study area.

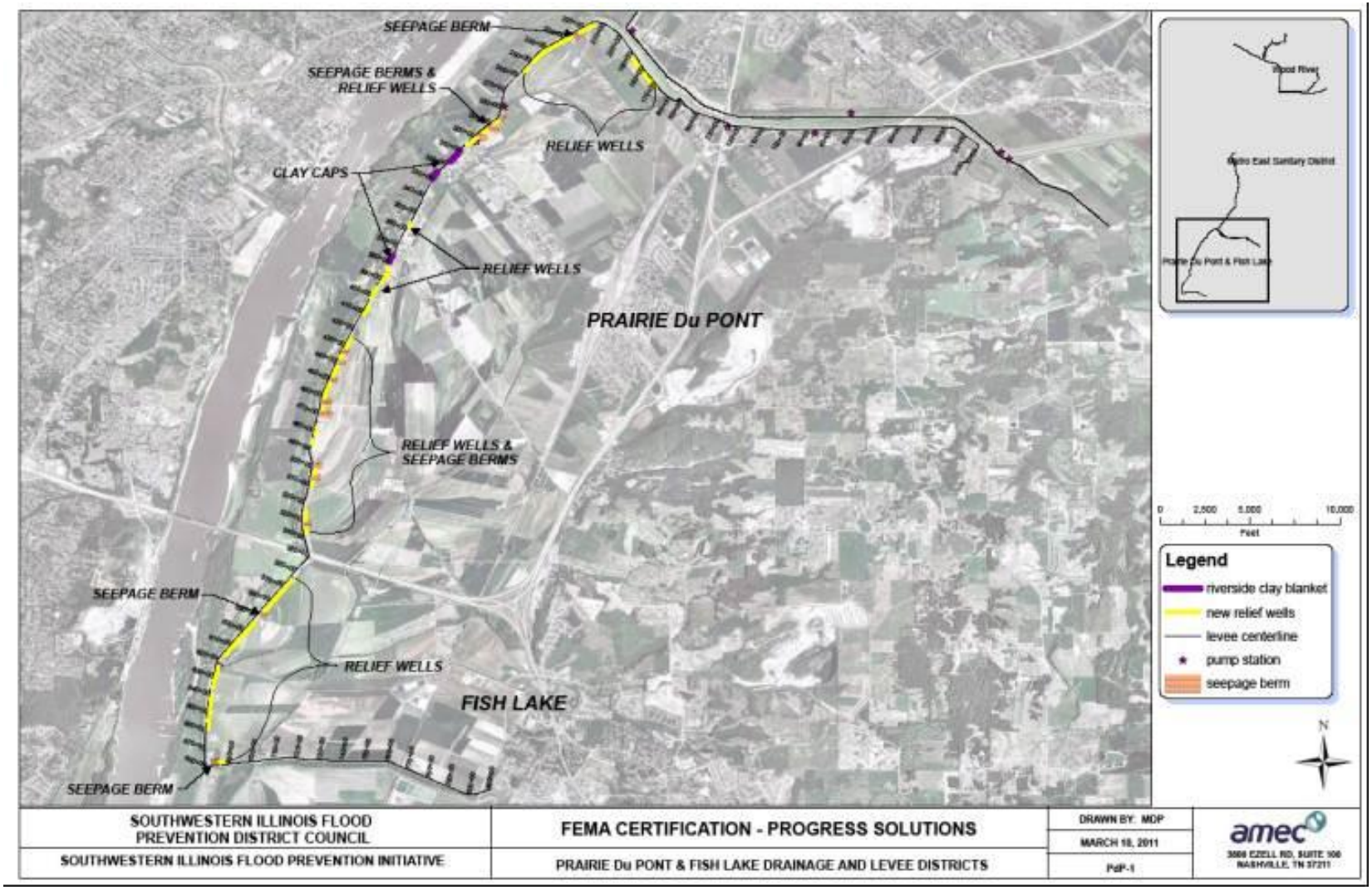

Figure 1. Map of Prairie du Pont and Fish Lake Project Area

3 IEPR Process

3.1 Planning and Schedule

Noblis developed a schedule that would meet USACE's goal of completing the IEPR as efficiently as possible in accordance with the Scope of Work (SOW). The established schedule required an aggressive deadline for completing the project. The schedule of activities was agreed upon by Noblis and USACE and included several approaches to create efficiencies in carrying out the project. Certain aspects of the task were initiated before the task award date at no expense to the USACE, and certain phases of the project were carried out concurrently. A table showing the major milestones and deliverables for the IEPR is presented in Table 1.

Table 1. Prairie du Pont and Fish Lake IEPR Project Milestones

TASK	MILESTONES
Prepare Work Plan to Conduct IEPR	* Draft Work Plan submitted
	USACE provides comments on Draft Work Plan
	Teleconference to discuss comments on Draft Work Plan
	* Final Work Plan with Charge submitted
Recruit and Select IEPR Panel Members	Noblis requests input from USACE on COI Questionnaire
	USACE provides comments on COI
	* List of selected Panelists submitted
	USACE provides comments on selected Panelists
	Noblis completes subcontracts for Panelists
	Review documents sent to Panelists
Meetings	IEPR Kickoff meeting with USACE and Noblis
	IEPR Kickoff meeting with USACE, Noblis, and IEPR Panel
	IEPR midpoint teleconference
	Teleconference meeting with Project Delivery Team (PDT) and Panel
Conduct IEPR	IEPR Panel provide response to Charge
	Noblis/Panel consensus meeting
IEPR Report	* Final IEPR Report submitted
Responses to IEPR Final Panel Comments	Noblis submits Final IEPR Comments to USACE
	USACE PDT provides draft evaluator responses (for information only) and clarifying questions to Noblis
	USACE submits final evaluator responses via email
	IEPR Panel completes backcheck comments
	* PDF of comment/response dialog submitted

* Indicates deliverable

Noblis prepared a draft and final Work Plan to define and manage the process for conducting the IEPR, including the screening and selection of peer reviewers, communication and meetings with the USACE project team, project schedule and quality control, and compilation and dissemination of peer reviewers' comments. The final Work Plan included the charge to the panel.

Noblis provided USACE with Project Status Reports on a weekly basis to communicate the current status of the project. The Project Status Reports included details of each task and noted any schedule changes. Noblis performed the requirements of this contract in accordance with its Quality Management System, which is compliant with ISO 9000.

3.2 Selection of Panel

Reaching out to its various pools of experts, Noblis identified experts who met and exceeded the technical expertise and requirements of this IEPR. Noblis provided potential candidates with a copy of the SOW, including the required expertise and project schedule, and conducted informal and formal discussions to identify any technical competency concerns or potential COI issues. Consistent with the guidelines of the OMB, the following were considered in the screening of the candidates:

- Expertise: Ensuring the selected reviewer has the knowledge, experience, and skills necessary to perform the review.
- Independence: The reviewer was not involved in producing the documents to be reviewed.
- COI: Identification of any financial or other interest that conflicts with the service of an individual on the review panel because it could impair the individual's objectivity or could create an unfair competitive advantage for a person or organization.
- Availability: Candidates' availability to meet the project schedule.

After screening candidates to exclude those with inadequate expertise or potential COI issues in accordance with the requirements and guidelines of the National Academy of Sciences and OMB, several candidates were selected for further screening and evaluation to ensure they met or exceeded the requirements of this task. The list was then narrowed down to identify the most qualified candidates that would be available to serve on the PdP/FL IEPR panel. Noblis provided the list of selected panelists along with their detailed résumés to USACE to identify any outliers who may have a potential COI based on USACE knowledge of the individual's past involvement with the PdP/FL project. USACE acknowledged the proposed panel members' experience relative to the requirements of the IEPR and that there are no perceived COI issues. A description of the panel is provided in Section 4.

3.3 Preparation and Charge for Peer Review Panel

USACE made available necessary project documents (listed in Appendix C) to Noblis, which were provided to the IEPR panel members via Noblis' secure file transfer system. Noblis communicated to the panel via email and held a kickoff meeting outlining the steps of the IEPR process, identifying the overall schedule and deadlines, and instructing the IEPR panel members how to access the documentation and undertake the review. Noblis requested all panel members to review the LRR, for which USACE had requested comments, and noted additional supporting documents as background material for their reference.

Subsequent to a cursory review of the documents by the panel but prior to the actual detailed IEPR, a meeting was held with USACE via teleconference to familiarize the IEPR panel members with the technical aspects of the project and the specific objectives of the review. As part of this meeting, USACE provided a detailed project briefing, reviewed project features and requirements, and provided the opportunity for the exchange of technical information between the panel and USACE technical staff. Noblis met with the panel members following the meeting with USACE to refine roles and responsibilities of the IEPR panel members, including providing them with general instructions and guidance for preparing their comments to ensure proper coverage of all important issues and consistency in the development of the IEPR comments. Noblis remained as the conduit for information exchange between the panel and USACE throughout the project in order to ensure a truly independent IEPR.

The final charge developed and approved by USACE established the general boundaries for the IEPR. The general charge questions are detailed in Appendix C.

3.4 Performing the IEPR

After the panel was oriented with the general scope and background information of the project, the panel initiated a detailed review of the LRR and supporting documentation. The PdP/FL IEPR involved conducting an independent technical peer review to analyze the adequacy and acceptability of environmental and engineering methods, models, data, and analyses presented in the LRR. The review was limited to a technical review and was not involved with policy issues. The IEPR panel identified, recommended, and commented on the information presented in the LRR relative to the charge.

Noblis coordinated a teleconference with all panel members at the approximate midpoint of the review process, in order to allow panel members to ask clarifying questions of the PDT to assist in the development of comments and to potentially eliminate the total number of final panel comments.

Noblis communicated to the panel all relevant project information, instructions and required actions, and deadlines. Any identified information or documents that the panel required to support its review were noted. Noblis used internal tools to track comments, issues, and information requests by the panel members during the evaluation process. Noblis facilitated information exchange and discussions between the panel and USACE in order to meet the needs of the panel and project objectives.

3.5 Panel Consensus Discussion and Finalization of IEPR Comments

After the IEPR review period ended and comments were submitted by the panel members, Noblis collated the panel comments and ensured they were complete and responsive to the charge. Noblis ensured the panel focused on performing a technical review of the documents and avoided commenting on policy-related issues. Noblis convened a group consensus meeting via teleconference with the panel members to discuss the panel's comments. This meeting provided a forum for reviewers to reach consensus on the comments, identify any overlapping comments, and resolve any contradictions. Further refinement and consolidation of the comments occurred via email exchange following the meeting. The panel discussion resulted in the final IEPR comments that were submitted to USACE in a Microsoft Word file ("Comment Tracking Form") and entered into DrChecks. The final IEPR panel comments are presented in Appendix A.

Each comment was formatted into four parts: (1) a clear statement of the concern ("Comment"), (2) the basis for the concern ("Basis for Comment"), (3) the significance of the concern (the importance of the concern with regard to project implementability) ("Significance"), and (4) the recommended actions necessary to resolve the concern to include a description of any additional research that would appreciably influence the conclusions ("Recommendation[s] for Resolution"). Comments were rated as "high," "medium," or "low" to indicate the general significance the comment has to project implementability. Noblis identified overall themes that were presented by multiple peer reviewers or repeated by one reviewer, comments that indicated conflicting peer review opinions, and other noteworthy comments.

3.6 Responses to IEPR Comments

Noblis provided the final IEPR comments to USACE and held a teleconference with USACE and the IEPR panel to review the comments. The teleconference provided the forum to seek any needed clarification on the IEPR comments as well as discuss USACE draft evaluator responses.

Following the teleconference, USACE submitted the final evaluator responses to the IEPR comments. All evaluator responses provided by USACE were labeled as "concur" or "not concur" to indicate agreement or non-agreement, respectively, on whether the concerns identified by the panel are valid. In addition, in response to the IEPR final panel comment recommendation for resolution, USACE included a statement to "adopt," "not adopt," or "adopt in future" for each recommendation, along with a response describing where documentation would/would not be expanded, revised, or changed. After the submittal of the final evaluator responses, Noblis met with the panel to discuss the responses and the approach for preparing the concluding backcheck comments, which were to provide concurrence or non-concurrence with the USACE responses on whether the responses adequately address the identified concerns. Noblis used the Comment Tracking Form to track the final IEPR comments, the USACE evaluator responses to those comments, and the panel's concluding backcheck comments.

After Noblis input the panel backcheck comments to each USACE evaluator response, the issue was closed out. Once all issues were closed out, Noblis provided USACE with a Portable Document Format (PDF) of the project file. The formal record of the USACE's responses to comments and panel's backcheck comments are captured in the Comment Tracking Form and in DrChecks.

Minor editorial changes were not included in the final set of comments unless they affected the understanding of the technical content. A listing of the editorial comments is included in Table A-2 of Appendix A.

4 Panel Organization

Noblis assembled a panel of experts to conduct the IEPR, responsible for reviewing and providing comments on the LRR for the PdP/FL project. Noblis guided communications between the panel and USACE to complete the IEPR project.

4.1 Panel Description

Noblis selected three panel members providing expertise in the required areas of biology/NEPA impact assessment, civil/geotechnical engineering, and economics. All panel members met and exceeded the minimum requirements for each of the specified areas of expertise. The panel

represented a well-balanced mix of individuals from academia, large companies, and individual consultants.

Figure 2 outlines the members of the IEPR Team. Table 2 presents the list of IEPR panel members and associated qualifications to participate in this IEPR. Panel member résumés are included in Appendix B.

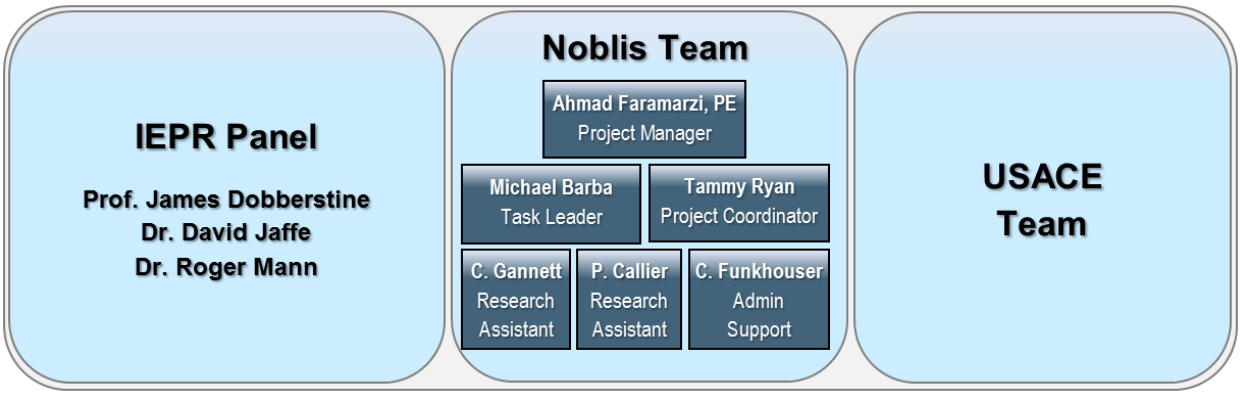

Figure 2. IEPR Team

4.2 IEPR Panel Members

James Dobberstine
Role: Biologist/NEPA Impact Assessment
Affiliation: Lee College

Prof. Dobberstine is a long-time advocate of Galveston Bay and his 18-year professional career is increasingly focused on strengthening the connections between science, policy, and public awareness. He currently teaches environmental science and biology at Lee College, in Baytown, Texas. He has extensive experience as an environmental scientist and regulatory specialist, focusing on wetlands and other aquatic habitats. Prof. Dobberstine has enjoyed working on a number of successful projects linking science to policy. He has experience developing and evaluating USACE permits, and is experienced with the complex regulatory framework affecting projects that potentially impact coastal habitat. He has also worked in the area of habitat conservation, and has experience with conservation easements, fee-simple acquisitions, and development of habitat assessments, project cost models, and easement contracts. He has leadership experience on aquatic habitat restoration projects aiding in project development, permit acquisition, safety and toxicity issues, fundraising/grant development, and project implementation. He has also served on the IEPR of the Engineering, Economic, and Environmental Evaluation of the Geotechnical, Hydrological, Hydraulic, and Economic Aspects of the Dam Safety Modification Study Report for Rough River Dam, Kentucky. Prof. Dobberstine has served on subcommittees of the Galveston Bay Council of the Galveston Bay Estuary Program, formerly as Vice-Chair of the Public Participation and Education Subcommittee, and currently as a member of the Monitoring and Research Subcommittee. He also serves on the Boards of Directors of the Texas Association of Environmental Professionals (as President 2010–2011), the South Central Regional Chapter of Society of Environmental Toxicology and Chemistry (SETAC), and the Galveston Bay Foundation.

