Independent External Peer Review

Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management General Reevaluation Report and Supplemental Environmental Impact Statement (Rev. 1)

Contract No. W912HQ-11-D-0002

10 August 2012

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For the best of reasons

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List of Acronyms

COI	conflict of interest
EA	Environmental Assessment
EC	Engineer Circular
FEMA	Federal Emergency Management Agency
ft	foot/feet
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
LEED	Leadership in Energy and Environmental Design
LFCC	Low Flow Conveyance Channel
NEPA	National Environmental Policy Act
NWR	National Wildlife Refuge
O&M	operations and maintenance
OMB	Office of Management and Budget
PUP	Probability of Unsatisfactory Performance
SADD	San Acacia Diversion Dam
SEIS	Supplemental Environmental Impact Statement
SOW	Scope of Work
SWILFPDC	Southwest Illinois Flood Prevention District Council
USACE	U.S. Army Corps of Engineers
yr	year(s)

Executive Summary

Noblis has performed an Independent External Peer Review (IEPR) of 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) 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 Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management GRR and SEIS. The GRR/SEIS addresses alternative plans to provide higher levels of flood risk management to floodplain communities within the San Acacia to Bosque del Apache Unit of the Rio Grande Floodway by determining (1) whether the Authorized Project is still implementable, (2) if any changes are necessary for implementation, and (3) if the changes are within the approval authority delegated to the Division Commander, the USACE, or if they require additional Congressional authorization. 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 flood protection 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 Rio Grande Floodway GRR and SEIS 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.

This effort was performed in two phases. During the course of both phases of the IEPR, Noblis served as the conduit for information exchange between the panel and USACE in order to ensure a truly independent IEPR. Phase 1, which began in October 2011, focused on the GRR/SEIS Alternative Formulation Briefing (AFB) read-ahead material and appendices. Charge questions from the USACE were provided to the panel to help guide Phase 1 of the IEPR, and resulted in IEPR panel comments on the materials reviewed (not a report) being provided to the USACE. USACE took into consideration the Phase 1 comments when developing the Draft GRR and SEIS for public review. After receiving public comments on the Draft GRR/SEIS, the Phase 2 IEPR activities began, where the panel—building upon the comments and feedback from Phase 1—conducted a review of the USACE's Draft GRR/SEIS. The Phase 2 IEPR was held to a very tight schedule in order to meet the statutory requirements of the Water Resources Development Act (WRDA) of 2007 for conducting this type of IEPR within 60 days after the close of the public comment period.

The GRR/SEIS provides an overview of the history of the project since Congressional authorization in 1948, and relies heavily on the analyses and insights from the 1992 SEIS. The final IEPR comments are focused on recommended changes to the GRR and SEIS to identify and clarify specific key design parameters and factors that should be considered in the selection of the preferred alternative as the SEIS is updated and finalized over the next few months. In general, the panel finds that the long history and several iterations of this project impair

transparency of the final evaluation and selection procedures. A large volume of historical data and analyses is included, but how the historical data and analysis was actually used and modified in the final analysis is unclear. In addition, thorough modeling efforts and results are described in detail but not cohesively presented. The panel comments reflect these concerns and offer suggestions as to how the documentation can be clarified. A time sequence and logic flow chart may be one approach to sorting out the issues for the reader's benefit. The panel recommends a more rigorous and sequenced discussion to increase the robustness of the selected plan. The following paragraphs include an assessment of the draft GRR/SEIS in three specific technical areas:

Economics. In terms of an economic evaluation, the GRR/SEIS and appendices did include a detailed analysis of the benefits and costs associated with each alternative. The methodology and approach for the tentatively selected plan (TSP) benefit-cost analysis appear to be generally consistent with USACE guidance except that annual levee operations and maintenance (O&M) costs were not included. In addition, the available documentation is not clear about some important assumptions. Additional supporting information related to the annual levee O&M costs and clarity regarding the noted assumptions, level of detail, handling of hydraulics, and benefits and costs associated with railroad facilities would support the justification of the selection of the preferred alternative.

Environmental. The analysis of environmental impacts for this project appears to be consistent with National Environmental Policy Act (NEPA) requirements and builds upon several prior studies conducted for the 1992 EIS. However, much of the supporting documentation for analyses of impacts and ultimate justification of selection of the preferred alternative either needs to be pulled forward from these prior studies in the SEIS document, or is still pending negotiation and approval by various agencies involved in the review process. As a result, the peer review identified several outstanding issues that should be addressed before a thorough assessment of environmental impacts and final project selection can be performed. While many environmental issues are likely to be adequately addressed on the basis of information presented to date (e.g., cultural resources, aesthetics, socioeconomic impacts, environmental justice), key issues still remain including impacts and mitigation to endangered species, as well as wildlife and riparian zone impacts.

Engineering. A series of multiple alternatives was presented by USACE to achieve the goals outlined and modified since the original 1948 project authorization. The present levee design for the project uses a probabilistic approach and contemporary levee design standards. The technical appendices have been improved greatly during the IEPR process, and provide a much clearer picture of the methods. However, outstanding questions remain regarding hydrologic/hydraulic modeling and analysis methods, particularly related to assumptions, parameters, and interpretation of results. While it appears that USACE standard practices were followed throughout the project, information is absent to determine if and where deviations from these standard practices were utilized. It is also unclear how the impacts predicted by alternatives analysis models were used to evaluate the effectiveness or the impacts of the various alternatives removed from further consideration. Additionally, there remains room for improvement of the presentation and description of assumptions and analysis of levee elevations, downstream impacts, and bridge soffit clearance within the analysis. From a civil/geotechnical perspective, the design and engineering is technically sound and meets current standards of practice.

1 Introduction

1.1 Report Introduction and Overview

This Independent External Peer Review (IEPR) Report provides a description of the IEPR conducted of 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), for the U.S. Army Corps of Engineers (USACE). This report includes a description of the IEPR objectives and process, overview of Rio Grande Floodway 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 Rio Grande Floodway Project GRR and SEIS. 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 provided 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 Rio Grande Floodway Project.

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 GRR and SEIS for the Rio Grande Floodway Project, in accordance with procedures described in the Department of the Army USACE EC No. 1165-2-209, *Civil Works Review Policy*, dated 31 January 2010, and the Office of Management and Budget's (OMB's) *Final Information Quality Bulletin for Peer Review*, released 16 December 2004. The Rio Grande Floodway 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 GRR and SEIS and was not involved in policy issues. The peer review was conducted by experts with extensive experience in civil works planning, biology/ecology,

hydrologic and hydraulic engineering, geotechnical/structural engineering, economics, and civil engineering/cost engineering. The experts were "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the GRR and SEIS.

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 (COI)-Free 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 Rio Grande Floodway Levee System or the Rio Grande Floodway GRR and SEIS. 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 2012 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 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 Rio Grande Floodway Project GRR and SEIS Project Description

The Rio Grande Floodway Project study area extends from the San Acacia Diversion Dam (SADD), located north of the City of Socorro, New Mexico, downstream to the confluence of the Low Flow Conveyance Channel (LFCC) with the Rio Grande. This nearly 58-mile reach is located in the southern-most section of the 219-mile-long Middle Rio Grande Valley. River channel, riparian woodlands, floodplain farmland, terraced plains of grasses and shrubs, basalt-capped mesas, and nearby mountains characterize the valley. The width of the Rio Grande

Valley through the proposed project area varies from 8–12 miles, with the nearly flat Rio Grande floodplain varying from 1–3 miles wide. The floodplain and bordering terraces are mostly rural and used for irrigated agriculture, livestock grazing, and wildlife conservation and enhancement. The City of Socorro, with a population of 8,877 (measured in 2000), is the major population area in the project area. Smaller communities, such as San Acacia, Polvadera, San Luis, Lemitar, Escondida, San Pedro, and San Antonio, are scattered throughout the project area. Elephant Butte Reservoir, immediately downstream of the project area, is the largest reservoir in New Mexico, storing water for irrigation, hydroelectric power, and recreation. The project area runs through the center of the Bosque del Apache National Wildlife Refuge (NWR). During flood events, the study area is characterized by large economic losses and very high frequency damaging events.