David Jaffe, PhD, PE, D.WRE
Role: Civil/Geotechnical Engineer
Affiliation: Dudek

Dr. David Jaffe has been involved in water resource development, water infrastructure financing, and water policy for more than a decade. His expertise in civil/geotechnical and hydraulics/hydrologic engineering includes computational methods and alluvial/fluvial transport and flood control research and design for over 15 years, with 16 publications and conference abstracts. He has worked on numerous flood control, levee design, sediment transport, and numerical modeling projects related to surface water conveyance and design, with a focus on flood control implementation and design. Dr. Jaffe has extensive experience with flood risk management projects with an emphasis on diversion channel design and large river control structures, as well as research and professional projects involving large, urban public works, flood risk, and flood control. He has conducted and led teams on numerous flood flow frequency analyses for modeling and design efforts and has taught professional level 1- and 2-D computational hydraulic and sediment transport courses. Dr. Jaffe has worked for more than a decade at the intersection of water resource development, water infrastructure financing, and water policy, with focused technical expertise on the translation of engineering science into actionable environmental benefit. He has a PhD in civil and environmental engineering, and is a Registered Civil Engineer in California and Arizona. Dr. Jaffe also serves as a Diplomate for the American Academy of Water Resources Engineers and a member of the American Society of Civil Engineers. He has served on the IEPR for the Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management General Reevaluation Report (GRR) and Supplemental Environmental Impact Statement (SEIS).

Roger Mann, PhD
Role: Economist
Affiliation: RMann Economics

Dr. Roger Mann has provided leadership and research services in resource economics for 25 years. His economics expertise includes water supply and quality economics, environmental economics, regional economics, agricultural economics, and benefit-cost (B/C) analysis. With a PhD in agricultural economics and economics from Colorado State University, his experience has supported projects with state and federal agencies, private investors, and environmental groups. Dr. Mann has developed and screened economic methods, including Hydrologic Engineering Center Flood Damage Reduction Analysis (HEC-FDA), for California public benefits including flood control; developed water supply and quality economic analysis for Delta levee material transfer facilities; and worked with Reclamation, California, and private clients in B/C analysis of multi-purpose projects under federal principles and guidelines (P&Gs), including consideration of federal Flood Damage Reduction (FDR) benefits as described in ER-1105-2-100. He has served on the USACE IEPR for the Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management GRR and SEIS.

Table 2. Prairie du Pont and Fish Lake IEPR Panel

		Prof. James Dobberstine	Dr. David Jaffe	Dr. Roger Mann
	Highest Degree	M.S.	PhD	PhD
	Years of Experience	18	15	25
	Past Experience with COE Projects	●	●	●
	Affiliation (e.g., academia, consulting firm, government, etc)	Academia	Private	Consulting
Civil/Geotechnical Engineer	≥10 years experience in civil/geotechnical studies and design of flood control works including levee and underseepage control features, access to work sites, disposition of excavated contaminated soil material, and design and construction of relief wells and slurry walls		●	
	Registered Professional Engineer from academia, a public agency whose mission includes flood damage prevention, or an Architect–Engineer or consulting firm		●	
	Familiar with geotechnical practices used in the Mississippi River Floodplain and have demonstrated experience related to levee design and construction..		●	
	Experience with hazardous waste and aquifer protection		●	
	Active participation in related professional engineering and scientific societies		●	
	Capable of addressing the USACE Safety Assurance Review (SAR)* aspects of all projects)		●	
Biologist/NEPA	≥10 years demonstrated experience in evaluation and conducting NEPA impact assessments, including cumulative effects analyses, for complex multi-objective public works projects with competing trade-offs	●		
	Scientist from academia, a public agency, a non-governmental entity, or an Architect-Engineer or Consulting Firm	●		
	Experience determining the scope and appropriate methodologies for impact assessment and analyses for a variety of projects and programs with high public and interagency interests and having project impacts to nearby sensitive habitats	●		
	Active participation in related professional societies	●		
Economist	≥ 10 years economics work experience including benefit cost analysis			●
	Experience directly related to water resource economic evaluation or review			●
	Direct experience working for or with USACE highly preferred but not required			●
	Familiar with the USACE planning process, guidance, and economic evaluation techniques.			●
	Active participation in related professional societies is encouraged			●
	Familiar with the USACE flood risk management analysis and economic benefit calculations, including use of standard USACE computer programs including HEC-FDA			●

4.3 Noblis Team

The Noblis Project Management Team (as outlined in Figure 3) included the following members:

Mr. Ahmad Faramarzi, PE, PMP, Project Manager, supervised project personnel and communicated policies, procedures, and goals to these employees, and maintained regular

contact with the USACE. Mr. Faramarzi was responsible for the overall project plan, project performance, and contractual obligations on project tasks.

Mr. Michael Barba, Task Leader, developed the Work Plan and Report and provided technical leadership in managing the IEPR activities.

Ms. Tammy Ryan, Project Coordinator, supported the Project Manager on all IEPR tasks, including the identification and recruitment of candidates for the expert panel. Ms. Ryan also supported Mr. Barba in coordinating IEPR activities.

Ms. M.R. "Peaches" Callier, and Ms. Christina Gannett served as Research Assistants and supported the IEPR activities on an as-needed basis.

Ms. Carolina Funkhouser provided Administrative Support for the project.

5 Conclusions and Observations

The PdP/FL IEPR resulted in several comments on the adequacy of the information presented in the LRR, as well as the information that was not found and recommended to be included. In general, the comments identify shortcomings and offer suggestions that would improve the technical adequacy and overall quality of the LRR. The comments also include a number of issues that should be addressed so that the LRR can be comprehensive in the assessment of all important considerations in the justification and implementation of the project.

The general themes of the technical comments cover issues relating to the completeness of the technical information and rationale discussed in the LRR to support the alternatives analysis and tentatively selected plan. Specific analyses and considerations that are important to the justification and implementation of the project were missing, unclear, or inconsistent. The identified issues note that the LRR did not include adequate discussion and detail that should be included to allow a more complete understanding of the project.

In general, the panel acknowledged that the LRR adequately identified underseepage issues and design deficiencies associated with PdP/FL levee system and assembled viable alternatives for correcting the design. The LRR presented appropriate analyses, methods, and models used in evaluating each alternative and identifying the tentatively selected plan. However, the implementation of the analyses in certain areas was not clearly identified or discussed in the LRR. The document lacked sufficient detail in certain sections that are essential for providing an adequate assessment of project impacts. A few important considerations were missing in the project analyses that support the justification of the project. The panel raised several issues noting the deficiencies and inconsistencies in the analyses that are important for providing a complete understanding of all considerations in the alternatives analysis and the tentatively selected plan. The recommended changes to the document provide for the development of an appropriate and thorough representation of economic, engineering, and environmental findings that support the justification and implementation of the project.

Economics. The LRR included appropriate methods for analyzing economic considerations associated with the alternatives evaluated. The cost-benefit analysis did include a sufficient assessment of reasonable costs and benefits to develop an accurate benefit-cost ratio (BCR). However, some costs and benefits were not included in the LRR that could improve the benefit-cost analysis. Some project benefits and costs were not thoroughly discussed or quantified. Data pertaining to cost-benefit analysis were mentioned but then not used in the detailed analysis.

While lack of detailed analysis for these costs and benefits would likely not affect the selection of the preferred alternative, the project analysis would be more complete and reliable if all proper project benefits were considered and adequately evaluated. Also, the discussion in the LRR was not clear and inconsistent in certain locations of the document. The panel understands that further revisions to the LRR are anticipated that will improve the analysis and present cost-benefit information appropriately.

Engineering. The overall hydrologic and geotechnical principles and methods used in conducting the project analysis and developing the project improvements were adequate and appropriate for evaluating alternatives and supporting the tentatively selected plan. The panel's comments primarily relate to the need for more discussion of important statistical and design procedures that support the design and implementation of the preferred alternative. Some design calculations and analyses were either missing or not adequately discussed. Also, the addition of key tables and figures in the LRR would improve the understanding of the project. Further, some tables in the LRR were either incomplete or were potentially misleading and confusing to the reader. The panel recognizes that the document will be updated to address the identified deficiencies, and additional detailed analyses and other design considerations are expected in future phases of the project.

Environmental. The LRR included appropriate methods for analyzing project impacts and included suitable mitigation approaches for addressing them. However, certain project impacts and aspects of the mitigation important to the justification and implementation of the project were not included or adequately discussed. Particularly, the panel raised issues associated with potential organic contaminants in dredged material that will be used as part of the tentatively selected plan. The documentation did not fully identify potential impacts and management actions from proposed dredged material as well as downstream impacts to human and aquatic populations that might result from project implementation. In addition, issues with the mitigation of project impacts to specific endangered species as well as issues with the long-term management of the project area were not adequately discussed. The panel recognizes that more detailed information to support the assessment of environmental impacts and mitigation approaches, particularly more detailed analysis of the management of potential contaminants in dredged material, will be added to the LRR as well as addressed in other stages of project implementation.

6 References

Department of the Army. 2010. USACE Engineer Circular (EC) No. 1165-2-209, *Civil Works Review Policy.* 31 January.

Office of Management and Budget (OMB). 2004. *Final Information Quality Bulletin for Peer Review*, released 16 December.

U.S. Army Corps of Engineers (USACE) St. Louis District. 2012. *Draft Limited Reevaluation Report for Design Deficiency Corrections, Prairie du Pont and Fish Lake Flood Risk Reduction Project, St. Clair and Monroe Counties, Illinois, Flood Risk Management.* August http://www.mvs.usace.army.mil/pm/DraftPrairieDuPontLRR/PrairieduPontLRR_prd.pdf.

Appendix A – IEPR Comments

A.1 Final IEPR Comments

This Appendix provides the PdP/FL IEPR comments on the LRR for PdP/FL, Illinois. The comments cover a range of issues that pertain to the technical aspects of the LRR. Each comment is formatted into four parts that include the following: (1) a clear statement of the concern ("Comment"), (2) the basis for the concern ("Basis for Comment"), (3) the significance of the concern (the importance of the concern with regard to project implementability) ("Significance"), and (4) the recommended actions necessary to resolve the concern to include a description of any additional research that would appreciably influence the conclusions ("Recommendation[s] for Resolution"). Comments are rated as "high," "medium," or "low" to indicate the general significance the comment has to project implementability. The significance ratings were applied using the following criteria:

- High = Comment describes a fundamental problem with the project that could affect the recommendation or justification of the project
- Medium = Comment affects the completeness or understanding of the recommendation or justification of the project
- Low = Comment affects the technical quality and understanding of the project based on the presentation of information in the report, but there is limited concern regarding project implementability.

The comments are arranged in order of significance. Of the final 35 comments, 10 were identified as having high significance, 14 were identified as having medium significance, and 11 were identified as having a low level of significance.

A.2 Summary of Comments

Following is a listing of the final comments submitted in the Comment Tracking Form.

Table A-1. Overview of Final Comments Identified by IEPR Panel

Significance – High	
1	The benefit-cost (B/C) analysis suggests that the B/C ratio (BCR) of the tentatively selected plan (TSP) is only 1.2 with little confidence that the B/C ratio even exceeds 1, but some important benefits are not included.
2	O&M cost savings associated with closure of the existing relief wells are not counted as a benefit.
3	Railway transportation delay costs were not included, but a reasonable estimate could have been included.
4	The probability of failure for the levee is not the same for all events, although the text assumes that this is the case. Therefore, the probability of unsatisfactory performance for the with-project condition may overstate the reliability of the improved levee system.

5	The Environmental Assessment (EA) does not fully identify potential hazards and management actions for organic contaminants, including contamination from proposed dredge material from the Mississippi River, impacts to surface water quality from dredge material effluent return, and downstream impacts to human and aquatic populations that might result from disturbing sediments at the dredge borrow sites.
6	Noise and light impacts to endangered bat species are not included in the EA and Appendix A.
7	In EA Section 4.16.3, the EA does not include information or quantitative data (field data) to support the statement, "Since the project area does not contain least tern nesting or adjacent foraging habitat, the St. Louis District has determined that the project poses "no effect" to the least tern."
8	The Finding of No Significant Impact (FONSI) is premature based on the need to gather additional information and provision of additional documentation regarding Hazardous Toxic Radioactive Waste (HTRW) impacts associated with dredge and fill operations, endangered species impacts, alternative analysis, and mitigation.
9	In the Mitigation Plan (MP), Section 4- Conservation Servitude and Section 12- Financial Assurances, the conservation servitude (easement) does not include financial provisions *specific to the servitude instrument* to ensure that the terms of the instrument can be monitored and enforced in perpetuity.
10	In the MP, Appendix EA, Section 8- Performance Standards the invasive species land cover component is much too high to ensure success in what is described as a long-disturbed environment.
Significance – Medium	
11	The estimated operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) annual cost in LRR Table 6-3 appears to be calculated incorrectly.
12	In the LRR, OMRR&R costs, Inspection & Minor Repair and Mech./Elec. Major Rehab. Costs for year-50 were not counted.
13	The agricultural benefit estimate is likely overstated because it does not include agricultural production costs that would be avoided because of a flood. On the other hand, the agricultural benefit is understated because clean-up costs have not been included.
14	Other O&M cost savings may have not been counted as a benefit.
15	Erosion loss on the landward side of the levee because of water ponded or flowing along the landward side of the levee has the potential to exacerbate or increase the impact of piping, sand boils and other potential failure mechanisms. The method of mitigating landward levee erosion is not clear.
16	Comprehensive hydraulic design of the relief wells are absent from the present study.

17	The documentation lacks key graphics that are needed to support the text in several cases.
18	The heterogeneity of the soils underlying the project site is not adequately discussed.
19	Cumulative and secondary effects are not fully considered in the EA.
20	The performance standards in Section 8 of the MP appear arbitrary, and there is no discussion in the text to support how the standards were determined.
21	In the EA-MP Section 10- Long-term Management Plan, it is not clear if the entity responsible for long-term monitoring and the entity conducting any corrective action in the event of a violation of the conservation servitude are two distinct entities to avoid a conflict of interest should a violation of the servitude agreement occur.
22	In the EA-MP Section 13- Cost, and Table EA-MP-6, the costs shown appear to be arbitrary. There is no discussion included regarding how these monitoring costs were established.
23	The level of information in the evaluation of alternatives involving slurry cutoff walls is not consistent with other alternatives analysis.
24	The potential effects of climate change do not appear to be considered in the LRR or supporting documents.
Significance – Low	
25	The subject levee provides indirect protection from flooding of other areas. The benefit of this indirect protection is not discussed or quantified as a benefit.
26	Vehicle and mobile home damages do not consider probable notification time.
27	The new Mississippi River bridge project is not considered within the traffic delay analysis.
28	The economics appendix is not consistent regarding whether or not specific costs are included in the economics analysis.
29	There is no information for the Regional Economic Development (RED) account included.
30	The source of expected annual damage (EAD) for agriculture is not completely documented.
31	It is not clear in the EA how wetland resource determinations were conducted to calculate impacts.
32	The sentence on Page EA-404-8 under “Description of Proposed Discharge Sites”: “Although exact locations have yet to be identified, wetland sites will be avoided,” is unclear and potentially misleading.
33	There are no recommendations or qualifications related to the inspections of the project improvements for future maintenance and operation.