The Flood Control Act of 1948 concluded that the flood problems of the Rio Grande Basin were severe and could be addressed under the USACE flood risk management program. Due to changes within the basin over the years, including budgetary requirements, real estate constraints, flood risk management features implemented in the upper watershed, and environmental concerns, the features of the project have changed several times. Preparation of the GRR/SEIS became necessary due to these changes, which include the following:

- Rectification of the Rio Grande channel by the Bureau of Reclamation as outlined in the 1948 authorization and construction of the LFCC under the same authority.
- A longer period of record for hydrological data is now available, which permits improved and updated hydrological analysis.
- A levee design modification has been added to address long duration flows: any proposed plan would have to incorporate design features to prevent seepage through the levee due to prolonged flow against the riverward toe.
- The USACE has departed from the use of the freeboard methodology to account for uncertainty and instead uses probabilistic determination of flood risk and levee design.
- Three species have been listed as threatened or endangered since 1994 (the Rio Grande silvery minnow, the Southwestern Willow Flycatcher, and Pecos sunflower—each occurring within the study area, two with critical habitat).

The purpose of the GRR/SEIS is to address alternative plans to provide higher levels of flood risk management to floodplain communities along the Rio Grande from the SADD downstream to Elephant Butte Lake, New Mexico, by determining (1) whether the Authorized Project is still implementable, (2) if any changes are necessary for implementation, and (3) if the changes are within the approval authority delegated to the Division Commander, the USACE, or if they require additional Congressional authorization.

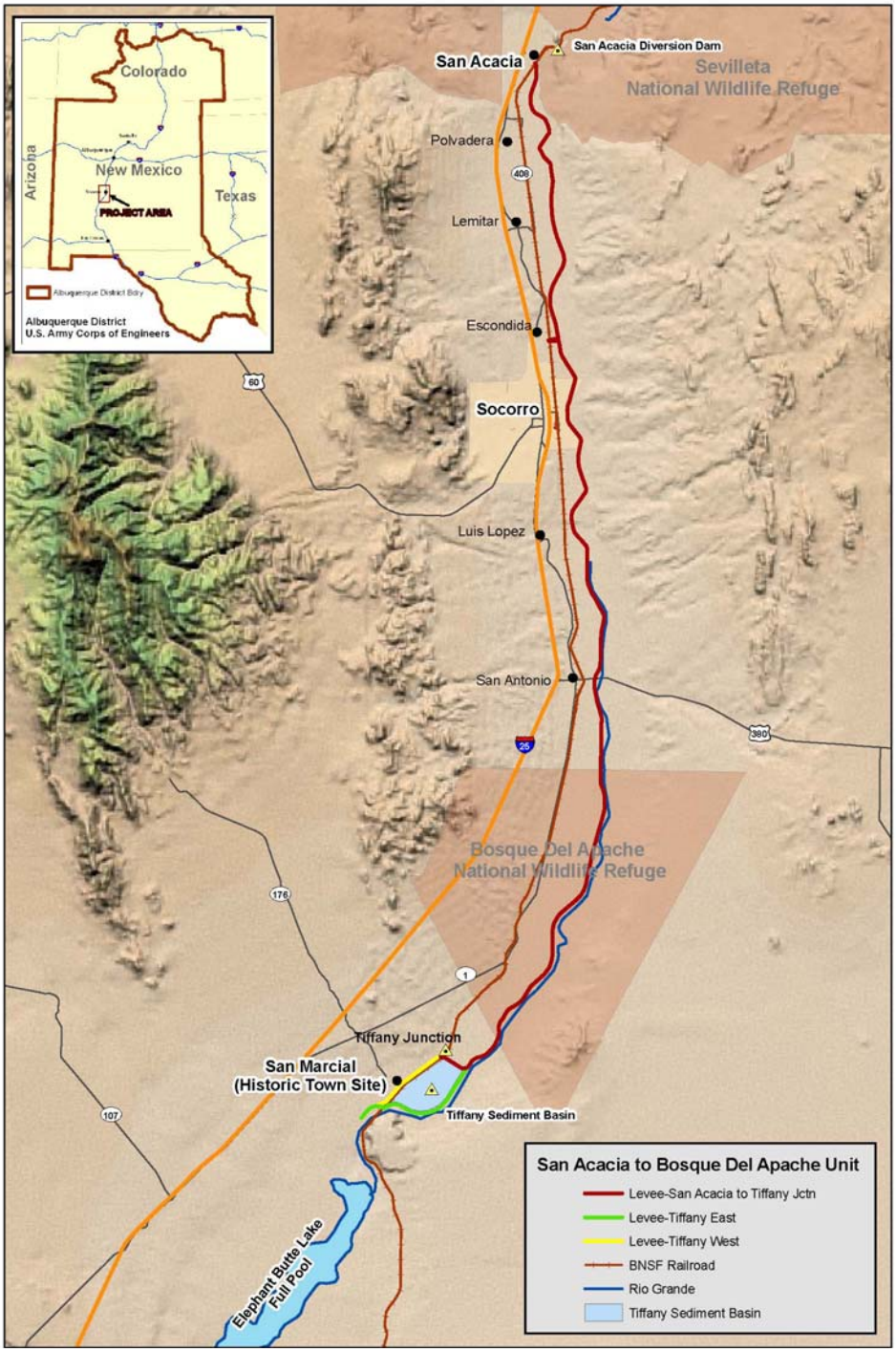

Figure 1. Map of Rio Grande Floodway Project Area

3 IEPR Process

3.1 Planning and Schedule

Noblis developed a schedule that would meet USACE's goal of completing the task as efficiently as possible in accordance with the Scope of Work (SOW). 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 to enhance the project efficiency. Figure 2 shows the overall process highlighting the major activities of the IEPR conducted of the GRR/SEIS for Rio Grande Floodway.

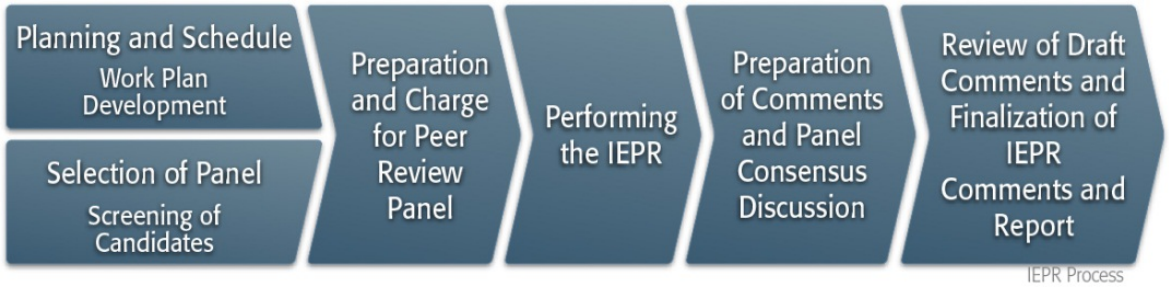

Figure 2. Rio Grande Floodway IEPR Process

Noblis prepared a Work Plan to define and manage the process for conducting each phase of the IEPR, including the screening and selection of peer reviewers (for Phase 1 only), communication and meetings with the USACE project team, project schedule and quality control, and compilation and dissemination of peer reviewers' comments. Upon review of the Draft Work Plans by USACE, the overall schedule was discussed, which established a project completion date of 10 September 2012. The schedule was updated and submitted in the Final Work Plans. A summary table showing the final schedule for both phases is presented in Table 1.

Noblis provided USACE with Project Status Reports 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.

Table 1. Rio Grande Floodway IEPR Project Schedule

Activity and Output	Completion Date
IEPR Phase 1	
Planning and Schedule *(Task Award Date: 29 September 2011)* Output: Final Work Plan	5 December 2011
Selection of Panel Output: Final Panel Members	8 November 2011
Preparation and Charge for Peer Review Panel Output: Final Charge	14 December 2011
Performing the IEPR Output: Panel Member Comments	21 December 2011

Activity and Output	Completion Date
Preparation of Comments and Panel Consensus Discussion Output: Draft IEPR Panel Comments	30 January 2012
Review of Draft Comments and Finalization of IEPR Comments Output: Final Phase 1 IEPR Comments (including responses and concluding "backcheck" comments)	25 July 2012
IEPR Phase 2	
Planning and Schedule *(Phase 2 Start Date: 25 April 2012)* Output: Final Work Plan	26 July 2012
Re-establish Subcontracts with Panel Output: Final Panel Members	23 July 2012
Preparation and Charge for Peer Review Panel Output: Final Charge	24 July 2012
Performing the IEPR Output: Panel Member Comments	2 August 2012
Preparation of Comments and Panel Consensus Discussion Output: Draft IEPR Panel Comments	9 August 2012
Review of Draft Comments and Finalization of IEPR Comments and Report Output: Final Phase 2 IEPR Comments (excluding responses and "backcheck" comments) and Final IEPR Report	10 August 2012
Review of Evaluator Responses and Finalization of Panel Backcheck Responses Output: Final Phase 2 IEPR Comments (including responses and concluding "backcheck" comments)	10 September 2012

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: 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. Noblis provided the list of candidates 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 Rio Grande Floodway Project. Also, USACE acknowledged the proposed panel members' experience relative to the requirements of the IEPR. The list was then narrowed down to identify the most qualified candidates that would be available to serve on the Rio Grande Floodway IEPR panel. 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 placed on Noblis' secure online collaboration site set up for this effort in order to provide IEPR panel members with electronic copies of relevant documents to be reviewed. Noblis communicated 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 review the GRR and SEIS for which USACE had requested comments, as well as 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. From this point on, Noblis was the conduit for information exchange between the panel and USACE in order to ensure a truly independent IEPR.