34	The understanding that the present design standard for water surface elevation (WSE) exceeds the Federal Emergency Management Agency (FEMA) standard, and the extent of this exceedance, is not discussed in the LRR.
35	Various tables within the documentation are lacking important details that make specific information unclear.

The following pages outline the final IEPR comments in detail, including the four-part analysis. The comments are sorted based on their designated significance.

Comment #: 1
The benefit-cost (B/C) analysis suggests that the B/C ratio (BCR) of the tentatively selected plan (TSP) is only 1.2 with little confidence that the B/C ratio even exceeds 1, but some important benefits are not included.
Basis for Comment:
The B/C ratio is 1.2. From Page J-20, Table 8, the probability that the net benefit from quantified benefits exceeds zero is about 55 percent; conversely, the probability that the B/C ratio is less than 1 is about 45 percent. This result does not provide confidence that the TSP is an economical project, but some important benefits have not been counted.
Significance: High
The low BCR does not bode well for this project considering that the minimum BCR required by past administrations to start projects has often been over 1.5. (GAO, 2010)[1]
Recommendation for Resolution:
Quantify benefits that have not been quantified, including operations and maintenance (O&M) cost savings, railroad delay benefits, and benefits of avoided damaged within adjacent protected areas. At a minimum, include the O&M cost savings, update the traffic costs to May 2012 price levels, and expand the discussion in the LRR Page J-21 to J-22.

[1] United States Government Accountability Office. 2010. Report to the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives. Army Corps of Engineers Budget Formulation Process Emphasizes Agencywide Priorities, but Transparency of Budget Presentation Could Be Improved. GAO-10-453. April.

Comment #: 2
O&M cost savings associated with closure of the existing relief wells are not counted as a benefit.
Basis for Comment:
The operating costs of 162 existing wood stave relief wells would be eliminated by the TSP. This should be counted as a benefit.
Significance: High
A benefit of over $100,000 annually would significantly affect the B/C ratio and would reduce the calculated risk of having a B/C less than one.
Recommendation for Resolution:
Calculate current annual O&M for the 162 existing wood stave relief wells. Consider if these without-project O&M costs are likely to increase in the future, and if so, include.

Comment #: 3

Railway transportation delay costs were not included, but a reasonable estimate could have been included.

Basis for Comment:

Page J-21.

> This station sees 40 to 60 trains passing through each day. This yard is a vital hub for the St. Louis area and the company expressed that a closure of 1 day would immediately add anywhere from a 24 to a 36 hour delay per train.

This information could be used with an estimate of value per hour of delay to provide a conservative estimate of the delay cost per day. Duration of flooding has been estimated, so total cost could be estimated.

Significance: High

Not quantifying this benefit may significantly understate the BCR.

Recommendation for Resolution:

Try to obtain a simple estimate, and see if it is an important part of the expected annual damage (EAD). An estimate of cost per hour duration based on data from the 2006 Statistical Abstract of the US Table 1103 is provided below. The depth-duration curve would be needed to calculate EAD.

Calculations to obtain an estimate of train delay cost per day of flood duration		
National averages from Statistical Abstract		
Train Operating Revenues	$36,639	Million $
Net Revenues	$5,199	Million $
Train miles	516	Million
Train miles per train hour	20	Miles
Calculations for Dupo		
Average Dupo trains/day	50	Avg from Page J-21
Average delay per train	30	Avg from Page J-21
Hours delay per day duration	1500	Hrs, 50 times 30
Net revenue per train-mile	$10.08	$5,199/516
Miles lost per day duration	30000	20 times 1500
Net rev. lost per day duration	$302,267	30000 times $10.08

Comment #: 4
The probability of failure for the levee is not the same for all events, although the text assumes that this is the case. Therefore, the probability of unsatisfactory performance for the with-project condition may overstate the reliability of the improved levee system.
Basis for Comment:
Table 4, economics appendix, shows that the with-project levee probability of failure for every event from 415 to 425 feet is assumed to be 0.01 percent, i.e., one in ten-thousand. The stage height of 425 feet, 51 feet at the St. Louis gage, has apparently never been experienced. It seems unlikely that the reliability of the with-project facility will be the same at 415 feet as it is at 425 feet. The probability of levee failure varies significantly by event. This is due in part to the reliability indexes, performance function, uncertainty parameters, and other values used in the calculation of failure probability for each event under consideration. There is broad literature discussing the calculation methods and assumptions used in this topic. The present study, however, uses the same value of failure probability for each event. The study, therefore, either under- or over-states the probability of failure for the different events relative to one another.
Significance: High
Even if EAD is not much affected, unrealistic assumptions cast uncertainty on the entire analysis.
Recommendation for Resolution:
Update the design chance of failure for the different water surface elevations/design events. Add a brief discussion of the methods used in the calculations of failure probability, and cite any design calculation standards and assumptions in the text.

Comment #: 5

The Environmental Assessment (EA) does not fully identify potential hazards and management actions for organic contaminants, including contamination from proposed dredge material from the Mississippi River, impacts to surface water quality from dredge material effluent return, and downstream impacts to human and aquatic populations that might result from disturbing sediments at the dredge borrow sites.

Basis for Comment:

The EA notes that the Environmental Protection Agency (EPA) (2006) found polychlorinated biphenyls (PCBs) in the vicinity of the project site. While the EA states that contaminated areas specified in the EPA report will be avoided, the potential for other similarly contaminated sites would appear possible based on the soils, adjacent land uses, and upstream sources. It is the panel's understanding that it is standard procedure on USACE projects to conduct contaminant analysis of dredge material prior to placement as necessitated by Section 404 of the Clean Water Act (CWA). When testing is determined to be necessary to comply with the Section 404(b)(1) guidelines, the USACE has provided that contaminant analysis generally follows the guidance found in the Inland Testing Manual (EPA-823-B-98-004).

Based on the data within the 2006 EPA study, the panel believes that there is sufficient evidence to suggest that there is potential for contaminants to be present in dredge sediment proposed for use in this project. The study noted levels of contaminants exceeding screening levels, including benzo(a)pyrene, heptachlor epoxide, 4,4'-dichlorodiphenyldichloroethane (DDD), 4,4'-dichlorodiphenyltrichloroethane (DDT), PCB-1016, and PCB-1260 at multiple sites located within the Mississippi River stretch from upstream of the project boundary to sample locations south of the project boundary. One sample site (S-1) from the study located approximately 8 miles upstream from the sample location found benzo(a)pyrene at nearly 5 times over the Ecological Screening Level (ESL). Nearly all of the sites sampled are characterized by sediments composed primarily of fine sands, silt, and clay, which have the potential to harbor these and other similar organic contaminants. Additionally, the project site is located approximately 5 miles downstream from the Sauget & County Landfill Superfund Site (EPA I.D.: ILD000605790). EPA data (Oct/Nov 2000) indicates that sediments in the Mississippi River adjacent to the superfund site showed high levels of contaminants including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, an herbicide, and PCBs. Additionally, the EPA noted that VOC and SVOC-contaminated groundwater was being released to the Mississippi River from the site.

It does not appear from the LRR that the footprint of the dredge-borrow site(s) have been identified specifically at this time. Based on the distribution of contaminants near and adjacent to the study area, composition of the sediments in the river, and potential upstream sources of these contaminants, the panel believes that the criteria triggering testing have been met as detailed in Part 230.60 of the 404(b)(1) guidelines, should the borrow area be located anywhere in the Mississippi River adjacent to the project site.

The LRR and EA should be revised to better reflect this potential and note specifically that sediments from the dredge material would be analyzed prior to disturbance and placement according to the Inland Testing Manual, and that appropriate protective measures will be taken to ensure compliance with the CWA.

Return water (effluent) from dredge material placement can introduce significant sources of direct impairment due to high turbidity, temperature, and other chemical and physical factors. These potential sources of impairment should be noted as a potential impact in the EA and applicable sections of Section III A, C, and D of Appendix A. It is not clear from Section III F 2 or Section IV C of Appendix A whether National Pollutant Discharge Elimination System (NPDES) limitations and performance standards would apply specifically to dredge effluent. This should be revised to indicate that NPDES limitations would apply and demonstrate how the USACE proposes to meet those performance standards as they apply to the dredge effluent.

Dredging can disturb sediments in the river, temporarily increase turbidity downstream, and mobilize previously covered contaminants located in the areas of dredging activity to downstream locations, thus increasing the risk of exposure to the public and downstream environment. These impacts (effects) should be identified and assessed in Appendix A. Additionally, number 2c indicates, "Toxic metals or organics are not expected to be encountered during construction." This statement is not well justified in the LRR materials. Assessing this risk fully would allow for determination of any required mitigation to reduce downstream migration of sediments (i.e., silt curtains, etc.).

Significance: High

The documentation does not include an adequate assessment of environmental impacts that affect key considerations in the justification and implementation of the project.

Recommendation for Resolution:

1. Revise the LRR, EA, and relevant appendices to better reflect potential organic hazard contamination and specify that sediments from the dredge material would be analyzed prior to disturbance and placement according to the criteria in the Inland Testing Manual, and that appropriate protective measures (mitigation) will be taken to ensure compliance with Section 404 of the CWA.
2. Note potential impact to surface water from dredge material return (effluent) and whether NPDES limitations would apply in Section 4.7 of the EA and applicable sections of Appendix A, and demonstrate how the USACE proposes to meet those standards as they apply to the dredge effluent.
3. Revise the referenced section in Appendix A to fully reflect potential effects from turbidity and toxic metals/organics associated with the proposed dredging work and propose mitigation for these impacts if necessary.

Comment #: 6
Noise and light impacts to endangered bat species are not included in the EA and Appendix A.
Basis for Comment:
The proposed plan to survey for Indiana bats and avoid tree felling during summer periods when bats are likely to be present is good. However, noise, light, and vibration should be considered as potential impacts as applied to endangered bat species. Insectivorous bats, including Gray and Indiana bats, are ecologically important species, and are declining rapidly in population size, reducing their ability to fill their ecologic niche. Research indicates these organisms are sensitive to noise, and are often displaced as a result (Shaub, et al, 2008). Noise can disrupt forage patterns and activity, and may alter roost selection and gestation success. The bat species of concern in this project currently suffer significant losses annually from white-noise syndrome (linked to the fungus *Geomyces destructans*), habitat disturbance, and pesticides. As these species are already in decline, they are likely more vulnerable to other environmental stressors. Temporary direct effects can lead to permanent secondary and cumulative effects, such as additional displacement and habitat fragmentation. Generally, threatened/endangered species are keystone species within their ecologic communities. Careful protection of these species can greatly benefit the community overall through the fulfillment of the species ecologic niches. According to the US Forest Service, these bats feed on nuisance and pest species, including alfalfa weevil and gypsy moth (pests that inflict significant economic and environmental damage nationally). Avoiding impacts to local bat populations could provide economic and environmental benefits to the surrounding community. In addition to the proposed impact avoidance from any tree clearing between April 1st and September 30th, additional mitigation for impacts might include structural sound and vibration attenuation during construction near locations likely to include bats at any time that construction activities are underway.
Significance: High
The documentation does not include a complete assessment of project impacts to endangered species that affect key considerations in the justification and implementation of the project.
Recommendation for Resolution:
Include potential noise and light impacts regarding bat populations, and develop appropriate strategies to reduce these impacts for construction activities adjacent to and during periods bats are likely to be present (i.e., sound attenuation, etc.).

Comment #: 7
In EA Section 4.16.3, the EA does not include information or quantitative data (field data) to support the statement, "Since the project area does not contain least tern nesting or adjacent foraging habitat, the St. Louis District has determined that the project poses "no effect" to the least tern."
Basis for Comment:
Aerial photos appear to show sand berms and shoreline habitat potentially suitable for nesting and foraging for Interior Least Terns along the southern half of the project area adjacent to the Mississippi River. Interior Least Terns have been described as adaptable by the U.S. Fish and Wildlife Service (USFWS) and have been noted to occasionally nest in unexpected locations, including on a levee structure in Indiana adjacent to the Wabash River in 1986. Given the endangered status of the Interior Least Tern, and the documented decline in suitable nesting and foraging habitat for this species in the region, the panel recommends conducting field surveys prior to the commencement of construction, dredging operations, or other project related activities to verify that Interior Least Terns are not making use of the project shoreline or adjacent sandbars for nesting. In the event that Interior Least Terns or evidence of nesting are found, coordination with the USFWS to avoid, minimize, and/or mitigate impacts is highly recommended.
Significance: High
The documentation does not include an adequate assessment of project impacts to endangered species that affect key considerations in the justification and implementation of the project.
Recommendation for Resolution:
Note in the EA that field survey(s) will be conducted prior to construction activities to verify that Interior Least Tern nesting and foraging activity is absent along the project area shoreline. Make note that if Interior Least Tern nesting or foraging activity is detected during proposed project actions, the USFWS would be contacted immediately.

Comment #: 8
The Finding of No Significant Impact (FONSI) is premature based on the need to gather additional information and provision of additional documentation regarding Hazardous Toxic Radioactive Waste (HTRW) impacts associated with dredge and fill operations, endangered species impacts, alternative analysis, and mitigation.
Basis for Comment:
According to Section 1508.9 of the Council on Environmental Quality regulations, an EA is to provide evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a FONSI. In this case, there is insufficient information and supporting data regarding HTRW impacts, endangered species, alternative analysis, and mitigation to support a FONSI at this time. It may be possible to provide additional information to support such a finding in the EA, or an EIS may be required. The FONSI would be better supported should the USACE choose to acknowledge and provide a strategy for addressing the above issues as the project proceeds in the LRR and/or EA.
Significance: High
Comment describes a fundamental problem with the project that could affect the recommendation or justification of the project.
Recommendation for Resolution:
Provide a strategy in the LRR and/or EA to address the noted issues as the project proceeds to better justify the FONSI, or remove the FONSI until the data is complete, or recommend an EIS.

Comment #: 9
In the Mitigation Plan (MP), Section 4- Conservation Servitude and Section 12- Financial Assurances, the conservation servitude (easement) does not include financial provisions *specific to the servitude instrument* to ensure that the terms of the instrument can be monitored and enforced in perpetuity.
Basis for Comment:
A discussion of financial provisions are included in general in Section 12- Financial Assurances, but are not specific to the servitude monitoring and enforcement, which is a separate consideration from the ecologic site performance monitoring that was discussed in the mitigation plan (i.e., percent target plant cover). These assurances are typically in the form of servitude (easement) stewardship and enforcement fees that are designated specifically for easement monitoring and enforcement (if necessary). At the time that the easement is signed, filed with the property title, and put into force, these funds are typically transferred to a third party land trust charged with monitoring and enforcing the easement. Conservation easements and similar tools can be excellent instruments for ensuring that a conservation site remains protected as intended in perpetuity. This is especially true when a third party entity is clearly identified and charged with monitoring and enforcing the easement, and has the financial and organizational capacity to do so indefinitely. Developing provisions for in-perpetuity monitoring of the site and enforcement of the terms of the conservation easement ensures that the intent and integrity of the conservation site remain intact after performance-monitoring requirements under the CWA permit have been met and permit-related monitoring has ceased. Typically, representatives of the land trust would conduct annual site visits to the mitigation site, inspecting the site to ensure that the provisions of the conservation easement have not been violated since the previous inspection, and that the ecologic and environmental parameters of the site continue to meet or exceed the baseline measures developed at the time that the easement was put into force. If violations are determined to have occurred, a plan is developed with the landholder to correct that violation. Failure to correct violations and adhere to the terms of the easement are enforceable in court. It is highly recommended that a third-party, dedicated land trust that is accredited by the Land Trust Alliance (LTA) be charged with the responsibility of monitoring and enforcing the provisions of the conservation servitude instrument (easement). LTA generally recommends that when a land trust accepts a contract to monitor and enforce an easement, that the landholder also provide funding to the land trust to offset the cost of annual monitoring and enforcement of the provisions of the easement. These financial assurances (fees) vary, but are very important to the viability of the easement across time, and should be negotiated with the land trust in advance, and incorporated as a cost of the project mitigation. Failure to accurately assess and incorporate funding for these costs specifically can lead to a failure of the conservation property's function and value across the 50-year life span of the project, thus resulting in a long-term failure of the mitigation site and potentially a net loss of ecologic functions and values associated with the project. Funding for this aspect of the mitigation should be incorporated into the project planning process, rather than externalized to the non-federal partner or third-party land trust. More information can be found at http://www.landtrustalliance.org/.