The final Charge Questions developed and approved by USACE established the general boundaries for the Phase 1 and Phase 2 IEPRs and are summarized in Table 2. The detailed Charge is included in Appendix C.

Table 2. Rio Grande Floodway IEPR General Charge Questions

Rio Grande Floodway Project IEPR General Charge Questions
IEPR Phase 1
1. Are the assumptions that underlie the hydrologic and hydraulic, economic, and environmental analyses sound?
2. Are the hydrologic and hydraulic, economic, and environmental methods, models and analyses used adequate and acceptable?
3. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?
4. Were risk and uncertainty sufficiently considered?
IEPR Phase 2
1. To what extent has it been shown that the project is technically sound for the purposes of informing an investment and plan selection decision?
2. Are the assumptions that underlie the engineering, economic, and environmental analyses sound?
3. Are the engineering, economic, and environmental methods, models and analyses used adequate and acceptable to inform an investment and plan selection decision?
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. Does the SEIS satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
7. 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.

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 GRR and SEIS and supporting documentation. The Rio Grande Floodway 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 GRR and SEIS. The review was limited to a technical review and did not involve policy issues. The IEPR panel identified, recommended, and commented on the information presented in the GRR and SEIS relative to the charge.

Considering the compressed schedule for this task, Noblis conducted one meeting with the panel members midway through their review to discuss their progress and current observations/comments. This meeting ensured an exchange of technical information among the panel experts and reflected their diverse scientific backgrounds. This information exchange provided additional context to the reviewers, ensured that the scope of the review remained

responsive to the charge, and was crucial in the development of the comprehensive peer review report. Schedule details were also discussed, and panel members were made aware of upcoming activities and deadlines. Any identified information or documents that the panel required to support its review were noted. Noblis facilitated discussions between the panel and USACE in order for the group to agree on reasonable solutions to address the major technical issues raised during the course of the effort.

Noblis used internal tools to track comments, issues, and information requests by the panel members during the evaluation process. This enabled Noblis to request additional information and documentation from USACE that closed out some of the comments during the review process to the satisfaction of the panel.

3.5 Preparation of Comments and Panel Consensus Discussion

After the IEPR review period ended and comments were submitted, 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 and to resolve any contradictions. Further refinement and consolidation of the comments occurred via email exchange following the meeting. The panel discussion resulted in draft comments that were sent to USACE for discussion.

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. 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 the sufficiency of the GRR and SEIS.

3.6 Review of Draft Comments and Finalization of IEPR Comments and Report

For both Phase 1 and Phase 2, Noblis provided a draft of the consolidated IEPR panel comments to USACE and held a teleconference with USACE and the IEPR panel to review the draft comments. The teleconference provided the forum to assess the factual accuracy of the panel comments, seek any needed clarification, and discuss specific technical positions. Based on verbal discussions with USACE, some comments were adjusted once USACE provided clarification and additional information. Subsequent to this discussion with USACE, updates were made to the IEPR draft panel comments as necessary resulting in 58 final comments for Phase 1, and 17 final comments for Phase 2, included in this report and submitted in a separate Comment Tracking Form. It should be noted that many of the Phase 2 comments were repeated from the Phase 1 IEPR. The final Phase 2 IEPR panel comments are presented in Appendix A.

Noblis uses the Comment Tracking Form to track the final comments of the IEPR panel, the development of USACE responses to those comments, and the panel's concluding "backcheck" comments. All responses in the Form provided by USACE and panel are labeled as

"concurrence" or "non-concurrence" to indicate agreement or non-agreement, respectively, on whether the concerns identified by the panel needed to be addressed in the GRR and SEIS. The formal record of the USACE's responses to comments and panel's backcheck comments are captured in the Comment Tracking Form.

After the USACE submits the responses to the IEPR comments, Noblis meets with the panel to discuss the responses and the approach for preparing the concluding backcheck comments, which are to provide concurrence or non-concurrence with the USACE responses on whether the identified concerns have been adequately addressed. After Noblis inputs the panel backcheck comments to the USACE responses to comments, each issue will be closed out. Once all issues are closed out, Noblis provided USACE with a Portable Document Format (PDF) of the project file.

Minor editorial changes were not included in the final set of comments unless they affected the technical understanding of the document. A listing of the editorial comments is included in Appendix A.3.

4 Panel Organization

Noblis assembled a panel of experts to conduct the IEPR, responsible for reviewing and providing comments on the GRR and SEIS for Design Deficiency Corrections for the Rio Grande Floodway Levee System. Noblis guided communications between the panel and USACE to complete the IEPR project.

4.1 Panel Description

Noblis selected five panel members providing expertise in the required areas of civil works planning, biology/ecology, hydrologic and hydraulic engineering, geotechnical/structural engineering, economics, and civil engineering/cost engineering. 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 small consulting firms, and individual consultants.

Figure 3 outlines the members of the IEPR Team. Table 3 presents the list of IEPR panel members and associated qualifications to participate in this IEPR. Panel member résumés are included in Appendix B.

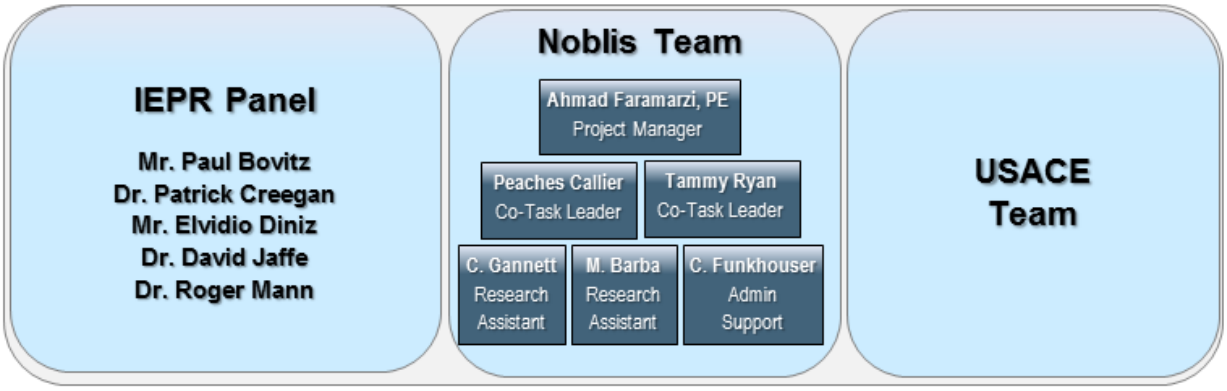

Figure 3. IEPR Team

4.2 IEPR Panel Members

Paul Bovitz, PWS, LSRP, CEM, LEED AP
Role: Biologist/Ecologist
Affiliation: Weston Solutions, Inc.

Mr. Paul Bovitz has more than 28 years of technical experience in the environmental field, including assessment of environmental impacts under the National Environmental Policy Act (NEPA), and experience in ecological assessment and natural resources management in public, private, and academic sectors, engaging in both theoretical and applied aspects of ecological research and encompassing a variety of geographic regions and habitats. His experience includes project management, field supervisory experience, expert testimony, proposal preparation, client negotiation, and budget management, as well as international experience in ecological assessment. Mr. Bovitz has served on IEPR panels for peer review of USACE flood control projects, and has managed millions of dollars of work for the USACE as a project manager for remedial investigations, including Ecological Risk Assessments, Environmental Assessments (EAs), Environmental Impact Statements (EISs), and feasibility studies, as well as civil works projects, such as 1135 projects. He has managed and participated as principal investigator for water quality and stormwater studies; wetlands delineation, assessment, mitigation, and permitting; and essential fish habitat investigation. He is a Leadership in Energy and Environmental Design (LEED) Accredited Professional and a Certified Professional Wetland Scientist. Mr. Bovitz has a Master's degree in ecology from Rutgers University.