Significance: High
Comment describes a fundamental problem with the project that could affect the recommendation or justification of the project.
Recommendation for Resolution:
Revise the mitigation plan to reflect that the terms of the conservation servitude agreement will be monitored and enforced in perpetuity, preferably by a third-party land trust accredited by LTA. Specify in the mitigation plan that financial assurances will spell out monitoring and enforcement funding of the conservation servitude to ensure that monitoring and enforcement are funded in perpetuity.

Comment #: 10
In the MP, Appendix EA, Section 8- Performance Standards the invasive species land cover component is much too high to ensure success in what is described as a long-disturbed environment.
Basis for Comment:
Invasive species are characterized by high fecundity and few (if any) natural controls in their non-native environment, giving them a significant competitive advantage over native species and allowing them to imbed and become pervasive over time (often in spite of efforts to control them). Many, including kudzu, can easily overgrow adjacent native vegetation in a single growing season, killing resident native plant species. In disturbed environments (including fallow agricultural lands, maintenance right-of-ways, etc.), many invasive plant species simply outcompete native plants for resources over time, especially once a seedbed is established in the soils. By the time 25% site coverage has occurred, many invasive plant species have had ample opportunity to become well established and are much more difficult to remove permanently. Once a seedbed is established, it can allow many invasive plant species to recover and reemerge well after monitoring and control efforts have ceased. In both cases, functional value of the restored habitat decreases as the biologic ecosystem becomes simplified. Impacts from invasive species can include biodiversity reduction, hydrologic changes to wetlands, and changes to native faunal uses. It is typically more cost-effective over time to manage these invasive plants when the populations are low. It is highly recommended that the performance standard target for invasive species land cover be reduced to 10% (the most common standard nationally) or less to prevent establishment of invasive plant species and a subsequent reduction in habitat values. In addition to studies investigating the prevalence and functional ecologic impacts of invasive species, there have been additional studies investigating invasive species performance standards for compensatory mitigation. There is some evidence in the literature to suggest that performance standards applied to invasive plant species might best be set individually for each species, and on a case-by-case basis for mitigation sites to reflect differences in the ecologic risk associated with different species in specific habitats, and the in-situ conditions of the proposed mitigation site relative to natural reference sites in the same watershed or ecologic region.
Significance: High
The performance standard specified is inadequate affecting concerns in project implementation.
Recommendation for Resolution:
Revise the invasive species performance standards to reflect a lower overall coverage (10% or less is recommended), or a standard that is clearly detailed and demonstrated to meet the ecologic goals of the site based on quantitative data or recommendations from relevant literature.

Comment #: 11
The estimated operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) annual cost in LRR Table 6-3 appears to be calculated incorrectly.
Basis for Comment:
The annual OMRR&R cost estimate in the document is $164,000. A calculation of the annualized OMRR&R cost based on data in LRR Table 6-3, without the year-50 costs for Inspection & Minor Repair and Mech./Elec. Major Rehab. Costs, shows that it should be $177,851.
Significance: Medium
Approximately $13,000 of annualized cost added may affect the BCR.
Recommendation for Resolution:
Recalculate OMRR&R costs and BCR, and change text in the economics appendix and LRR.

Comment #: 12
In the LRR, OMRR&R costs, Inspection & Minor Repair and Mech./Elec. Major Rehab. Costs for year-50 were not counted.
Basis for Comment:
All economic costs anticipated within the stated planning horizon should be counted. The OMRR&R costs presented in Table 6-2 Page 42. With the year 50 costs, OMRR&R costs should be $180,353 instead of the corrected $177,851. This is an insignificant change to the B/C ratio. However, the net benefit of the National Economic Development (NED) plan (Berms with Relief wells) is only $3,000 more than the "Berms Only" plan (Page J-20, Table 8). It appears that inclusion of the year 50 costs would reduce net benefits of the NED plan by $2,500.
Significance: Medium
The BCR is affected by a small amount, but the NED plan could be affected.
Recommendation for Resolution:
Include year-50 costs in the OMRR&R, or better justify why year-50 costs are not included.

Comment #: 13
The agricultural benefit estimate is likely overstated because it does not include agricultural production costs that would be avoided because of a flood. On the other hand, the agricultural benefit is understated because clean-up costs have not been included.
Basis for Comment:
The agricultural damage estimates are less than crop revenue primarily because only about 50% of the cost of crops can be counted under NED. However, the economic loss from flooding of agricultural lands is less than revenue also because floods can occur when crops are not planted, and floods can occur before all costs are sunk. The measure of benefit should be crop revenue, minus cropping expenditures not yet incurred. This measure can be developed for different times of the year and weighted by the probability of damaging events at different times of the year. The agricultural damage estimates should include clean-up and land restoration costs required to return the land to a productive state. These costs may include debris removal, excavation of sediment from roads and other improvements, re-grading, and soil treatment.
Significance: Medium
If agriculture damages are reduced by half, EAD would be reduced by about $14,000.
Recommendation for Resolution:
1. At a minimum, crop revenues should be reduced for harvest costs. Harvest costs will clearly not be incurred if cropland ready for harvest is flooded. 2. Include agricultural land clean-up costs as damages in addition to lost crop net revenue. At a minimum, discuss agricultural land clean-up and restoration costs.

Comment #: 14
Other O&M cost savings may have not been counted as a benefit.
Basis for Comment:
Other O&M cost savings might be identified and counted as a benefit. Page 42 of the LRR shows an Additional Grass Mowing Annual Cost of $19,500 for the 195 acres of berm. It is not clear whether the berms cover an area that, without-project, would also be mowed.
Significance: Medium
There is not much additional O&M cost savings expected that would affect project implementation.
Recommendation for Resolution:
Consider if any other with-project O&M costs would reduce or replace existing costs. Consider monitoring costs that may not be required with-project. Include these cost savings as a benefit.

Comment #: 15
Erosion loss on the landward side of the levee because of water ponded or flowing along the landward side of the levee has the potential to exacerbate or increase the impact of piping, sand boils and other potential failure mechanisms. The method of mitigating landward levee erosion is not clear.
Basis for Comment:
Where water can pond or flow on the landward side of the levee there is the potential for erosion independent of piping or sand boils. This ponded and/or flowing water may result from surface runoff, high water tables, pumping, and other factors. Moreover, the shear force from water flowing along the landward side of the levee can exacerbate the impact of piping and sand boils by increasing erosion on the levee and further decreasing stability.
Significance: Medium
The lack of discussion of mitigation of landward levee erosion affects the complete understanding of actions to manage project impacts.
Recommendation for Resolution:
Address in the text what methods to mitigate landward levee erosion from ponded or flowing water (on the landward side of the levee).

Comment #: 16
Comprehensive hydraulic design of the relief wells are absent from the present study.
Basis for Comment:
To understand how the present design is to be implemented, the design information for the relief wells should be given within the text. Some design calculations are included in the Plates in Appendix D, but without accompanying explanations, equations, or supporting documentation. If, however, the relief wells will be design/build in a future phase then this should be clearly stated in the text. Additionally, the design standards, basis of design documents, variability of relief well design within the project, and other relief well design considerations should be referenced. A general design drawing wells should be included.
Significance: Medium
The lack of information and discussion affects the understanding of the appropriateness of key design details.
Recommendation for Resolution:
Update the text to include information related to the design of project relief wells.

Comment #: 17
The documentation lacks key graphics that are needed to support the text in several cases.
Basis for Comment:
There are presently no figures illustrating historical problem locations. Moreover, it is unclear to the reader where improvement locations are in relation to the historical seepage, piping, and sand boils. A map or other graphic illustrating where the most recent (1993, 1998, etc.) event seepage areas occurred should be included. Also, a graphic or map to illustrate where project improvements will be implemented to address these areas of concern and/or potential failure locations should be included. The project justification will be strongly supported by these graphics. There are also insufficient graphics within the LRR or EA to allow the reader to evaluate the text discussion or tabular data (Tables EA-MP-2, EA-MP-3, and EA-MP-4) on existing conditions or project impacts. It is not clear how these tables correspond to where the impacted site locations are within the project area included in the EA (or text that refers the reader to the appropriate appendices or plates in Appendix D). Also, it is not clear why the tables are not completed by impact location (station), and instead are completed with "NA's." This is a matter of clarity and is important for an understanding of the project and public notice. Evaluating the proposed project on the basis of National Environmental Policy Act compliance and the underlying scientific accuracy/assumptions/completeness is difficult when the spacial locations are not clear in the supporting materials, and information regarding individual impacted sites is not complete. The text does not adequately present a clear understanding of where cultural resources are relative to the points of impact. The text describes the cultural resources and potential impact resulting from the proposed project, but lacks any significant graphics showing where the cultural resources fall relative to the points of impact. This is important for reviewer, including the public, understanding of the overall impacts of the project.
Significance: Medium
The documentation lacks sufficient graphics that would greatly assist in providing a complete understanding of key aspects of the project.
Recommendation for Resolution:
1. Update the text to include historical failure and proposed improvement graphics in the same figure. 2. Include a map depicting the impact locations and include missing data (or rationale for excluding it). 3. Include graphics (i.e., maps or diagrams) detailing relative locations of cultural resources and impact sites.

Comment #: 18
The heterogeneity of the soils underlying the project site is not adequately discussed.
Basis for Comment:
Section 4 of Appendix D discusses the horizontal and vertical distribution of sediments in a relatively cursory fashion. Locations within the project watershed typically have great variation in stratigraphy owing to the very active geologic and hydrologic history of the Mississippi River. This high level of heterogeneity of the sediments within the project is important to the design and placement of the relief wells owing to the related variability in conductivity, porosity, pore distribution, and other sediment parameters.
Significance: Medium
A complete understanding of the high level of heterogeneity of the sediments is a critical aspect of project implementation.
Recommendation for Resolution:
Update the text to more fully address the variability of the soils, particularly related to the design of the relief wells, how the design of the wells of the will be determined by the local stratigraphy, and how design considerations will be addressed according to the specific design and technical manuals.

Comment #: 19
Cumulative and secondary effects are not fully considered in the EA.
Basis for Comment:
Cumulative effects analysis within the EA and Appendix A appear to be limited to federal and local partner projects. It is not clear whether any attempt to identify non-federal, commercial projects in the vicinity may have been completed or are reasonably foreseeable. This may be partly a result of the narrowly defined geographic area, which may not accurately envelop projects that could impact the project area or organisms making use of the project area (including endangered species).
Significance: Medium
The documentation does not include discussion necessary for a complete understanding of the project scope.
Recommendation for Resolution:
Note in the EA and Appendix A whether any non-federal, commercial projects were scoped or identified. This may require expanding the geographic boundary to recognize effects from upstream and across the river from the project area, and other adjacent locations.

Comment #: 20
The performance standards in Section 8 of the MP appear arbitrary, and there is no discussion in the text to support how the standards were determined.
Basis for Comment:
Some discussion of how and why performance standards are set for compensatory mitigation should be included in the MP. Currently, the selection of the performance standards noted in the MP are not backed up in the document in terms of how the coverage ratios chosen would ensure ecologic success. This is extremely important in order to determine that there will be no net loss of functions or values associated with the proposed project, and that the mitigation site will achieve the desired outcome. While the standards are quantitative and verifiable in nature (percent cover), the plant coverage ratios for the three communities identified appear arbitrarily chosen and not tied to any specific outcome related to ecologic function (i.e., ecologic niche provision, habitat values, etc.). It is common practice to identify a reference site that meets the desired performance standard, and match the mitigation site design criteria accordingly. It is not clear from the EA whether the St. Louis District Regulatory Division currently has compensatory mitigation guidance that provides a rationale for developing performance standards. If so, these should be referred to in the text of the EA.
Significance: Medium
The documentation does not include discussion of key considerations affecting a complete understanding of the project.
Recommendation for Resolution:
Include a discussion of how the performance standards for the project are developed and set, including reference to the relevant science and regulatory protocols.

Comment #: 21
In the EA-MP Section 10- Long-term Management Plan, it is not clear if the entity responsible for long-term monitoring and the entity conducting any corrective action in the event of a violation of the conservation servitude are two distinct entities to avoid a conflict of interest should a violation of the servitude agreement occur.
Basis for Comment:
LTA and its partners typically require that servitude (easement) enforcement be the role of a third-party, accredited land trust, and that site management be the responsibility of the landowner or named managing entity separate from the land trust. This is important to ensure the integrity of the servitude agreement, in that the entity responsible for meeting the terms of the servitude agreement is not also responsible for enforcing these same terms (thereby monitoring and possibly enforcing on itself).
Significance: Medium
The documentation does not include discussion necessary for a complete understanding of the project.
Recommendation for Resolution:
Revise Section 10 to reflect that enforcement of the servitude and any required correction to meet the terms of the agreement will be by different parties.

Comment #: 22
In the EA-MP Section 13- Cost, and Table EA-MP-6, the costs shown appear to be arbitrary. There is no discussion included regarding how these monitoring costs were established.
Basis for Comment:
These should be based on real estimates of time and effort required to mobilize field personnel, collect data, etc., and should reflect likely cost increases across time (i.e., travel costs, personnel, materials, etc.).
Significance: Medium
The documentation does not include information that affects a complete understanding of the project.
Recommendation for Resolution:
Revise costs to reflect real estimates.

Comment #: 23
The level of information in the evaluation of alternatives involving slurry cutoff walls is not consistent with other alternatives analysis.
Basis for Comment:
Section 2 of the EA indicates that slurry cutoff walls were not evaluated as an alternative in this project due to high cost relative to the relief well and berm alternatives. The EA indicates that slurry walls were in fact considered for the PdP/FL project, but were dismissed as being too costly based on work done on a previous project, but does not specify that project or provide reference to the costs that were developed. If the action was considered, enough information should be included for the reader to evaluate this alternative relative to the others considered, and to provide enough information for the reader to understand the rationale for the ultimate alternative recommendation. In this case, there is not enough information in the EA to support the USACE decision not to carry consideration of the slurry wall alternative forward. This could rely on the data developed for the prior project, but should be included in this EA for review.
Significance: Medium
The documentation does not include discussion necessary for a complete understanding of the project scope.
Recommendation for Resolution:
Include some additional information regarding the slurry wall alternative under Section 2 of the EA- Alternatives Considered by Decision Segment, and in appropriate appendices.

Comment #: 24
The potential effects of climate change do not appear to be considered in the LRR or supporting documents.
Basis for Comment:
Climate change is projected to increase extreme weather events over the 50-year project life. These could include both extreme drought and extreme precipitation and flood events. It is not clear from the LRR and supporting materials whether this has been taken into consideration, what effect (if any) these extreme events might have on the levee or other elements of the proposed project, including proposed mitigation, and whether this might have an effect on the alternatives analysis and selection.
Significance: Medium
The documentation does not include discussion of key considerations that affect a complete understanding of the project.
Recommendation for Resolution:
Include some discussion of climate change within the LRR and/or supporting documents.

Comment #: 25
The subject levee provides indirect protection from flooding of other areas. The benefit of this indirect protection is not discussed or quantified as a benefit.
Basis for Comment:
LRR Section 5.2.1 Page 24. > If the levee failed in the north part of the levee system, the river water flowing through the breach could build up force and could cause breaches in the PdP/FL south flank and the north flank of the Columbia levee immediately to the south of the PdP/FL system. The economic benefit of avoiding this effect is not counted.
Significance: Low
The expected benefits potentially gained would not affect project implementation.
Recommendation for Resolution:
At a minimum, include a discussion of this potential benefit within the economics appendix. If the probability of a breach in the north part of the system can be quantified, and potential damages in the other areas have been quantified, then a benefit estimate should be provided.

Comment #: 26
Vehicle and mobile home damages do not consider probable notification time.
Basis for Comment:
From the mid-point call, the USACE stated "If the levee were going to be overtopped, the Corps would generally be able to predict that it would be and give advanced notice" Notification time has a large influence on damages to mobile assets. Presumably, a large share of vehicles present in the study area would be removed, but some would not. On the other hand, some of the mobile homes would be removed.
Significance: Low
Since no vehicle damages were counted, but all mobile homes were counted, it is unclear whether or not a realistic treatment of notification time would increase EAD.
Recommendation for Resolution:
Discuss the notification system in place and how vehicle and mobile home costs might be affected.

Comment #: 27
The new Mississippi River bridge project is not considered within the traffic delay analysis.
Basis for Comment:
Page J-21: > the ongoing construction for the addition of a new bridge from Illinois into St. Louis very close to this project area. The Mississippi River bridge project should be considered within the traffic delay analysis.
Significance: Low
It is expected that inclusion of the bridge project would not have much effect on the traffic delay analysis.
Recommendation for Resolution:
If practical, include the Mississippi River bridge project in the traffic analysis. Describe how the bridge affects the traffic cost analysis. If it has no effect, explain why.

Comment #: 28

The economics appendix is not consistent regarding whether or not specific costs are included in the economics analysis.

Basis for Comment:

Specific costs include railway transportation delay, railway facility damage, vehicle damages; and commercial, industrial, and public contents damages.

Regarding transportation delay costs, from Page J-6:

> The economic impacts on transportation interruptions within the project area due to a project flood were estimated for both vehicular and railway interruptions.

But on Page J-21:

> The total cost expressed within this report relating to the inundation impacts to the Dupo, IL switching station are greatly understated. While the structure and infrastructure costs were attained, the truly large and complex costs of delay impacts were not provided.

The incorrect statement on Page J-6 could lead some to believe that this benefit has been counted.

Regarding railway facility damage costs, from Page J-5:

> Within Dupo, IL, there is a moderately sized rail yard and truck-transfer station. No value was given to this as of the current date. The railway lies within the floodplain so there are known damages and we are currently working with executives within the organization to quantify costs associated with this site.

But on Page J-21:

> While the structure and infrastructure costs were attained, the truly large and complex costs of delay impacts were not provided.

The statement on Page J-5 suggests that facility damages were counted, but the statement on Page J-21 suggests that they were not.

Regarding vehicles, from Page J-14:

> In order to calculate the damages from the inundation of structures, their contents, and ***vehicles*** that would occur at each stage, three relationships were developed for this analysis: depth-damage relationships, stage-frequency relationships, and levee system failure probabilities. . .

From the mid-point call, the USACE stated "no vehicle damages or estimates were done for this report."

Regarding contents, on Page J-14 to J-15:

> Commercial, Industrial and Public structures were not assigned a content value for this study. All damages associated with these structures are based on the depreciated replacement value of only the structure in question, not the value of any contents within the structure.

In contrast, the next paragraph states (***emphasis added***):

> A normal probability density function was used for each of the residential and ***commercial content categories***. . . .***An uncertainty range was not assigned to the content value of the structures on the industrial complex.*** The facility operators provided the value of the contents for these buildings. It must be noted here that ***no content or other damage value was obtained for the commercial or industrial structures.***

Significance: Low

This comment suggests text revisions that would not affect the economic analysis, but are suggested to make the analysis documentation more understandable.

Recommendation for Resolution:

Correct all text to show that:

- railway delay costs were not counted
- railway facility damages were counted
- vehicle damage costs were not counted
- all content damages were included, and how

Comment #: 29
There is no information for the Regional Economic Development (RED) account included.
Basis for Comment:
Review of Economics Appendix, LRR, Environmental Assessment, and confirmed by mid-point review confirms that the RED account is not included.
Significance: Low
The missing information does not affect plan selection, but local interests may want to see it.
Recommendation for Resolution:
Include a small RED section. Include discussion of potential costs of not maintaining accreditation for the 100-year flood event.

Comment #: 30
The source of EAD for agriculture is not completely documented.
Basis for Comment:
From Page J-6: . . .the total annual gross revenue from crop production in the project area for a typical year approximates $4,501,000. From Page J-15, Table 2, the maximum EAD for agriculture is $2,505,000. From Page J-15: The agricultural depth-damage curve was developed using Geographic information system (GIS) software to identify what percentage of the fields would be covered at each flood frequency. For the midpoint review, the USACE responded: About 95-98% of the fields are covered by a 0.200 flood frequency, but only about 50% of the cost of crops can be counted under NED.
Significance: Low
The manner in which references and analysis are presented can affect understanding of the project.
Recommendation for Resolution:
Mention that only about 50% of the cost of crops can be counted under NED, and explain why, and state that this is the main reason why full agricultural revenues are not claimed as potential benefits.

Comment #: 31
It is not clear in the EA how wetland resource determinations were conducted to calculate impacts.
Basis for Comment:
The EA does not include discussion of how the wetland resources in the project area were determined. Presumably, these were either delineated in the field or calculated using a GIS overlay (using National Wetlands Inventory maps, or other resource). The method used is important to the accuracy of the impact calculation and resulting mitigation calculations.
Significance: Low
The documentation does not include discussion necessary for a complete understanding of the project scope.
Recommendation for Resolution:
Identify the method for wetland resource determination in the EA and Appendix A.

Comment #: 32
The sentence on Page EA-404-8 under "Description of Proposed Discharge Sites": "Although exact locations have yet to be identified, wetland sites will be avoided," is unclear and potentially misleading.
Basis for Comment:
The EA details a number of wetland impacts associated with the discharge of dredge material.
Significance: Low
Comment affects the technical quality and understanding of the project, but there is limited concern regarding project implementability.
Recommendation for Resolution:
Revise the sentence accordingly.

Comment #: 33
There are no recommendations or qualifications related to the inspections of the project improvements for future maintenance and operation.
Basis for Comment:
The continued safe operation of the project improvements will be based, in part, on continued inspections and maintenance of project features. Some discussion of the project improvement's maintenance and inspection should be included, particularly if a local agency will be assuming these duties. Moreover, any associated costs should be included in the economic analysis.
Significance: Low
Comment affects the understanding of the project but has little effect on project implementability.
Recommendation for Resolution:
Add project improvements inspection requirements or a reference to inspection requirements such that improvements can be maintained at design operating levels.

Comment #: 34
The understanding that the present design standard for water surface elevation (WSE) exceeds the Federal Emergency Management Agency (FEMA) standard, and the extent of this exceedance, is not discussed in the LRR.
Basis for Comment:
In Appendix C, the test refers to the FEMA 1% event for the project to be developed in the future by an outside engineer. The present study's design standard appears to significantly exceed FEMA event. It will be beneficial to the reader to understand that the present design standard exceeds the FEMA standard, and the extent of this exceedance. An approximate WSE at the gage location is an acceptable comparison.
Significance: Low
Comment affects the technical quality and understanding of the project, but there is limited concern regarding project implementability.
Recommendation for Resolution:
Add a comparison between the current design and FEMA WSE.

Comment #: 35
Various tables within the documentation are lacking important details that make specific information unclear.
Basis for Comment:
Several tables within the text (for example: D-1, C-1) lack units, headings and other data to understand what is being presented to the reader. The meaning and intent of the data within the tables are unclear to the reader. Additionally, it would be helpful to the reader to have the decision segments referred to in imbedded tables also be depicted graphically in accompanying maps for reference. Tables in the EA document routinely refer to decision segments (i.e., "Old Prairie du Pont", "Falling Springs", etc.), but a map showing the relative locations of these decision segments within the project footprint is not prominent within the EA (other than Figure EA-1, which does not specifically delineate the decision segments). This is a special case given the overall high quality of the supporting figures (maps) within the EA. All of the maps would benefit from an imbedded layer showing the decision segments for reference. Incorporating this layer into the figures would be a benefit for reviewers during the public notice phase and aid in understanding the proposed project.
Significance: Low
Comment affects the technical quality and understanding of the project, but there is limited concern regarding project implementability.
Recommendation for Resolution:
1. Review and update the tables within the study to include units, column headings and other information to increase legibility, and hence value, of the tables. 2. Include a map showing the decision segments and/or incorporate layers within each figure in the EA depicting the decision segments.

A.3 Editorial Comments on the LRR

One editorial comment is provided below as a reference for USACE. The comment listed does have some significance to the technical understanding of the project but not considerable enough to affect project implementability.

Table A-2. Editorial Comments

No.	Comment	Notes
1	In the EA, the discussion regarding the "ecological study area" within Section 3.13 does not appear to pertain to socioeconomics.	On Page EA-22, the "ecological study area" is discussed within Section 3.13, Socioeconomic Resources. This discussion should be moved elsewhere.

Appendix B – IEPR Panel Members

Noblis selected three panel members to conduct an IEPR of the LRR for Design Deficiency Corrections for the PdP/FL, Illinois. Consistent with the requirements of the USACE SOW, the panel members provided expertise in three areas: biology/NEPA impact assessment, civil/geotechnical engineering, and economics. All panel members met and exceeded the minimum requirements for each specified areas of expertise, as outlined in Table 2 of this IEPR Report. The panel represented a well-balanced mix of individuals from academia, large companies, and individual consultants.

B.1 Résumés of panel members

The résumés of the panel members follow.

Jim Dobberstine

Qualifications Summary

- Extensive experience as a biologist and environmental scientist (since 1993), and with evaluation and review of NEPA impact and cumulative affects assessments (since 2002) on complex, multi-objective projects including port/shipping terminal, rail, drilling and pipeline, commercial and residential development, and aquatic habitat restoration projects. The projects involved coordination with agencies including the USACE, NOAA-NMFS, EPA, USFWS, and numerous state, local, and private entities. Experience in research of many aspects of aquatic and riparian habitats, including water and sediment characterization (toxicity, biotic community, chemistry) in stream/river environments within the Houston Ship Channel/San Jacinto River system.
- M.S. in Environmental Management (NEPA, CWA, ESA and other regulatory), an M.S. in Environmental Science (Biology and Environmental Toxicology), and a B.A. in Life Sciences (Biology/Chemistry). Have earned certificates in USACE wetland delineation (Texas A&M) and water quality improvement using constructed wetlands (Clemson).
- Evaluation experience with NEPA impact and cumulative affects assessments on projects with high public and interagency interest within sensitive aquatic habitats, including wetlands. A recent example includes a habitat restoration and preservation project on a sensitive bay-side tract on Galveston Island associated with a residential housing development; the project included beneficial uses of dredge material to restore estuarine marsh and seagrass beds, and coastal marsh preservation.
- Extensive experience developing and evaluating USACE permits applications and related documents for the Galveston Bay Foundation. Experienced with the complex regulatory framework affecting projects that potentially impact aquatic habitat (NEPA, ESA, CWA, etc.).
- Extensive experience and working knowledge of NEPA as it applies to projects in aquatic/riparian systems. A recent example includes a habitat restoration project along the San Jacinto River (TX) in a mixed urban/industrial area where there were potential toxicant/exposure concerns contrasted with significant cultural and environmental benefits including community education and recreation opportunities, and ecosystem enhancement.
- Board member of the Texas Association of Environmental Professionals (TAEP): President of the Board (2010-11) and Education Director (2007-11).
- Board Member of the South Central Regional Chapter of the Society of Environmental Toxicology and Chemistry (SETAC) 2010-11.
- Galveston Bay Council: current member of the Monitoring and Research Subcommittee, former Vice-Chair of the Public Participation and Education Subcommittee
- Has served on the Independent External Peer Review of the Engineering, Economic, and Environmental Evaluation of the Geotechnical, Hydrological, Hydraulic, and Economic Aspects of the Dam Safety Modification Study Report for Rough River Dam, Kentucky

Education

- M.S., Environmental Science, University of Houston Clear Lake
- M.S., Environmental Management, University of Houston Clear Lake
- B.A., Life Sciences, Concordia University Portland

Certifications and Licenses

- Certificate: 40 hour USCOE Wetland Delineation Course. Texas A&M, Texas Seagrant, and the Texas Coastal Watershed Program, 2007.
- Certificate: Constructed Wetlands for Water Quality Improvement. Entrix, Clemson University, and University of

Houston Clear Lake, 2004.

- Certificate: Management Development at the American Zoo and Aquarium Association School for Zoo and Aquarium Personnel conducted by North Carolina State University, 1999.
- Completed: GIS Techniques in Environmental Assessment. SETAC short course conducted by the University of North Texas, 2011.
- Completed: Probabilistic Ecological Risk Assessment. SETAC short course conducted by Texas Tech University, 2010.
- Completed: Application of Adaptive Management to Address Climate Change Related Challenges. Restore America's Estuaries (RAE) Special Program conducted by the NOAA Coastal Service Center and the PBS&J Ecosystem Restoration Division, 2010.
- Completed: Benthic Mapping Techniques aboard the Alletta Morris. Benthic mapping techniques including sidescan sonar, underwater video, sediment profile cameras, and soil cores. RAE Special Program conducted by the EPA, USDA-NRCS, and the University of Rhode Island, 2008.
- Completed: Sampling Benthic Sediments: Methods, Analyses, and Judgments. SETAC short course conducted by the University of North Texas Institute of Applied Sciences, 2006.
- Completed: Conserving Land with Conservation Easements short course, a program of the National Land Trust Alliance's 2006 Land Conservation Leadership Program.

Summary of Professional Experience

Lee College, Environmental Science and Biology—*Faculty*

- Lead instructor in the environmental science program. Includes development of new courses and textbook/lab manual selection. Courses often focus on Galveston Bay as a model for concepts discussed, and incorporate practical experience and research in aquatic ecosystem function of estuarine communities. Courses also cover many aspects of environmental regulation, including the National Environmental Policy Act, the Clean Water Act, the Clean Air Act, and the Endangered Species Act.
- Has worked to foster research opportunities for students through partnerships with local universities, the results of which have been featured through organizations including Restore America's Estuaries (RAE) and the Society of Environmental Toxicology and Chemistry (SETAC).
- Ongoing research in benthic habitats, ecotoxicology, and ecosystem function in aquatic estuarine communities.
- Editor and contributor to Laboratory and Field Exercises in Environmental Science (Lehmberg, 2010).
- Member on the Professional Development Committee (a subcommittee of the Lee College Faculty Assembly).
- Member of the Faculty Learning Community of Lee College, working to develop improved teaching methods for critical thinking.
- Member of the Instructional Learning Outcomes Committee, developing program assessments for student learning.
- Member of the Faculty Learning Community of Lee College, working to develop improved teaching methods for critical thinking.
- Member of the Stephen F. Austin State University Arthur Temple College of Forestry and Agriculture (ATCOFA) College-level Advisory Council (2012).
- External Advisor for the University of Houston Environmental Management Program Curriculum Review, April 2007.
- Ongoing grant development for program development, student research, and student support. Recent award includes HSI:STEM (US Dept. of Ed.) grant funding for Project TES: Teacher Education Science, providing funding for equipment (including GC Mass Spec) and materials aimed at developing curricula and skills for education majors interested in teaching in the sciences.
- 2010: Session Chair at the Restore America's Estuaries Conference (Galveston, TX) session titled

"Opportunities, Challenges, and Lessons Learned with the Use of Dredged Materials".

- 2009: Session Chair at the Galveston Bay Estuary Program's Ninth Biennial State of the Bay Symposium (Galveston, TX) session titled "The Science of Estuarine Wetlands".
- 2009: Peer reviewer for the TCEQ Galveston Bay Estuary Program's "State of the Bay: A Characterization of the Galveston Bay Ecosystem. Third Edition". Reviewed and commented on Chapter 8: The Bay's Living Resources.
- 2007-2008: Member of the Technical Advisory Committee of the Chambers County (TX) Greenprint Project of the Trust for Public Land.