Patrick J. Creegan, D.Eng., CE, GE, SE
Role: Civil/Geotechnical/Structural Engineer
Affiliation: GENTERRA Consultants, Inc.

Dr. Patrick J. Creegan has more than 60 years' experience in the planning and design of heavy civil works, with principal emphasis on water development projects, embankment dams, and associated hydraulic structures and water conveyance and storage facilities. He is a Registered Civil, Structural, and Geotechnical Engineer in California, and has a Doctor of Engineering degree in Civil Engineering (University of California, Berkeley) with specialized expertise in dam and earthwork engineering, structural/geotechnical design of heavy civil works, and construction management. Dr. Creegan has demonstrated experience in performing cost engineering/construction management for all phases of flood risk management related projects, and has served as Past Chairman of ACI Committee 355, several years as an active Member of ACI 350 (now a consultant Member), and as a past member of Earthquake Committee and Materials Committee of U.S. Commission on Large Dams (USCOLD)/U.S. Society on Dams (USSD). Dr. Creegan is capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects.

Elvidio V. Diniz, PE, D.WRE
Role: Civil Works Planner/Hydrologic Engineer
Affiliation: Weston Solutions, Inc.

Mr. Elvidio V. Diniz has 42 years' professional experience in hydrology, civil engineering, and water resources for federal, state, local, industrial, and tribal clients, with 29 years on the Mid. Rio Grande region. Mr. Diniz has a thorough understanding of hydraulic, hydrographic, and hydrologic principles and practice, derived from many years of water resource analyses, modeling, and construction plan development. He has served as a Registered Professional

Engineer in New Mexico and Texas for 32 years, and has completed course work for his PhD in civil/water resources engineering. Mr. Diniz served as Program Manager for the Southwest Valley (Mid. Rio Grande) flood Damage Reduction Study for USACE, and for the sediment control dams feasibility study on Rio Puerco and Rio Salado, plus Drainage Management Plans for eight more tributaries to the Mid. Rio Grande. Mr. Diniz is a Diplomate, American Academy of Water Resources Engineers, and has served as adjunct professor at the University of New Mexico, has lectured on water resource issues in flood hydrology and hydraulics short courses at the University of Texas at Austin, and has presented at numerous professional conferences. Mr. Diniz is an expert computer modeler, having authored various models for the USEPA and the U.S. Bureau of Reclamation, and serves as a beta tester for USACE Hydrologic Engineering Center Programs and for U.S. Office of Water Resources Technology Programs.

David Jaffe, PhD, PE, D.WRE
Role: Hydrologic/Hydraulic Engineer
Affiliation: Dudek

Dr. David Jaffe has been involved in hydraulic/hydrologic engineering including 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.

Roger Mann, PhD
Role: Economist
Affiliation: RMann Economics

Dr. Roger Mann has more than 25 years' experience in economics, specializing in water resources, and environmental, agricultural, and regional economics, with a PhD in agricultural economics and economics. Recent work has included the review of California grant requests for flood damage reduction and stormwater projects, and Delta Risk Management Strategy development, and compilation of lost use cost data for the California Delta. He has assisted the California Department of Water Resources with the Flood Emergency Response Program, California urban water supply economics, Salinas Valley flood damage costs, and consideration of principles and guidelines related to conveyance and reservoir development in California. In the Pacific Northwest, Dr. Mann served as a Member and twice Chair of the Independent Economic Analysis Board charged with cost-effectiveness analysis of BPAs Fish and Wildlife Program including habitat restoration. He has two years' experience as a USACE subcontractor.

Table 3. Rio Grande Floodway IEPR Panel

		Mr. Paul Bovitz	Dr. Patrick Creegan	Mr. Elvidio Diniz	Dr. David Jaffe	Dr. Roger Mann
	Highest Degree	MS	PhD	MS	PhD	PhD
	Years of Experience	28	63	42	16	25
	Past Experience with USACE Projects	●	●	●	●	●
	Affiliation (e.g., academia, consulting firm, government, etc)	Private	Private	Private	Private	Consulting
Civil Works Planner	≥ 10 years experience			●		
	Familiar with large, complex civil works projects with high public and interagency interests.			●		
	Extensive experience associated with the six-step planning process, which is governed by ER 1105-2-100.			●		
	Experience related to the identification and evaluation of structural flood risk management alternatives for projects located in the southwestern United States.			●		
Biology/ Ecology	≥ 10 years demonstrated experience in evaluation and conducting National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analyses, for complex multi-objective public works projects with competing trade-offs.	●				
	Extensive experience working with freshwater fisheries, wetlands, and riparian ecology of the Middle Rio Grande Valley.	●				
	Extensive background experience and working knowledge with the implementation of the NEPA compliance process and Endangered Species Act requirements.	●				
Hydrologic / Hydraulic Engineering	Registered professional engineer with ≥ 15 years experience in hydrologic and hydraulic engineering with an emphasis on large public works projects.			●	●	
	Active participation in related professional societies.			●	●	
	Extensive experience associated with flood risk management projects with an emphasis on diversion channel design and large river control structures.			●	●	
	Experience modeling large river systems and possess a thorough understanding of the dynamics of open channel flow systems, floodplain hydraulics, and interior flood control systems			●	●	
	Familiar with USACE application of risk and uncertainty analyses in flood risk management studies.			●	●	
	Familiar with standard USACE hydrologic and hydraulic computer models including HEC-1, HEC-HMS, HEC-2, HEC-RAS, FLO-2D, and HEC-DSS.			●	●	

		Mr. Paul Bovitz	Dr. Patrick Creegan	Mr. Elvidio Diniz	Dr. David Jaffe	Dr. Roger Mann
	Highest Degree	MS	PhD	MS	PhD	PhD
	Years of Experience	28	63	42	16	25
	Past Experience with USACE Projects	●	●	●	●	●
	Affiliation (e.g., academia, consulting firm, government, etc)	Private	Private	Private	Private	Consulting
Geotechnical / Structural Engineering	Registered professional engineer with ≥ 10 years experience in civil or construction engineering.		●			
	Demonstrated experience in performing cost engineering/construction management for all phases of flood risk management related projects.		●			
	Experience in the design and construction of bridges and large control structures in cold climates, including interaction with ice conditions.		●			
	Experience and familiarity of geotechnical practices associated with foundations and dams, fishways, earthworks, and/or pavement sub grades required for the construction of projects on and around navigation dams.		●			
	Active participation in related professional engineering and scientific societies.		●			
	Capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects.		●			
Economics	≥ 10 years experience directly related to water resource economic evaluation or review.					●
	≥ 5 years experience directly working for or with USACE.					●
	Familiar with the USACE flood risk management analysis and benefit calculations, including use of standard USACE computer programs and experience with the National Economic Development analysis procedures, particularly as they relate to flood risk management.					●
Civil / Cost Engineering	Registered professional engineer with ≥ 10 years experience in civil or construction engineering.		●			
	Demonstrated experience in performing cost engineering/construction management for all phases of flood risk management related projects.		●			
	Familiar with and have demonstrated experience related to levee design and construction.		●			
	Experience in associated contracting procedures, total cost growth analysis and related cost risk analysis		●			
	Familiar with the construction industry.		●			
	Active participation in related professional engineering and scientific societies.		●			
	Extra Requirement. Capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects.		●			

4.3 Noblis Team

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

Mr. Ahmad Faramarzi, PE, 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 client satisfaction on project tasks.

Ms. Tammy Ryan, Co-Task Leader and Project Coordinator, developed the Work Plan and Report, provided technical leadership in managing the IEPR activities, and coordinated Rio Grande Floodway IEPR activities. Ms. Ryan also supported the Project Manager on all IEPR tasks, including the identification and recruitment of candidates for the expert panel.

Ms. M. R. "Peaches" Callier, Co-Task Leader, developed the Work Plan and Report, provided technical leadership in managing the IEPR activities, and coordinated Rio Grande Floodway IEPR activities.

Mr. Michael Barba 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 Rio Grande Floodway IEPR resulted in several comments on the adequacy of the information presented in the GRR and SEIS, as well as the information that was not found and recommended to be included. In general, the comments identify shortcomings and offer considerations that would improve the technical adequacy and overall quality of the GRR and SEIS. The comments also include a number of issues that should be addressed so the GRR and SEIS can be comprehensive in its representation of all factors that should be considered in determining the preferred alternative.