Grant Funding Acquired

- 2012 Lee College HSI Stem Faculty Mini-grant. $9K to fund a student research project investigating aquatic habitat restoration on private land in cooperation with the Galveston Bay Foundation. Funding four student researchers. The results are proposed for presentation at the 2012 Restore America's Estuaries Conference, Tampa, FL.
- 2011 NOAA/Texas General Land Office (GLO) Coastal Management Program (CMP) grant awarded in partnership with Lee College and the University of Houston Clear Lake. $79K to fund research titled "Science-based Monitoring of Created Wetlands and Restored Habitat within the Galveston Bay System." Project to commence November 2012.
- 2011 US Department of Education Hispanic Serving Institution (HSI) STEM grant awarded to Lee College, including the $162K subcomponent "Project TES: Teacher Education Science", providing funding for equipment (including GC Mass Spec) and materials aimed at developing curricula and skills for education majors interested in teaching in the sciences.

HB EcoGIS: Environmental Consulting and GIS Services—*Vice President*

- 2012: Assisting with all aspects of start-up and operational development of small environmental consulting and services firm.
- Environmental consultant specializing in aquatic habitats, assisting clients with project needs related to USACE (Sec. 404/10) permitting, NEPA compliance, habitat assessment and wetland delineation, impact and risk assessment, and project design/implementation/management.

The Galveston Bay Foundation—***Environmental Scientist***

- Land Programs Manager, working as an environmental scientist and regulatory specialist, focusing on wetlands and other aquatic habitats. Experienced team member on numerous aquatic habitat restoration projects aiding in project design, funding development, safety and toxicity issues, and habitat quality/needs. Projects included numerous aquatic habitat (stream/river, estuarine wetland) restoration projects, stream bank erosion protection, and stream/estuarine aquatic habitat assessments, including lifecycle and habitat needs. Extensive experience developing and evaluating U.S. Army Corps of Engineers permits applications and related documents for the Galveston Bay Foundation. Experienced with the complex regulatory framework affecting projects that potentially impact coastal habitat (NEPA, ESA, CWA, etc.).
- Worked in the area of habitat conservation, overseeing the Foundation's Land Conservation program managing more than 2,500 acres of protected coastal habitat (terrestrial and aquatic). Included conservation easements, fee-simple acquisition, and development of habitat assessments, project cost models, and easement contracts. The management focus of these holdings to protect and enhance important, complex habitats for biologic communities at all trophic levels, including threatened and endangered species.
- Habitat restoration experience at all phases, including project development, permit acquisition, fundraising/grant development, and project implementation. Projects include:
    - Emergent estuarine marsh and seagrass habitat beneficially using dredge material from onsite, coupled to preservation (conservation easement) of associated coastal high marsh and prairie (buffer) habitat in west Galveston Bay and Galveston Island.
    - Emergent estuarine and palustrine marsh within riparian corridors of lower Galveston Bay.
    - Estuarine marsh and correction of erosional losses of shoreline in high wave energy areas of east Galveston Bay.

- Subsided marsh within mixed urban/industrial areas of upper Galveston Bay and the San Jacinto River where potential toxicant/exposure concerns contrasted with significant cultural and environmental benefits including community education and recreation opportunities, and ecosystem enhancement.

- Project manager for a number of federal grant funded habitat research and educational projects at all phases. This includes fund raising, project design and implementation, reporting, and public outreach. Example projects include:
  - "Science Based Monitoring of Created Wetlands and Restored Habitat within the Galveston Bay System", a joint project in partnership with the University of Houston Clear Lake. This research focused on the functional aspects (biotic community, sediment, and water quality) of multiple wetland habitat restoration sites, generating data regarding the vegetation and faunal uses of created marshes relative to natural ones. The research was framed along the recommendations from "Science-based Restoration Monitoring of Coastal Habitats (NOAA Coastal Ocean Program, Decision Analysis Series No. 23, Volumes 1 and 2). Funding partners included NOAA, the Texas General Land Office Texas (GLO) Coastal Management Program (CMP), and the Galveston Bay Estuary Program (GBEP). Data was collected according to the Quality Assurance Program Plan (QAPP) prepared by Jim Dobberstine and Cynthia Howard to meet EPA and TCEQ requirements for scientific data. Data collected is anticipated to aid habitat restoration managers with the design and implementation of future projects in the lower Galveston Bay watershed.
  - "Discover Galveston Bay Interpretive Sign Project": Two-tier grant funded project placing educational signs on the natural history specific to 40 locations around the Galveston Bay watershed in cooperation with multiple private and public agency partners. Funded by NOAA and the Texas GLO CMP.
- Project manager for a number of successful projects linking science to policy, including:
  - The Galveston Bay Foundation's Wetland Permit Review Program working proactively with citizens, local business, and federal, state and regional policy makers to affect positive change to both individual actions and the underlying policies affecting the Galveston Bay watershed. Coordinated with federal, state, and local agencies to review project proposals within the lower Galveston Bay watershed, providing comments on impacts, alternatives analysis, mitigation requirements, and project design, aimed at reducing any given project's adverse impacts to Galveston Bay. Also conducted rulemaking reviews and comment development, and worked to establish clear links between the relevant science and policy affecting aquatic habitat management within the bay system.
  - The federally funded (USFWS) Living Shorelines programs, assisting local landowners with permitting, fundraising, and project implementation for shoreline restoration and alternative shoreline stabilization on private lands within the bay system to correct habitat losses due to erosion and subsidence.
- GBF representative on citizen advisory panels (CAPs) facilitating communication between local petrochemical industry and neighboring communities, including the Bay Area Citizens Advisory Panel (Baycap) and the Seashore Area Citizens Advisory Panel (Seacap).

Grant Funding Acquired

- 2007 NOAA/Texas GLO Coastal Impact Assistance Program (CIAP) grant award to the Galveston Bay Foundation. $71K to fund the GBF Living Shorelines Program.
- 2007 Galveston Bay Estuary Program grant awarded to the University of Houston Clear Lake in partnership with the Galveston Bay Foundation. $10K to supplement the NOAA/Texas GLO Coastal Management Program (CMP) grant for "Science-based Monitoring of Created Wetlands and Restored Habitat within the Galveston Bay System."
- 2006 US Fish and Wildlife Service Coastal Program grant to the Galveston Bay Foundation. $30K to fund the Living Shorelines Program.
- 2006 Fish America Foundation/NOAA Restoration Center grant to the Galveston Bay Foundation. $50K to fund a portion of the coastal habitat restoration at Snake Island Cove.
- 2006 NOAA/Texas GLO CMP grant awarded to the University of Houston Clear Lake in partnership with the Galveston Bay Foundation. $42K to fund a portion of a research project titled "Science-based Monitoring of Created Wetlands and Restored Habitat within the Galveston Bay System." Project to complete Summer 2008.

- 2006 NOAA/Texas GLO CMP grant awarded to the Galveston Bay Foundation. $33K to fund the Drive and Discover Galveston Bay Interpretive Sign Project (Phase 2).

The Houston Advanced Research Center (HARC)—*Contract Consultant*

- Assisted information management, technical communications, and stakeholder facilitation related to the Galveston Bay Freshwater Inflows Group, a program of the Galveston Bay Estuary Program. Required extensive knowledge of stream and estuarine ecology, water quality, and research methods.

The University of Houston Clear Lake (UHCL)—*Graduate Research Assistant*

- Research assistant to Dr. Cindy Howard, working on estuarine habitat assessments (water, sediment, benthic community), sediment toxicity (internship completed with the PBS&J Environmental Toxicology Laboratory, Houston under Dr. Jim Horne), and sediment contaminants (heavy metals, organics).

Public zoo and aquarium field—*Senior Biologist, Aquatic Habitat Specialist*

- Extensive experience working with aquatic organisms, water quality, and aquatic habitats with organisms including fish, birds, and marine mammals.

Related Publications

- 2009-11: Editor and section contributor to Laboratory and Field Exercises in Environmental Science (Lehmberg, 2010; ISBN978-0-578-05921-1).
- 2011: Platform presentation at the 2011 Native Plant Society of Texas Annual Symposium titled "Functional Assessment of Coastal Marsh Communities at Four Restored Sites in the Galveston Bay System. Co-presenter: Cynthia L. Howard, University of Houston Clear Lake.
- 2008: Platform presentation at the 4th National Restore America's Estuaries Conference (Providence, RI) on ongoing research titled "*Comparing salt marsh ecosystem responses to different restoration techniques*". Also presented at the 2009 Texas Coastal Conference hosted by the Texas General Land Office (Galveston, TX).
- 2007: Co-author of a research poster presented at the Eighth Biennial State of the Bay Symposium (Galveston, TX) titled "*Identifying suitable reference sites for impacted sites along the Houston Ship Channel*" (J. Dobberstine, J. Horne, L. Brzuzy, C. Howard). Full paper in the conference proceedings, viewable at http://gbic.tamug.edu/gbeppubs/sobviii/sobviii_rpr.htm#Dobberstine. This work was also presented as a platform at the 2006 Society of Environmental Toxicology and Chemistry National Conference (Montreal, Canada) and at the American Association for the Advancement of Science (AAAS) Southwestern and Rocky Mountain Division Annual Meeting (Clear Lake, TX), April 2007, where it was awarded "Honorable Mention" for outstanding student paper presentation.
- (2007) "*Sediment Triad Approach to Finding a Suitable Reference Bayou for Patrick Bayou and Similar Sites Located on the Houston Ship Channel*". Master's Thesis, UHCL.
- 2007: Presenter at the Texas Association of Environmental Professionals Environmental Challenges and Innovations Conference; presented a platform titled "*Public Comments and the role of an NGO in the NEPA process; an overview of the Galveston Bay Foundation's volunteer Permit Review Committee*." Also presented at the Society for Wetland Scientists annual conference in June 2007.
- 2007: Co-author of two research posters, " *Functional Assessment of Plant Communities at Four Restored Sites in a Lower Galveston Bay Estuarine Marsh Complex*" (L. Ray, J. Dobberstine, J.C. Whitney, C. Howard) and "*Comparison of Benthic Macroinvertebrate Communities among Native, Restored, and Impacted Salt Marshes in the Galveston Bay System*" (K. Farmer, J. Dobberstine, C. Howard), presented at the Society of Environmental Toxicology and Chemistry National Conference (Milwaukee, WI).
- 2006: Round Table presenter and panelist at the Texas A&M University Chapter of Sigma Xi's Spring Symposium (College Station, TX) on "Sea-level rise, hurricanes, and the future of our coasts".
- 2006: Platform presentation titled "*Successes and Challenges: An overview of community-based coastal marsh restoration in Galveston Bay*" at the 3rd National Restore America's Estuaries National Conference (New Orleans, LA).
- 2005: Co-author of a platform presentation, "*PAHs Environmental Overview: Occurrence in Houston Area*

Sediments" (I. Rhodes, J. Dobberstine, L. Brzuzy), presented at the SETAC SW Regional Meeting (Marble Falls, TX).

Research manuscripts in progress:

- "*An Assessment of Restored Wetlands in the Lower Galveston Bay Watershed*". Co-Author: Cynthia L. Howard, University of Houston Clear Lake.

Professional Associations

- Texas Association of Environmental Professionals (TAEP): President (2010-present) and Education Director (oversees the association's Chuck Glore Memorial Scholarship program, which awards scholarships to environmental science and engineering students at several southeast Texas universities).
- Galveston Bay Council: former Vice-Chair of the Public Participation and Education Subcommittee, current member of the Monitoring and Research Subcommittee.
- The Galveston Bay Foundation: Delegate Trustee representing TAEP, advisor for the Land Committee and the Wetland Permit Review Committee,
- South Central Regional Chapter of the Society of Environmental Toxicology and Chemistry (SETAC): Board Member.
- 2007-2008: Member of the Technical Advisory Committee of the Chambers (TX) Greenprint Project of the Trust for Public Land.

Awards

- 2009 Phi Theta Kappa "Certificate of Appreciation" in recognition of valuable contributions to the 2009 student inductees.
- 2007 "Honorable Mention" for outstanding student paper presentation. "*Identifying suitable reference sites for impacted sites along the Houston Ship Channel*" at the American Association for the Advancement of Science (AAAS) Southwestern and Rocky Mountain Division Annual Meeting (Clear Lake, TX).
- 2004 Student Scholarship to attend the SETAC 4th World Congress, Portland OR to present a research poster titled "Is there a Suitable Reference Site for Impacted Sites along the Houston Ship Channel?"
- Brown and Root Halliburton Environmental Management Student Scholarship 2002 through 2005.
- Jones Endowment School of Business and Public Administration Student Scholarship 2003/2004.
- Rhome and Haas Environmental Science Student Scholarship 2004/2005.
- 2002 student scholarship for the "State of the Bay" symposium from the Texas Commission on Environmental Quality Galveston Bay and Estuary Program.

David Jaffe, PhD, PE, D.WRE

Qualifications Summary

- Licensed Civil Engineer. Involved in flood control research and design for over 14 years, including 16 publications and conference abstracts. Worked on numerous flood control, levee design, sediment transport and numerical modeling projects related to surface water conveyance and design. Worked on projects involving the removal of contaminated soils, relief wells, slurry walls, however, his focus is on flood control implementation and design. Areas of expertise are numerical modeling, flood control, sediment transport, design and related permitting.
- Worked for more than a decade at the intersection of water resource development, water infrastructure financing, and water policy. Focused technical expertise on the translation of engineering science into actionable environmental benefit.
- Familiar with geotechnical practices used in the Mississippi River Floodplain and have demonstrated experience related to levee design and construction. Example projects: Pointe a la Hache, LA, Mississippi River levee diversion and wetland restoration; Santa Clara River, CA, Newhall buried soil cement bank protection and flood control design and construction; San Jacinto River, CA, ACOE levee extension design and sediment transport analysis. Over 10 years of experience related to levee design and construction, including flood control, sediment transport and numerical modeling. 16 publications and conference abstracts related to flood control, numerical modeling and surface water applications. Worked on levee design projects both domestically and internationally.
- Experience with hazardous waste and aquifer protection. Example project: Kern County, CA, Tejon Village water quality modeling and remediation design. Expertise in implementation and design of BMPs for the reduction of pollutants entering streams and aquifers. Worked on hazardous waste projects.
- Diplomate, American Academy of Water Resources Engineers; Member, American Society of Civil Engineers
- PhD, Civil & Environmental Engineering, University of California, Irvine
- Has served on the Independent External Peer Review for the Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management General Reevaluation Report (GRR) and Supplemental Environmental Impact Statement (SEIS)

Education

- PhD, Civil & Environmental Engineering, University of California, Irvine, 2002
- Regent's Dissertation Fellow, 2001–2002
- MS, Civil & Environmental Engineering, University of California, Irvine, 2002
- BS, Physical Marine Science/Stennis Space Center, University of Southern Mississippi, 1998
- BA, Earth Science, Johns Hopkins University, 1994
- M.S., Natural Resources Management, University of Michigan, 1989

Certifications and Licenses

- Registered Civil Engineer, California (68321)
- Registered Civil Engineer, Arizona (44318)
- Disaster Service Worker, California (SAP62634)
- Diplomate, Water Resource Engineer (D.WRE) American Academy of Water Resource Engineers, 2010

Summary of Professional Experience

Dudek

- Provided project management experience, assisted with construction document preparation, and provided team member training and standards development. Has served as internal lead for federal and state resource permitting, including CWA 401/404/1600, California Environmental Quality Act/National Environmental Policy Act (CEQA/NEPA) review and environmental impact report (EIR) preparation, and water quality modeling and design.

INTERNATIONAL PROJECTS

- **Adaptation to international regulatory concerns:** Engineering design and policy compliance in Russia and China related to flood control (i.e., flood control structures design, development, and operation; statistical analysis of hydraulics and hydrology); water quality (i.e., best management practice (BMP) design, development, and operation); water and wastewater treatment (i.e., treatment plant design, development, and operation); civil design (i.e., infrastructure layout and design)
- **Project management:** Client relations; international meetings; billing; foreign resource agency contact; local labor procurement (i.e., selection and advisement of local contractors, engineers, and designers); and project-specific standards development
- **Technology transfer (for Cape Verde, West Africa):** Applicability, legal and security compliance, operations and maintenance, site setting, and research.

DOMESTIC AND INTERNATIONAL PROJECTS

- **Project management:** Contract and proposal preparation and authoring; cost estimates; project team lead; internal and external client relations; document preparation (i.e., report authoring and preparation, plan set preparation and review, construction document preparation and review); meetings organization; billing; resource agency contact (Federal Emergency Management Agency (FEMA) Conditional Letter of Map Revision and Letter of Map Revision (CLOMR/LOMR)), U.S. Army Corps of Engineers/U.S. Environmental Protection Agency (ACOE/EPA) 404 permitting, state Department of Fish and Game and Clean Water Act permitting (i.e., 1600 series, 401 certification); team member training (i.e., development of course work; review and training of engineering and analytic methods); California Environmental Quality Act/National Environmental Policy Act (CEQA/NEPA) review and subsequent environmental impact report (SEIR) preparation; internal standards development; and numerical modeling lead
- **Engineering analysis and design:** Hydrology (i.e., HEC-1 modeling, rational method, statistical analysis, etc.); hydraulics (i.e., HEC-RAS modeling, FLO-2D modeling, empirical analysis); sediment analysis (i.e., debris production, debris basin design, erosion control specification and design, bank protection specification and design, SAM modeling, HEC-6T modeling, empirical analysis, fluvial/alluvial hazards mitigation); flood control and water quality (i.e., runoff mitigation analysis and design, flood storage analysis and design, weir design, channel design; BMP specification and design, etc.); research; statistical analysis; conference presentation; and research publication.

RELEVANT PREVIOUS EXPERIENCE

- Santa Clara River and Tributaries, Private Land Developer, Santa Clarita, California. Led the design for buried soil cement bank protection from upstream of Interstate 5 to downstream of the Los Angeles–Ventura County Line (approximately 7 miles). Bank protection design was based on Los Angeles County Flood Control District Design Manual and Los Angeles County Department of Public Works Sedimentation Manual criteria, updated to ensure HEC-18 compliance. The design encompassed the lateral location, the top and toe elevations, and the backfill coverage. Buried soil cement bank protection led to a 30% to 50% reduction in cost over conventional methodologies and provided aesthetic and environmental benefits. Approximate contract value: $550,000.
- Santa Clara River and Tributaries, Private Land Developer, Santa Clarita, California. Led the design and developed analysis methodologies for sediment transport with Santa Clara River from upstream of Interstate 5 to downstream of the Los Angeles–Ventura County Line (approximately 7 miles). Numerical modeling (SAM) was employed to estimate general adjustment, historical topographic analysis techniques were created to

estimate long-term adjustment, and empirical analyses were utilized to calculate local scour components. Total bed adjustment was estimated following HEC-18 criteria. Sediment stream yield and sediment watershed yield were determined; maximum and no delivery scenarios were examined. Approximate contract value: $850,000.

- Newhall Land, Santa Clarita, California. Led the analysis for placement of a sanitary sewer siphon within Santa Clara River upstream of the Interstate 5 Bridge. Numerical modeling (historical and contemporary), historical topographic analysis, and bridge scour estimates were conducted. Siphon design was based on Los Angeles County Department of Public Works and Los Angeles County Sanitation Department criteria and was based partially on a new analysis of the historically significant San Francis Dam failure. Approximate contract value: $100,000.
- Santa Clara River, Private Land Developer, Santa Clarita, California. Led the hydraulic investigation for habitat impacts analysis related to infrastructure improvements within Santa Clara River from upstream of Interstate 5 to downstream of the Los Angeles–Ventura County Line (approximately 7 miles). Geographic information system (GIS)-based numerical methods were developed to compare changes in local hydraulic parameters to habitat location and quantity. Impacts were quantified by location and habitat type. The methods developed here are a powerful tool for both impacts analysis and for the mitigation of impacts within the design phase prior to construction. These methods were used to provide preliminary and final design for habitat restoration following construction, and in conjunction with biology and habitat teams. Approximate contract value: $250,000.
- Malibu Creek and Lagoon, Private Land Owner, Malibu, California. Led Clean Water Act, Department of Fish and Game, FEMA, and California Coastal Commission permitting for the restoration and remediation of 500 linear feet of bank protection in lower Malibu Creek. Also led alternatives and design efforts for the restoration and remediation effort, including the selection of environmentally sensitive methods of mitigation and bank protection in environmentally sensitive habitat. Approximate contract value: $150,000.
- Santa Clara River, Private Land Owner, Santa Clarita, California. Led Clean Water Act and Fish and Game permitting for bank restoration, habitat mitigation, and flood control improvements along the south bank of the Santa Clara River. Also led the alternatives analysis and design for habitat restoration measures in an environmentally sensitive area. Approximate contract value: $225,000.
- Private Developer, San Jacinto, California. Led Clean Water Act permitting efforts for a large, unnamed ephemeral drainage, crossing several property boundaries and a tributary to San Jacinto River. Particular effort was taken to resolve issues related to the (then) recent Solid Waste Agency of Northern Cook County (SWANCC) Supreme Court decision, particularly related to connectivity. Approximate contract value: $75,000.
- Public Agency, Pointe á la Hache, Louisiana. Led hydraulic and sediment transport efforts to determine the diversion rate and impacts to hydraulics and sediment transport as part of a wetland restoration effort.
- Whittmann Study Area H-3 Fan, Public Agency, Maricopa County, Arizona. Led 2-D, numerical modeling effort of the Whittmann Study area. The project achieved the three main goals of determining the baseline FEMA floodplain, calculating the design discharge of the main alluvial fan feeder channels, and providing a preliminary estimate of sediment transport within the sub-fan study area. Modeling results provide an aid to FEMA, Arizona Department of Game and Fish, and ACOE permitting efforts. Approximate contract value: $100,000.
- Ft. Tejon Road, Public Agency, Palmdale, California. Modeled the railroad underpass using FLO-2D to calculate the distribution of surface flow crossing the study area to design regional stormwater infrastructure improvements. The project addressed a complex site condition where a regional road was crossed by a local road and a railroad overpass bridge. Approximate contract value: $50,000.
- Conejo & Calleguas Creek, Public Agency, Ventura County, California Led 2-D modeling efforts to characterize the baseline floodplain of the Conejo-Calleguas floodplain downstream of State Highway 101, Camarillo, California. After the baseline flood condition was determined, modeling was updated to the proposed condition where infrastructure improvements to both channels and several crossings were designed. Improvements included updating bridges, increasing channel capacity, removing several parcels from the floodplain, and providing additional flood protection improvements in a system characterized by several confluences. Special modeling effort was made to consider the influence of stream confluences on 2-D hydraulics. Modeling results were utilized for FEMA CLOMR/LOMR applications. Approximate contract value: $275,000.

- Whitewater River, Private Development Group, Riverside County, California Led modeling of Whitewater River to include design for part of an 18-hole, championship golf course, erosion control, and habitat improvements. Tees, greens, and erosion control were designed to minimize disturbance during the design event, while improving the current state of channel habitat. Coordinated with the local Indian tribe and Bureau of Indian affairs to accomplish federal and state water quality and habitat permitting. Approximate contract value: $300,000.
- San Jacinto River, Public Agency, Riverside County, California. Led modeling and design support team to develop improvements to the existing ACOE levee with the City of San Jacinto. Led sediment data collection efforts and hydrology determination, including design storm and long-term hydrographs, numerical modeling, gas pipeline protection measures, levee top- and toe-elevation determination, and downstream habitat impacts analysis. Project included historical and gravel mining operations analysis. Coordinated with local Indian tribe to address local tribal concerns. The primary design concern was to restore River habitat and functions while minimizing impacts to downstream special habitat areas. Approximate contract value: $300,000.
- San Juan Creek, Public Agency, Orange County, California. Led technical analysis for sediment transport from the Pacific Ocean to Caspers Regional Park (approximately 13 miles), including HEC-6T sediment transport numerical modeling, site surveying and sampling, empirical streambed analysis, historical geomorphologic analysis, and floodplain and erosion limits determination. The project also determined the historical variation in lateral migration and the design top and toe of hypothetical bank protection. Approximate contract value: $275,000.
- Lytle Creek, Private Developer, Riverside County, California. Led the design of pipeline scour protection along the Lytle Creek alluvial fan complex adjacent to Interstate 15. Significant design tasks included sediment transport estimates, scour potential, habitat impacts mitigation, and on-site drainage. Approximate contract value: $75,000.
- Special Project Area 4, Public Agency, Maricopa County, Arizona. As stormwater project lead, conducted analysis and led design for roadway drainage and on-site stormwater improvements, including a downstream discharge weir intended to mitigate downstream, off-site habitat. Approximate contract value: $45,000.
- Special Project Area 4, Public Agency, Maricopa County, Arizona. As stormwater project lead, conducted analysis and led design for on-site stormwater improvements and associated infiltration basins, and off-site alluvial fan feeder channel diversions. Approximate contract value: $30,000.

Related Publications and Presentations

- Jaffe, D.A. 2008. “Examination of an Arithmetic Approach for the Coupling of Two-Dimensional Hydraulic Surface Water Models.” FMA News (December) 18(4): 13–18.
- Jaffe, D.A. 2007. “The Use of Historic Topography for the Characterization of Time Dependent Geomorphic Change and Sediment Delivery.” ASCE COPRI Coastal Sediments Conference Proceedings, edited by Kraus and Dean-Rosati. New Orleans, Louisiana: Vol. 2, 861–887.
- Jaffe, D.A. 2007. “The Use of Geospatial Hydraulic Analysis for the Characterization of Habitat Impacts on Wide, Braided Rivers.” ASCE EWRI WEWRC Conference Proceedings, edited by K. C. Kabbes. Tampa, Florida.
- Sanders, B.F., J.C. Pau, and D.A. Jaffe. 2006. “Passive and Active Control of Diversions to an Off-line Reservoir for Flood Stage Reduction.” Advances in Water Resources, 29(6): 861–871.
- Sanders, B.F., D.A. Jaffe, and A.K. Chu. 2003. “Discretization of Integral Equations Describing Flow in Non-prismatic Channels with Uneven Beds.” Journal of Hydraulic Engrg. 129(3): 235–244.
- Jaffe, D.A. 2002. “Levee Breaches for Flood Reduction.” PhD dissertation; University of California, Irvine.
- Jaffe, D.A., and B.F. Sanders. 2001. “Engineered Levee Breaches for Flood Mitigation.” Journal of Hydraulic Engrg. 127(6): 471–479.
- Burnett, B.H., V. Kamenkovich, D.A. Jaffe, A.L. Gordon, and G.L. Mellor. 2000. “Dynamical Balance in the Indonesian Seas Circulation.” Geophysical Research Letters 27(17): 2705-2708.

- Sanders, B.F., and D.A. Jaffe. 1999. "Mitigation of extreme flooding events by Tactical Depression Wave Control." ASCE International Water Resources Engineering Presentation Summaries. Edited by R. Walton and R. Nice. Seattle, Washington.
- Jaffe, D.A. 1998. "Determination of the Pathway of Waters through the Indonesian Seas." Master's thesis; University of Southern Mississippi.

CONFERENCE ABSTRACTS

- Jaffe, D.A. 2009. "A Comparison of Long-Term Sediment Transport Numerical Model Results Using Historical and Statistical Hydrograph Data in the Arid Southwestern United States." California Shore and Beach Preservation Association (CSBPA) Headwaters to Ocean (H2O) Conference. Long Beach, California.
- Jaffe, D.A., and B. Jones. 2008. "Application of Multiple-Scale, Two-Dimensional Coupled Hydraulic Modeling for Estimation Flood Extents in the California Bay-Delta Area." Floodplain Management Association Annual Conference. San Diego, California.
- Jaffe, D.A., and R.J. Rovansek. 2004. "Creating 2-D Velocity Distributions from a 1-D Hydraulic Model: Applications for Impact Analysis." Fourth Annual CalCoast H20 Conference. Long Beach, California.
- Jaffe, D.A. 2003. "Ten Coastal Environmental Concepts to Teach Your Children." Groundswell Society SAIC 4. San Diego, California.
- Jaffe, D.A, and B.F. Sanders. 2001. "Tactical Levee Breaching for Flood Mitigation." Proc. Third International Symposium of Engrg. Hydrology. Tempe, Arizona.
- Jaffe, D.A. 1999. "Effects of Engineered Structures on Coastal Erosion: A Review." Surfrider Foundation Summit. San Diego, California.

Professional Associations

- American Society of Civil Engineers

Roger Mann, PhD

Qualifications Summary

- More than 25 years experience in economics.
- PhD in agricultural economics and economics.
- Recent work on review of California grant requests for flood damage reduction and stormwater projects, Delta Risk Management Strategy development and compilation of lost use cost data for Calif. Delta, some using GIS information by island, including residential, business, highways, natural gas. Assist DWR with Flood Emergency response Program, Calif. urban water supply economics, Salinas Valley flood damage costs; consideration of P&Gs related to conveyance and reservoir development in Calif. In Pacific Northwest, member and twice chair of Independent Economic Analysis Board charged with cost-effectiveness analysis of BPAs Fish and Wildlife Program including habitat restoration. In all cases, met or exceeded expectations.
- About two years experience as USACE subcontractor; emergency repair funds CA B/C analyses following 1997 floods, Prado Dam water conservation operations, Farmington Dam raise alternatives, City of Norwalk water supply improvements.
- Several years experience working with Reclamation, California and private clients in benefit-cost analysis of multi-purpose projects under federal principles and guidelines (P&Gs), including consideration of federal FDR benefits as described in ER-1105-2-100.
- Specialization in water resources, environmental, agricultural and regional economics.
- Has served on the USACE Independent External Peer Review for the Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management General Reevaluation Report (GRR) and Supplemental Environmental Impact Statement (SEIS)

Education

- PhD, Agricultural Economics and Economics, Colorado State University, 1988
- MS, Agricultural and Resource Economics, University of Nevada Reno, 1979; Virginia Polytechnic Institute and State University, 1980
- BS, Resource Economics, University of New Hampshire, 1976

Summary of Professional Experience

RMann Economics — Founder and Principal

- Specializing in water resource economics under State and national guidance and criteria. Example projects:

– Economic methods and review: For California Department of Water Resources (DWR), developed economic methods, criteria and ranking for more than 50 Integrated Regional Water Management (IRWM), storm water management, and groundwater storage grant and loan proposals. Participated in common assumptions process for hydrologic and economic models for use in benefit-cost evaluations, including considerations of federal Principles and Guidelines (P&Gs).

– Flood damage reduction: IRWM proposals included flood damage reduction projects using expected annual damages to estimate benefits. DWRs Delta Flood Emergency Preparedness, Response and Recovery Project: evaluated a study of alternative locations for Delta transfer facilities for storing supplies for Delta levee repairs. Compiled lost use cost estimates for evaluation of levee repair strategies. Delta Risk Management Strategy: developed lost use costs for business, residences, natural gas, wastewater and highways using GIS data.

– Water transfers: Provided analysis of environmental water account (EWA) effects on crop idling, water transfer market and regional economies. Investigated appropriate price for environmental water supplies from new surface storage projects. In 2002, developed a method to estimate the economic impacts of water transfers using

detailed crop budgets for first-round impacts and IMPLAN results for induced and indirect effects. For other clients, estimated fair market price for water transfers in the Sacramento Valley.

- Municipal water supply: Provided analysis of Frank's Tract improvements including municipal water supply and quality economics. Chaired LCPSIM review group to recommend improvements for a municipal water economics model. In Economic Evaluation of Water Management Alternatives developed municipal water supply economic analysis, including transfer assumptions, with California stakeholders.
- Cost Allocation: Assisted with preliminary cost allocation and plan formulation report for North of Delta Off-stream Storage project. Reviewed cost allocation for the State Water Project and described alternatives. Evaluated cost allocation associated with groundwater management agreements in the Chino Basin.
- Water use efficiency and finance. For Delta Vision process, provided a scoping-level analysis of economic efficiency of water use and allocation in California and wrote a description of potential financing strategies. For California Bay-Delta Authority (CBDA) assisted with water use efficiency program cost estimates. In 2004, participated on the CBDA finance planning team. Investigated economic incentives for irrigation water conservation in southern California and conversion to level basin irrigation in Arizona. Developed finance plan for environmental programs in the Lake Tahoe basin.
- Other natural resources: Provided expert witness testimony regarding economic costs of flows for salmonids on the lower Tuolumne River. Helped investors estimate employment associated with walnuts and vineyards. Assisted with NEPA analysis of PG&E hydropower projects for water supply. Developed economic methodology for aquatic plant management. Developed analysis related to public land ownership, habitat protection, property values, local government finances, irrigation costs, and vacation home/resort development in Washington. For Bonneville Power Administration, wrote funding and economics sections and assisting with preparation of Columbia River Fish and Wildlife Implementation EIS. For Northwest Power and Conservation Council, developed analysis and description of human effects of multi-species framework planning alternatives.