The GRR/SEIS provides an overview of the history of the project since Congressional authorization in 1948, and relies heavily on the analyses and insights from the 1992 SEIS. The final IEPR comments are focused on recommended changes to the GRR and SEIS to identify and clarify specific key design parameters and factors that should be considered in the selection of the preferred alternative as the SEIS is updated and finalized over the next few months. In general, the panel finds that the long history and several iterations of this project impair transparency of the final evaluation and selection procedures. A large volume of historical data and analyses is included, but how the historical data and analysis was actually used and modified in the final analysis is unclear. In addition, thorough modeling efforts and results are described in detail but not cohesively presented. The panel comments reflect these concerns and offer suggestions as to how the documentation can be clarified. A time sequence and logic flow chart may be one approach to sorting out the issues for the reader's benefit. The panel recommends a more rigorous and sequenced discussion to increase the robustness of the selected plan. The following paragraphs include an assessment of the draft GRR/SEIS in three specific technical areas:

Economics. In terms of an economic evaluation, the GRR/SEIS and appendices did include a detailed analysis of the benefits and costs associated with each alternative. The methodology and

approach for the tentatively selected plan (TSP) benefit-cost analysis appear to be generally consistent with USACE guidance except that annual levee operations and maintenance (O&M) costs were not included. In addition, the available documentation is not clear about some important assumptions. Additional supporting information related to the annual levee O&M costs and clarity regarding the noted assumptions, level of detail, handling of hydraulics, and benefits and costs associated with railroad facilities would support the justification of the selection of the preferred alternative.

Environmental. The analysis of environmental impacts for this project appears to be consistent with NEPA requirements and builds upon several prior studies conducted for the 1992 EIS. However much of the supporting documentation for analyses of impacts and ultimate justification of selection of the preferred alternative either needs to be pulled forward from these prior studies in the SEIS document, or is still pending negotiation and approval by various agencies involved in the review process. As a result, the peer review identified several outstanding issues that should be addressed before a thorough assessment of environmental impacts and final project selection can be performed. While many environmental issues are likely to be adequately addressed on the basis of information presented to date (e.g., cultural resources, aesthetics, socioeconomic impacts, environmental justice), key issues still remain including impacts and mitigation to endangered species, as well as wildlife and riparian zone impacts.

Engineering. A series of multiple alternatives was presented by USACE to achieve the goals outlined and modified since the original 1948 project authorization. The present levee design for the project uses a probabilistic approach and contemporary levee design standards. The technical appendices have been improved greatly during the IEPR process, and provide a much clearer picture of the methods. However, outstanding questions remain regarding hydrologic/hydraulic modeling and analysis methods, particularly related to assumptions, parameters, and interpretation of results. While it appears that USACE standard practices were followed throughout the project, information is absent to determine if and where deviations from these standard practices were utilized. It is also unclear how the impacts predicted by alternatives analysis models were used to evaluate the effectiveness or the impacts of the various alternatives removed from further consideration. Additionally, there remains room for improvement of the presentation and description of assumptions and analysis of levee elevations, downstream impacts, and bridge soffit clearance within the analysis. From a civil/geotechnical perspective, the design and engineering is technically sound and meets current standards of practice.

A number of editorial comments were also provided. Although they should be addressed to improve the overall quality of the GRR/SEIS, they are not included in the final list of IEPR comments submitted into the Comment Tracking Form. These editorial comments are provided in Appendix A.3 of the report.

6 References

Agency Technical Review (ATR) Comments and Responses to USACE Albuquerque District Pre-Alternative Formulation Briefing, Rio Grande Floodway, San Acacia to Bosque Del Apache Unit, Socorro County, NM, Post-Authorization Change Report and Supplemental EIS, 6 December 2011.

Alternative Formulation Briefing, Rio Grande Floodway, San Acacia to Bosque Del Apache Unit, Socorro County, NM, Post-Authorization Change Report and Supplemental EIS Policy Guidance Memorandum, 3 June 2012.

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.

Public Comments in Response to USACE Albuquerque District, *Rio Grande Floodway, San Acacia to Bosque del Apache, Socorro County, New Mexico Preliminary Draft GRR/SEIS*, June 2012.

USACE Albuquerque District, Public Meeting Fact Sheet, San Acacia to Bosque del Apache Unit Socorro, NM, 22 May 2012.

USACE Albuquerque District, *Rio Grande Floodway, San Acacia to Bosque del Apache, Socorro County, New Mexico Draft GRR/SEIS* (to include Appendices A–G), April 2012.

Appendix A – Phase 2 IEPR Comments

A.1 Final Phase 2 IEPR Comments

This Appendix provides the Rio Grande Floodway GRR and SEIS Project. The comments cover a range of issues that pertain to the technical aspects of the GRR and SEIS. Each Comment is formatted into four parts that include the following: (1) a clear statement of the concern (the Comment), (2) the basis for the concern, (3) the significance of the concern (the importance of the concern with regard to project implementability), and (4) the recommended actions necessary to resolve the concern to include a description of any additional research that would appreciably influence the conclusions. Comments are rated as "high," "medium," or "low" to indicate the general significance the Comment has to the sufficiency of the GRR/SEIS. The significance ratings are 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 of the reports but will not affect the recommendation or justification of the project

After the IEPR review period ended and comments were developed, Noblis consolidated and collated the final panel comments. The comments are arranged in order of significance. Of the final 17 comments, 7 were identified as having high significance, 7 were identified as having medium significance, and 3 were identified as having a low level of significance.

A.2 Summary of Phase 2 Comments

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

Table A.2-1. Overview of Final Phase 2 Comments Identified by IEPR Panel

Significance – High	
1	The economic analysis in Appendix F-10 suggests that the tentatively selected plan (TSP) is economical. Although most issues raised by the panel were addressed in the revised documents, the panel is still not fully convinced that the TSP is economical, for three reasons 1) the cost of a drainage facility that would provide the same benefits as the LFCC might be much less than the replacement cost of the LFCC, 2) the favorable benefit-cost ratio of the project is apparently assured by somewhat subjective distributions introduced by HEC-FDA, and 3) there appear to be no operations, maintenance, repair or replacement costs (OMRR&R) included. USACE concurred with the original Comment #25 and stated that costs were recomputed to include O&M costs as recurring annual costs. Please indicate where these changes are reflected. The USACE may be well within their authorities regarding 1) and 2). OMRR&R costs should be added.
2	Additional detail on silvery minnow populations and distribution within the study area should be provided as a basis for ascertaining potential impacts. Provide weight of the evidence conclusion regarding projected silvery minnow populations in the future without the project. The project requires a detailed mitigation plan for the silvery minnow impacts.
3	There is insufficient documentation on ecological resources (outside of endangered species) to reach a conclusion regarding whether the proposed alternative should be chosen and also regarding impacts of the proposed plan on wildlife and aquatic resources. Provide additional detail to substantiate Future No-Action projections in Section 3.3.1 and 3.3.2. The text would benefit from a more complete and cogent discussion of the overall potential project impacts to the Southwest willow flycatcher (and other riparian species) in terms of population impacts, habitat impacts, and potential mitigation measures.
4	There are several issues identified concerning the hydrologic, hydraulic, and sediment transport analyses that can easily be resolved with the inclusion of more detail.
5	The GRR/SEIS discussion on flow and sediment transport analyses for all bridges, must be more detailed.
6	The floodwall at San Acacia Dam may be impacted by dam improvements planned by others.
7	The rationale for selection of the TSP is weak. Alternatives that might be preferred to the current TSP are 1) Alternative K, and 2) Alternative A or K, but with a slightly lower or higher levee.

Significance – Medium	
8	The economic analysis may be unnecessarily conservative for two reasons: 1) It does not appear to include appropriate consideration of sediment damages or an appropriate amount of sediment clean-up costs. 2) It does not include LFCC maintenance cost savings
9	Subsection 4.7.6.3 provides inadequate detail in support of the findings presented.
10	The GRR/SEIS document should make it clear the extent to which alternative bank and channel stabilization designs that incorporate vegetation were considered, or could be considered under NEPA.
11	The GRR/SEIS does not show the top of the levee and bosque access roads or ramps.
12	The various sections of the report are not consistent with respect to assumptions regarding the size of events in which damages begin.
13	Appendix F-10 (the economics appendix) is not especially well organized or written. Some tables and data are absent. This inhibits the ability of the expert panel to evaluate the economic analysis and creates uncertainty about the economic analysis.
14	The GRR/SEIS is difficult to evaluate because of numerous errors and omissions; wrong data provided in tables, outdated text, updates needed, unclear definitions, better example needed, incorrect internal references
Significance – Low	
15	GRR/SEIS Section 6.8 (Socioeconomics) should address potential regional economic impacts generated by the project to the community.
16	Assertions regarding water quality from flood events on p. 6-11 require further support or modification.
17	The GRR/SEIS should contain more figures to support statements and conclusions made in the text. The aesthetics sections (existing conditions and future action) would greatly benefit from photographs or photomontages to provide an objective analysis of project impacts.

The following pages outline the IEPR comments in detail (as submitted in the Comment Tracking Form), including the four-part analysis for each. The comments are sorted based on their designated significance (High, Medium, or Low) in regards to the sufficiency of the GRR/SEIS.

Comment #1:

The economic analysis in Appendix F-10 suggests that the tentatively selected plan (TSP) is economical. Although most issues raised by the panel were addressed in the revised documents, the panel is still not fully convinced that the TSP is economical, for three reasons 1) the cost of a drainage facility that would provide the same benefits as the LFCC might be much less than the replacement cost of the LFCC, 2) the favorable benefit-cost ratio of the project is apparently assured by somewhat subjective distributions introduced by HEC-FDA, and 3) there appear to be no operations, maintenance, repair or replacement costs (OMRR&R) included. USACE concurred with the original Comment #25 and stated that costs were recomputed to include O&M costs as recurring annual costs. Please indicate where these changes are reflected.

The USACE may be well within their authorities regarding 1) and 2). OMRR&R costs should be added.

Basis for Comment:

The estimated annualized benefit of the TSP is $17.995 million (GRR page 4-31). Annualized construction costs are $11.077 million, so the B/C ratio is 1.62.

1) Regarding the LFCC:

The analysis assumes that the LFCC, if destroyed by a flood, would be replaced. However, there does not appear to be any analysis of the economic merits of replacement. Are the following benefits (page 48) worth $125 million?

> "The LFCC has and continues to serve multiple water resource related purposes that include providing effective valley drainage; being a wasteway for irrigation return flows; serving as a water source for four pumping locations to deliver water back to the river for Endangered Species flow needs; and providing irrigation diversion for the Middle Rio Grande Conservancy's Socorro Division, Bosque Del Apache National Wildlife Refuge, and the Armendaris (Turner) Ranch."

Also, the same benefits might be achieved for a much lower cost.

Reclamation states (page 50)

> "If the LFCC had been constructed for drainage purposes only, it would have been smaller and would have had much less riprap lining. Obviously, it would have been less expensive to construct. Operational costs are lower now than when the LFCC was in full."

The USACE might base the replacement cost of LFCC on a facility that serves current needs, rather than the authorized facility. Given current maintenance costs of $150,000 to $700,000 per year, could a piped facility be more economical? A piped facility might sustain far less damages from a flood.

However, it is understandable if the LFCC replacement cost must be based on the cost of the authorized facility. That is, the analysis might not be faulted for using the LFCC replacement cost even though, on a conceptual basis, a more suitable facility design should be entertained.

2) Regarding HEC-FDA

The Panel has had extensive discussion with the USACE regarding potential reasons for differences in EAD between estimates based on event damages, and estimates obtained directly from HEC-FDA. In both the original and revised Appendix F-10 and GRR, the estimate based on event damages has been much lower than that based on HEC-FDA. The USACE has provided potential explanations, but some of the explanations were themselves in error.

In the current Appendix F-10, average annual damages under the future condition, Table F6-B are shown as $18.285 million. Table F5-A can be used to estimate average annual damages based on event damages as shown below.

Event damages, Table F-5B, future condition					Average damage in interval				Interval Prs times average damages				Sum
PR	10.00%	2.00%	1.00%	0.20%	10.00%	2.00%	1.00%	0.20%	10.00%	2.00%	1.00%	0.20%	
Residential	4,572	7,014	7,863	9,945	5,793	7,439	8,904	9,945	463	74	71	20	629
ResContent	1,451	2,229	2,533	3,187	1,840	2,381	2,860	3,187	147	24	23	6	200
Commercial	1,962	3,924	4,685	6,005	2,943	4,305	5,345	6,005	235	43	43	12	333
Comm.Content	15,792	21,256	23,998	29,017	18,524	22,627	26,508	29,017	1,482	226	212	58	1,978
Public	152	203	240	281	178	222	261	281	14	2	2	1	19
Pub.Content	133	183	248	356	158	216	302	356	13	2	2	1	18
Apartments	1	1	3	16	1	2	10	16	0	0	0	0	0
Apt.Contents	0	1	1	5	1	1	3	5	0	0	0	0	0
Outbuildings	105	170	195	256	138	183	226	256	11	2	2	1	15
OutContents	71	106	122	160	89	114	141	160	7	1	1	0	10
												Total	3,193
Streetsroads	10,466	21,720	25,021	36,715	16,093	23,371	30,868	36,715	1,287	234	247	73	1,842
Utilities	232	762	898	1,317	497	830	1,108	1,317	40	8	9	3	60
Railroad	1,693.65	1,838.59	1,927.93	2,829.59	1,766	1,883	2,379	2,830	141	19	19	6	185
Vehicles	2,705	3,430	4,086	5,075	3,068	3,758	4,581	5,075	245	38	37	10	330
Agriculture	704	1,100	1,209	1,493	902	1,155	1,351	1,493	72	12	11	3	97
Irr.Drains	210	396	440	798	303	418	619	798	24	4	5	2	35
LFCC	14,392.51	18,967.44	20,753.11	27,275.17	16,680	19,860	24,014	27,275	1,334	199	192	55	1,780
AvoidedWaterLosses	0	0	0	0	0	0	0	0	0	0	0	0	0
Recreation	2,837.38	2,837.38	2,837.38	2,837.38	2,837	2,837	2,837	2,837	227	28	23	6	284
EastBank	285.57	372.63	401.21	482.24	329	387	442	482	26	4	4	1	35
EmergencyCosts	599.53	957.49	1093.58	1447.47	779	1,026	1,271	1,447	62	10	10	3	86
												Total	4,732
												Grand total	7,925

The estimated annual average damages estimated using event damages is $7.925 million which is considerably less than claimed benefits of $17.995 million, and is less than annualized costs of $11.077 million.

The Panel believes that the difference between the $7.925 million, and the $17.995 million must be caused primarily by probability distributions used in HEC-FDA to account for uncertainty. Whether the difference between $7.925 and $17.995 is justified by this application remains unclear.

From Section F-04, page 16

> "Principal sources of error affecting the stage-damage relationship were examined in a risk and uncertainty framework. Those sources of error are 1) errors associated with the damageable property elevation, 2) errors associated with the values of structures in the floodplain inventory, 3) errors associated with values of structure contents in the floodplain inventory, 4) errors associated with the damage functions used against the floodplain inventory."

Section F-04 goes on to explain how variance was added to the analysis to account for the "sources of error." Clearly, the amount of variance to add for each "source of error" is somewhat subjective. This subjectivity leads the panel to be uncertain about the increment of damages between $7.925 million and $17.995 million.

3) Regarding OMRR&R Costs

This is unfinished business.

Regarding comment #25, the USACE responded

> "Concur – Adopt: Project costs were recomputed using O&M costs."

However, there are still no O&M costs

From Appendix F-10 page 117

> "Table F-18 shows, for each alternative and the aggraded channel future situation considered, construction cost, interest during construction, total investment cost, interest and amortization costs, OMRR&R costs, and total average annual costs."

However, there are no OMRR&R costs in Table F-18

From GRR p 5-18

> "In general, OMRR&R will consist of maintaining the vegetation management zone free of woody vegetation larger than 0.5-inch-diameter stems or trunks. The sponsor will be responsible for maintaining levee integrity by repairing runoff erosion, eliminating rodent burrows in the levee, replacing rip rap lost in flow events, and inspecting and cleaning seepage infrastructure regularly. The sponsor will also be available to perform annual inspections of the levee system with Corps personnel."

Therefore, there will be OMRR&R costs. These costs should be estimated and included in the project costs.

Significance: HIGH
The economic justification for this project does not appear to be highly reliable.
Recommendation for Resolution:
1) The text on page 10 of Appendix F-10 reads: "For each category. . . . Tables F-5A and F-5B display the single occurrence damages by category for the floodplain evaluated. Tables F-6A to F-6C present the average annual damages computation from the HEC-FDA analysis. . . ." A paragraph or more should be added after this paragraph to explain why the average annual damages estimates in Tables F-6A and F-6B do NOT follow from Tables F-5A and F-5B. Maybe include this text: HEC-FDA does not generate point estimates of flows, stages, or damages for a specific event. The software, essentially, performs a statistical analysis of hydrology, hydraulic, and economic information using concepts of risk and uncertainty, meaning that a specific event frequency can have a range of flows, stages, and damages as a result of all the variables entered into the study. 2) Provide a rationale for requiring the LFCC to be replaced in its current form instead of rebuilding a smaller facility or no facility 3) If OMRR&R costs are included, show where they can be found, particularly in the computation of the Benefit Cost ratio for Alternative "A" If they are not included, OMRR&R costs must be added, or justify why they are not included.