Independent Economic Analysis Board of the Northwest Power and Conservation Council —Member and Chair

- Assist the Council with cost effectiveness analysis of fish and wildlife programs. Principal investigator for analyses of zebra/quagga mussels, integrated hatchery management, Fish and Wildlife program cost reporting and potential for cost benchmarking, bioeconomic analysis of mainstem actions to increase juvenile salmonid survival, and analysis of irrigation conveyance systems to benefit salmonids in Washington.

CH2M HILL, Sacramento — Economist

- For USACE, developed benefit/cost analysis of California levee repair projects. For DWR, estimated economic benefits from flood control in the Salinas Valley. For USACE, developed benefit-cost analysis of water conservation operations at Prado Dam, Orange County and Farmington Dam, San Joaquin County.
- Assisted Bureau of Reclamation with Water Supply Improvement Plan and Integrated Resource Plan for agricultural water use in the westside San Joaquin Valley. For Trinity River Mainstem Fisheries Restoration EIS, estimated impacts of fisheries restoration actions on four regional economies. Analyzed effects of the Central Valley Project Improvement Act (CVPIA) and Trinity River fisheries restoration on municipal water costs and water transfers, and wrote corresponding sections for the Programmatic Environmental Impact Statement (PEIS) and Trinity River Mainstem Fisheries Restoration EIS/EIR. Assisted with development of data for Central Valley Production Model (CVPM). Assisted with writing of CVPIA PEIS agricultural economics, and environmental assessments for interim contract renewals, interim 800,000 AF, and refuge water EIR/EIS. Reviewed *Water for the West*, reports of the Western Water Policy Review and Advisory Commission. Summarized modeling needs the San Joaquin basin.

Novato — Independent Consultant

- Critiqued economic analysis of critical habitat designation for Colorado River endangered fish. Modified an economic model of south coast municipal water supply reliability to estimate benefits of alternative water supplies. Analyzed economic impacts of South Coast agricultural water price increases.

BioSystems Analysis, Inc., Tiburon —Senior Resource Economist

- Evaluated water conservation programs and land fallow to help reduce saltwater intrusion in the Salinas Valley.

Evaluated effects of USDA farm programs on irrigation water use in California and potential for related water conservation and transfers to municipal water suppliers. Evaluated water operations models for alternative Bay/Delta water quality standards. Evaluated water quality and ground water models and temperature standards for migrating salmon.

Hydrosphere Resource Consultants, Inc., Boulder, Colo. — Economist

- Developed water demand forecasts interacting with flows for Colorado River endangered fish. Considered water supply options for out-migrating juvenile salmon in the Snake River Basin. Estimated irrigation, municipal, structural, hydropower and fisheries impacts of critical habitat designation for the threatened Sacramento River winter run chinook salmon. Surveyed public and officials' attitudes toward municipal water supply reliability in several Colorado communities. Studied alternative irrigated crop and livestock operations and farm co-op business opportunities.
- In Arizona, conducted detailed benefit-cost analyses of irrigation projects for Practicably Irrigable Acreage (PIA) analysis. Investigated discount rate, farm programs, marketing costs, water opportunity costs and other benefit-cost issues. Valued reservoirs for water supply, hydropower and recreation. Developed a water allocation model of the Gila River Basin using the out-of-kilter algorithm. Investigated feasibility of a ground water credit market near Phoenix.

Hydrosphere Resource Consultants —Board of Directors

Pinewood Springs Water District —Board of Directors

Economics Institute, Boulder, Colo. —Instructor

Texas Attorney General's Office, Austin —Independent consulting

- Estimated economic costs of water supply shortages and salinity damages to Texas and New Mexico due to shortages of the Pecos River.

Colorado State University, Fort Collins —Research Assistant/Associate

- Estimated secondary costs and benefits of construction, operation and finance of the Animas-La Plata project using three state-level models. Calculated change in agricultural multipliers over time in the Great Plains. Investigated values of irrigation projects on four Indian reservations.

Division of Agricultural Economics, University of Wyoming —Research Associate

- Developed simulation models of pumping costs, crop evapotranspiration, soil moisture and crop yields under center pivot irrigation and evaluated electricity rate structures to slow declining Ogallala aquifer water tables.

Virginia Tech, Blacksburg —Research Associate

University of Nevada, Reno —Graduate Fellow/Research Associate

New Hampshire State Government, Concord —Research Intern

Related Publications

- 2010. With Independent Economic Analysis Board. Economic Risk Associated with the Potential Establishment of Zebra and Quagga Mussels in the Columbia River Basin. IEAB 2010-1.
- 2009. With Independent Economic Analysis Board. Integrated Hatchery Operations: Fish and Wildlife Program Costs and Other Economic Effects Phase 1. Task 139. IEAB 2009-2.
- 2008. With M-Cubed. EIP Phase II Finance Options Report. For Tahoe Regional Planning Agency. May.
- 2008. With Western Resource Economics. Economic Efficiency of Water Use and Allocation in California A Scoping-Level Analysis. For Delta Vision Process. July.
- 2008. With Western Resource Economics. Financing Strategies for Delta Vision. September.
- 2005. Economic Impacts of Tax-Exempt Habitat and Recreation Lands on Local Economies and Governments in Washington State. Draft. For Interagency Committee for Outdoor Recreation, Olympia.

- 2005. Scoping-Level Analysis for Economic Issues Involving Environmental Protection in the Yakima Region. Draft. For Yakima County Public Services, Yakima.
- 2004. With Independent Economic Analysis Board. Scoping for Feasibility of Columbia River Mainstem Passage Cost-Effectiveness Analysis. November. IEAB 2004-02. Portland.
- 2003. Methodology for Aquatic Plant Management Economics. For: San Francisco Estuary Institute. June.
- 2002. Economic Effects of Land Idling for Temporary Water Transfers. For California Department of Water Resources. March.
- 2002. Draft Principles and Methodologies Report. Benefit and Cost Allocation Planning Process for CALFED Projects and Programs. June.
- With CH2M HILL and Meyer Resources, Inc. 2000. Human Effects Analysis of the Multi-Species Framework Alternatives. Prepared for Northwest Power Planning Council. Council Document 2000-5. March.
- With CH2M HILL. 1999. Economic Evaluation of Water Management Alternatives. Screening Analysis and Scenario Development. Prepared for CALFED Bay-Delta Program. October.
- With CH2M HILL. 1997. Central Valley Project Improvement Act Programmatic EIS. Municipal Water Use and Costs Economics Technical Appendix, and Municipal Water Use and Costs Economics Methodology/Modeling Technical Appendix.
- 1996. Antimarket Economics. Blind Logic, Better Science, and the Diversity of Economic Competition. Praeger Publishers, Greenwood Publishing Group, Westport, CT.
- With Camp, Dresser & McKee. 1994. Watershed Management Policies and Programs of State and Federal Government. For: American Water Works Association Research Foundation. Draft Technical Memorandum. Boston.
- With C. W. Howe, M.G. Smith, L. Bennett, C.M. Brendecke, J.E. Flack, R.M. Hamm, L. Rozaklis and K. Wunderlich. 1994. "The Value of Water Supply Reliability in Urban Water Systems." Journal of Environmental Economics and Management. 26(1) pp. 19-30. January.
- 1993. Using Farm Programs to Promote Water Management Goals: Innovative Arrangements Using U.S. Department of Agriculture Programs to Promote Water Resource Management in California. With Moore Associates. For California Urban Water Agencies, Sacramento.
- With Young, Robert A. 1993. "Cheap Water and Rural Area Development in Indian Country." In: T. R. McGuire, W. B. Lord, and M. G. Wallace, Eds. Indian Water in the New West. University of Arizona Press, Tucson.
- 1990. An Evaluation of Economic Welfare Analysis and Input-Output Methods. Presented at the American Agricultural Economics Association (AAEA) Annual Meetings, Vancouver, B.C.
- 1990. Welfare Implications of Regional Economic Models with Application to the Animas-La Plata Project. Ph.D. Dissertation, Colorado State University, Fort Collins.
- With Jacobs, James J., J.M. Oster, and D.R. Franklin, 1988. An Economic Analysis of Irrigation Strategies with Increasing Electricity Prices and Declining Groundwater Table. University of Wyoming Agricultural Experiment Station RJ-208, Laramie.
- With E. Sparling and R.A. Young. 1987. "Regional Economic Growth from Irrigation Development: Evidence from Northern High-Plains Ogallala Groundwater Resource." Water Resources Research 23(9).
- With J.J. Jacobs and E.B. Bradley. 1987. "Application of Inventory Control Theory to Economic Thresholds," and "Simulation Modeling of the Economics of Grasshopper Control." In Integrated Pest Management on Rangeland: A Shortgrass Prairie Perspective. Westview Press, Boulder CO.
- With Shane, Ronald, and F.D. Fillo. 1980. "Effects of Annual Assessment: The Case of Nevada." Assessors Journal 15(3).

Appendix C – Charge for IEPR Panel

The IEPR review documents and general charge questions provided by the USACE to support the IEPR for the PdP/FL project are listed below. The charge was provided to the panel to guide its review.

C.1 Documents Provided

The following documents pertaining to the IEPR were provided:

- *Limited Reevaluation Report, Prairie du Pont and Fish Lake, St. Clair and Monroe Counties, Illinois, Flood Protection Project*, with plates and appendices and supporting documentation (approximately 802 pages of text and drawings).

C.2 General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the PdP/FL LRR. Please focus on your areas of expertise and technical knowledge. Even though there are some sections that do not specifically have charge 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 1 and 2 below per USACE guidance (EC No. 1165-2-209; Appendix D).

1. Assess the adequacy and acceptability of the evaluation and selection of alternatives.
2. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation for construction, authorization, or funding.
3. Evaluate whether the interpretations of analysis and conclusions are reasonable.
4. Please focus the review on scientific information, including factual inputs, data, the use and soundness of models, analyses, assumptions, and other scientific and engineering matters that inform decision makers.
5. 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.
6. If desired, panel members can contact one other. 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.

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.

C.3 General Charge Questions

1. To what extent has it been shown that the project is technically sound?
2. Are the assumptions that underlie the engineering, and environmental analyses sound?

3. Are the engineering, and environmental methods, models and analyses used adequate and acceptable?
4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?
5. Were risk and uncertainty sufficiently considered?
6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?
7. Does the EA satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
8. Assess the recommended alternatives from the perspective of systems. It should also include systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Safety Assurance Review Questions

9. Were the methods used to evaluate the condition of the structure adequate and appropriate given the circumstances?
10. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
11. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
12. Are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?
13. Have the hazards that affect the structures been adequately documented and described?
14. Are the models used to assess hazards appropriate?
15. Are the assumptions made for the impacts appropriately documented and explained?
16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?
17. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?
18. Does the physical data and observed data provide adequate information to characterize the structures and their performance?
19. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including but not necessarily limited to population-at-risk been considered?
20. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?
21. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?

22. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?
23. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

C.4 Specific Charge Questions for the Prairie du Pont and Fish Lake LRR and Environmental Assessment

Objectives

24. Is the purpose of the project adequately defined? If not, why?
25. Has the project need been clearly described?
26. Have the public concerns been identified and adequately described?
27. Are the specific objectives adequately described?
28. In your opinion, are there any other issues, resources, or concerns that have not been identified and/or addressed?

Alternatives (Includes review of Appendix B Tentatively Selected Plan Plates)

29. Has the criteria to eliminate plans from further study been clearly described?
30. Is each of the different engineering alternative plans clearly described?
31. Were the assumptions made for use in developing the future with-project conditions for each engineering alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?
32. Are the changes between the without- and with-project conditions adequately described for each engineering alternative?
33. Have comparative impacts been clearly and adequately described?
34. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each engineering alternative?
35. Are there any unmitigated environmental impacts not identified and if so could they impact project designs?
36. Please comment on the likelihood of the recommended engineering alternative will achieve the expected outputs.
37. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?
38. Have the impacts to the existing infrastructure, including the existing flood risk management project, utilities, and transportation infrastructure, been adequately addressed?

Affected Environment (Includes Review of Appendix M Cultural Resources)

39. Is the description of the climate in the study area sufficiently detailed and accurate?
40. Is the description of wetland resources in the project area complete and accurate?
41. Is the description of aquatic resources in the project area complete and accurate?
42. Is the description of threatened and endangered species resources in the study area complete and accurate?
43. Is the description of the historical and existing recreational resources in the study area complete and accurate?
44. Is the description of the cultural resources in the study area complete and accurate?
45. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate? Were specific socioeconomic issues not addressed?

Environmental Consequences

46. Have impacts to significant resources been adequately and clearly described?
47. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?
48. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?
49. Have impacts from borrow areas been adequately and clearly described?

Cumulative Impacts

50. Are cumulative impacts adequately described and discussed? If not, please explain.

Mitigation

51. Are mitigation measures adequately described and discussed? If not, please explain.

Appendix A Section 404(b)(1) Evaluation

52. Have the short-term and long-term impacts associated with the discharge of dredged and fill material been adequately and clearly described?
53. Was the process used to select the recommended mitigation sites implemented in a reasonable manner given the project constraints?
54. Are the assumptions used to determine mitigation credit for the proposed project adequate?
55. Are the assumptions used to for the Wetland Value Assessment Methodology for the proposed project adequate?

Appendix C Hydrology and Hydraulics

56. Was the hydrology discussion sufficient to feasibility scope to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions. Please comment on

the completeness of the discussion on the relationship between subsurface hydrology and the hydrodynamics of the project area.

57. Was the hydrodynamic modeling performed technically sound?

Appendix D Geotechnical Engineering

58. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?

Appendix E Design

60. Have the design and engineering considerations presented been clearly outlined and will they achieve the objective to address the underseepage design deficiencies?
61. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?
62. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Appendix F Real Estate, Real Estate Plan

63. Comment on the extent to which assumptions and data sources used in the economics analyses are clearly identified and the assumptions are justified and reasonable.
64. Does the Real Estate appendix adequately address all real estate interests (public and private)?

Appendix G Relocations

65. Have potential relocations as a result of the project been adequately addressed?

Appendix H Hazardous, Toxic and Radioactive Waste

66. Comment on the extent to which impacts of the engineering alternatives may have on hazardous, toxic, and radioactive waste issues?

Appendix I Cost Estimates and Appendix J Economics

67. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to cost ratio for each of the project alternatives?
68. Was the methodology used to determine the characteristics and corresponding value of the structure inventory for the study area adequate?
69. Were the methods used to develop the content-to-structure value rations appropriate and were the generated results applicable to the study area?
70. Were the methods to develop the depth-damage relationships appropriate ad were the generated results applicable to the study area?
71. Has the economic analyses addressed the issue of repetitive flood damages and the subsequent extent of rebuild/repair by property owners as it relates to annual damage estimation?
72. Were risk and uncertainty sufficiently considered in relation to the future development process?

73. To what extent have significant project construction costs been adequately identified and described?
74. Are the costs adequately justified?

Appendix K Farmland Conversion Impacts

75. Has the conversion of farmland to seepage berms and its impacts been adequately addressed?
76. Was the process used to select the recommended mitigation sites implemented in a reasonable manner given the project constraints?
77. Was the process used to select the recommended mitigation sites implemented in a reasonable manner given the project constraints?
78. Are the assumptions used to determine mitigation credit for the proposed project adequate?

Appendix L Public Involvement and Correspondence

79. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties? Should additional public outreach and coordination activities be conducted?

Final Overview Question

80. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?