Comment #2:

Additional detail on silvery minnow populations and distribution within the study area should be provided as a basis for ascertaining potential impacts. Provide weight of the evidence conclusion regarding projected silvery minnow populations in the future without the project. The project requires a detailed mitigation plan for the silvery minnow impacts.

Basis for Comment:

The existing conditions text provides an excellent summary overview of existing habitat conditions for silvery minnow but a more detailed assessment of the 40+-mile-long study area would appear warranted given that the project could directly impact this species. USACE should consider collaborating with USFWS to perform censusing of minnow populations by river reach to ascertain the most sensitive areas to be avoided and to determine precise impacts and mitigation measures necessary to offset them. If this information is already available, USACE should consider appending it to the SEIS.

Subsection 3.3.4.1 provides a sufficiently detailed summary of No-Action conditions pertaining to the silvery minnow from the perspective of factors adversely impacting this species versus management initiatives designed to sustain its populations. While predicting the future is difficult, the document should reach some conclusion regarding the most likely scenario for the future regarding this species. (For example, under existing conditions, it sounds as if a certain amount of the population may wash downstream every year into Elephant Butte Reservoir and die). The text should address the question head on: Are populations likely to continue to decline if current trends continue, without the project? Or at a minimum, are they likely to continue to decline without significant Government intervention and expenditure of public funds? NEPA does not require certainty, and Federal management decisions are made routinely on the basis of incomplete information. As such, the value of the current text is limited by not weighing the evidence to reach some conclusion. In addition, while it is appreciated that the Future No Action section attempts to address issues associated with climate change, an attempt should be made to connect future trends with slivery minnow habitat and population changes. If snowmelt is earlier in the year than previously, the document should attempt to address the implications on water levels in the Rio Grande and supporting tributaries, particularly in relation to late summer months, impacts on juvenile recruitment, and movement downstream.

While it is recognized that Phase 2 of the IEPR review will likely deal with mitigation issues once it is determined whether the proposed project should proceed, evaluating ecological impacts is difficult without a detailed mitigation plan in place. For example, in Subsection 6.5.1. the text notes "*Maintenance of suitable silvery minnow critical habitat remains dependent on routing flow within the existing floodway to maximize fluvial processes during flood events.*" It would be helpful to follow this paragraph with a quick bulleted summary of how that flow routing will be maintained. In addition, a detailed mitigation plan with alternatives considered should be developed that would ensure project impacts do not adversely affect that species.

Significance: HIGH
Understanding the spatial extent and quality of minnow habitat is critical to evaluating impacts to this endangered species. Data and information have been provided but the GRR/SEIS needs to take a stance and indicate what impacts would occur relative to Future No-Action conditions. It cannot be determined whether impacts on this species would be effectively mitigated.
Recommendation for Resolution:
Provide the requested information or indicate why it is infeasible in the text of the document. Provide the suggested conclusion in the text. Developing a mitigation plan that evaluates potential alternatives for mitigating project impacts can be done in parallel with ongoing design studies for finalizing the project, regardless of whether the proposed project proceeds exactly as planned. This evaluation should also include further consideration of measures that might be undertaken to prevent or offset minnow mortality should the Tiffany Basin portion of the project be implemented.

Comment #3:

There is insufficient documentation on ecological resources (outside of endangered species) to reach a conclusion regarding whether the proposed alternative should be chosen and also regarding impacts of the proposed plan on wildlife and aquatic resources. Provide additional detail to substantiate Future No-Action projections in Section 3.3.1 and 3.3.2. The text would benefit from a more complete and cogent discussion of the overall potential project impacts to the Southwest willow flycatcher (and other riparian species) in terms of population impacts, habitat impacts, and potential mitigation measures.

Basis for Comment:

Section 4.1.1 Ecological Resources does not provide sufficient background on methodology, rationale, or analysis to provide the technical support necessary to justify the selection of the proposed alternative from the perspective of impacts. At a minimum, the supporting documentation should be cited and appended to the GRR/SEIS. As such, the conclusion cannot be verified.

Under Section 6, while extensive text has been written on potential endangered species impacts, there is little follow-up discussion on all the other wildlife discussed under existing conditions. Which species would benefit or be adversely impacted by the project? Would fish habitat (in general) be impacted? What other aquatic resources other than silvery minnows would potentially be affected? Was a rapid bioassessment or other evaluation of stream habitat conducted for comparison of alternatives? Were prior valuation studies performed for the 1992 GRR/SEIS incorporated into the analysis of impacts or selection of alternatives?

In addition, the text should note the relationship between water levels, changes in phreatophytic water use (with both salt cedar eradication under No-Action, and with vegetative removal for levee construction and with woody vegetation exclusion on the new levees), and their impact on fish and wildlife habitat within the area affected by the proposed levee so that project impacts can be more readily evaluated.

Section 3.3.1 on p. 3-8 lacks sufficient detail in support of the broad statements "*In the future without-project scenario, the current status of the riparian ecosystem would continue to degrade, including continued fragmentation of remaining habitat, lack of overbank flooding necessary for regeneration of native vegetation, and nonnative vegetation replacing native vegetation*." Specifically, the document would benefit from discussion of: What are the specific sources of continued fragmentation of habitat (development into smaller parcel sizes? If so, how is this occurring if demography is flat over the next decade? How far out is USACE projecting, 50 years?), and, What specific factors would encourage non-native vegetation to continue replacing native vegetation? If, for example, cottonwood trees will continue to mature, that would benefit some wildlife (and presumably plant) species at the expense of others. Also, the document could address to what extent the spread of non-native vegetation be offset by existing management programs. Are these programs currently working to keep the spread in check throughout the entire study area reach or are they a "drop in the bucket" focused on specific areas such as the Bosque del Apache refuge?

Section 3.3.2 on p. 3-8 could also benefit from more detail in support of the conclusions regarding trends, and sounds a bit generic as written: "*In the future without-project scenario, the*

current status of the aquatic ecosystem would continue to degrade, including continued fragmentation of remaining habitat, aggradation of the floodplain coupled with increasing depths to groundwater, and narrowing of river channel from the effects of water regulation and restriction of historical river avulsion patterns due to constrains on the channel, resulting in the loss of warmwater aquatic habitat and wetlands." Specifically, the document should address whether sedimentation in the river would be greater in the future under No-Action conditions, simply as a result of the more extreme storm events referenced in the climatic change section that would increase the steepness of the hydrograph and cause greater erosion. This, in turn, would be expected to increase the amount of sediment plug events. The text should then address the specific impacts—Southwestern willow flycatchers seem to benefit because they can colonize the young willow growth that may generate in these areas before they are cleaned out. Silvery minnows, in contrast, would not benefit from those trends without considerable intervention and maintenance at Government expense. Also, the effect of climatic change would tend to exacerbate channel desiccation mentioned under Subsection 3.3.4.1. While this would probably be detrimental to silvery minnows, the discussion should be broadened to the aquatic community as a whole.

Table 4.11 summarizes project impacts to the Southwest willow flycatcher as *"minor impacts resulting from removal of riparian vegetation in the southern two-thirds of the project."* The southern two-thirds would consist of a 28-mile-long area; depending on the width and extent of cutting, the impacts could be significant. Moreover, impacts from the authorized project are described as "unknown." More clarification and elaboration is needed; at a minimum, an explanatory footnote is warranted.

Section 6.6.5 concludes that there would likely be impacts to flycatcher habitat. However it stops short at that point of addressing whether the impacts would be adequately mitigated. While mitigation has been proposed for vegetation, the text should address proposed mitigation measures for endangered species habitat, or at least the process that will be followed to achieve interagency concurrence regarding mitigation requirements.

Further, Section 6.4.2 addresses mitigation proposed for disturbance to riparian vegetation from construction of the proposed project. The text states, "*For the construction of the proposed, A +4 ft alternative, a total of 36.2 acres of riparian vegetation within the floodway would be removed to accommodate the levee structure and Vegetation-free Zone (Table 6.4). Considering the net increase of about 74 acres in the floodway after construction of the proposed levee, approximately 35.2 acres of that area would be suitable for planting, or otherwise establishing, riparian vegetation. All of this plantable area would occur between the upstream end of the levee alignment and BDANWR. Following construction, the Corps would reestablish 36.2 acres of woody riparian vegetation within the floodway, or on lands managed by BDANWR."* It is not clear how the mitigation requirements (apparently 1:1 replacement of vegetation) were arrived at and if the habitat quality data collected during the 1992 GRR/SEIS were incorporated into the proposed mitigation plan. While it is understood that the majority of vegetation impacts are to invasive salt cedar, the fact that mature woody vegetation will take some time to become reestablished suggests that greater than 1:1 replacement may be warranted. Further, the vegetative impacts summarized in Table 6.4 are not sufficiently detailed (e.g., native versus non-native) for the reader to come away with a clear picture of impacts. Are the non-native impacts to mature cottonwood trees or to young coyote willow? The difference has a bearing on re-establishment time, habitat quality for different species, and ultimate mitigation requirements.

The bottom line is that the text should address how these measures will offset the potential impacts to the Southwest willow flycatcher as well as other species using the riparian zone and why that plan is the best way to mitigate for the impact.

For example, the text on p. 2-24 states "*The largest breeding population of flycatchers along the Rio Grande in New Mexico occurs in the upper reaches of Elephant Butte Reservoir, approximately 5 miles downstream from the San Marcial Railroad Bridge. Receding lake levels allowed the establishment of riparian shrub species that were quickly colonized by the flycatcher*." If true, this suggests a potential mitigation measure for any impacts to willow flycatchers should USACE, USFWS, U.S. Bureau of Reclamation (USBR), and the local water conservancy be able to come to agreement on management of water levels in the reservoir to encourage habitat establishment along the lake margins.

Significance: HIGH

More detail is required to evaluate the conclusions of the GRR/SEIS. More detail is necessary to enable an informed comparison of project impacts with Future No-Action conditions. More detail is required to determine whether impacts would be significant.

Recommendation for Resolution:

Provide more detail on studies undertaken to date and project impacts on the basis of existing conditions data already reported. Discuss any changes in water salvage to increase or decrease river flows and water table elevations.

Add the additional detail to the text as a basis to allow detailed comparison with the Future Action alternative.

Revise the text to clarify how proposed mitigation measures will offset the referenced potential project impacts to the Southwest willow flycatcher.

Comment #4:

There are several issues identified concerning the hydrologic, hydraulic, and sediment transport analyses that can easily be resolved with the inclusion of more detail.

Basis for Comment:

- Telephone conversations with USACE personnel indicated that some of the information related to long-term sediment transport is included in other documents, not provided. Moreover, USACE personnel noted that approximately 87 historical sections, equally spaced, were used in determining the long-term transport. None of the analysis data is presented in the documents. USACE staff has noted that this data will be reviewed during design phase.
- It is difficult to understand how flooding depths, velocities, and sediment erosion/deposition were analyzed with the various tools—FLO-2D, HEC-RAS, comparison of river cross-sections, sediment Transport equations, etc. For example, in Appendix F4 it is stated that infiltration losses are included in FLO-2D modeling, but no description is included as to how infiltration rates were determined and/or calibrated. There are similar parameter discussions absent from the present text for both modeling and analysis procedures and parameters.

Significance: HIGH

Modeling and analysis results are strongly dependent on parameters and methods. While it is expected that procedures used in the present study followed USACE requirements and guidelines, these procedures are never stated, and, at present, unclear.

Significant improvements in the readability and organization of the modeling and hydro/hydraulic analysis data have achieved during the review period. The continued absence of detailed modeling and analysis documentation is confounding, however. Typical EIS/EIR documents will include a detailed technical appendix that will later form the basis for the design documentation. This is not the case here, where detailed documentation is to be provided following the environmental review during design.

Recommendation for Resolution:

The GRR/SEIS should be updated to include an appendix containing:

1. The description of the methodology for the analysis of long-term sediment transport should be made clearer. Figures and tables showing reach locations and sedimentation changes should be included where appropriate.
2. The clarification and description of sediment transport sections and analysis should be included with respect to the long-term sediment transport analysis and procedures.
3. Higher level discussion of modeling and analysis procedures should be included in the appendix. A summary discussion of how the various tools were used, the assumptions behind them, and the limits or risks from using these results should be included in the text. This discussion should include approaches and parameters for modeling, statistical and other analysis tools.
4. Maps showing where the various models were applied, comparisons between the model results, how well the existing and proposed conditions compared, etc., should be

included. Explain why FLO-2D modeling did not account for sediment movement, if that is the case.

5. A brief discussion of how erosional/depositional processes across the floodplain were analyzed. It appears that volumetric comparison of range lines was the main method. Or, were FLO-2D results also used, and how?
6. A more detailed discussion detailing how alternatives were removed from consideration using modeling and analytical approaches should be included for each alternative. Discuss any alternatives that looked at other than levees for the reach above Tiffany Junction.
7. A brief discussion of how the project may continue to develop a perched channel bottom, and the possible environmental consequences, should be included. Include the O&M responsibilities to the local sponsors, and the attendant cost/benefits.
8. A discussion of how Yang's equation was selected for sediment transport analysis and a summary of any sensitivity analysis for equation selection should be included.

Comment #5:
The GRR/SEIS discussion on flow and sediment transport analyses for all bridges must be more detailed.
Basis for Comment:
The hydraulic and sediment transport impacts at all existing bridges, constrictions, tributary inflows, etc. must be discussed. If there are existing problems at these locations, the GRR/SEIS is not clear on how these problems will be alleviated and the nature of maintenance issues that may be required of local sponsors in the future. It also is not clear if the planned approach is compliant with the IWRM objective (public concern). Additionally, including the discussion of a new Railroad (RR) bridge at this location in the GRR/SEIS is confusing. Clarification is needed.
Significance: HIGH
It is not clear as to what impacts the existing bridges will have on levee performance, back-water effects and sediment transport. O&M requirements must be considered to determine viability of any alternative.
Recommendation for Resolution:
Identify these locations in the GRR/SEIS with a summary table of existing and expected impacts. Provide a detailed discussion of the issues at each location in App. F-2/F-3, including existing and expected channel meandering, sediment deposition or erosion, and maintenance requirements for a sustainable river system. It should be explicitly stated that a new RR bridge is not considered in the SEIS. However studies with a new bridge were investigated and those results should be documented in an attachment to the Appendix. Furthermore, the disposition of the existing bridge under future conditions should be discussed – will the bridge remain in place, will it be destroyed by floods, and how much sedimentation or erosion may be expected under either scenario.

Comment # 6:
The floodwall at San Acacia Dam may be impacted by dam improvements planned by others.
Basis for Comment:
The flood wall on the west side of San Acacia Dam may be impacted by proposed improvements to the stilling basin downstream from the dam. A proposed river crossing through this basin may also be problem if the approach road crosses the wall. Additional scour protection and /or extension of the wall may be necessary.
Significance: HIGH
New dam improvements may destabilize the flood wall; so, additional protection of the flood wall will be required.
Recommendation for Resolution:
Acquire details of the proposed changes below the dam and how those changes will interface with the wall. Conduct the appropriate analysis if necessary; or, reconsider the wall—perhaps a rip-rap lined slope tied to the stilling basin with a paved roadway over it should be considered.

Comment #7:

The rationale for selection of the TSP is weak. Alternatives that might be preferred to the current TSP are 1) Alternative K, and 2) Alternative A or K, but with a slightly lower or higher levee.

Basis for Comment:

1) From ER-1105-100

> "For all project purposes except ecosystem restoration, the alternative plan that reasonably maximizes net economic benefits consistent with protecting the Nation's environment, the NED plan, shall be selected. The Assistant Secretary of the Army for Civil Works (ASA (CW)) may grant an exception when there are overriding reasons for selecting another plan based upon other Federal, State, local and international concerns."

From Page 4-32, the GRR rationale for picking Alternative A over K based on NED is very weak. The estimated annualized benefit of the TSP is $17.995 million (GRR page 4-31). Annualized construction costs are $11.077 million. For alternative K, these values are $17.990 and $11.085.

These differences are so small that they may not justify selection of Alternative A over K based on NED alone.

From Tables F-18 and F-43, the Alternatives A and K benefits category for "Tiffany basin (RR and reroutes)" is $379.35 and $374.74, respectively, and the "Levee" benefit is the same. Alternative K should not have less benefits than Alternative A when it just extends the levee downstream.

Appendix F-10, page 104 to 105 suggests that other factors plaid into selection of Alternative A over K. These factors should be summarized in the GRR.

Reclamations opinions:

> "Reclamation also recommends that the Corps extend their Flood Control Levee down to the San Marcial Railroad Bridge Crossing. Reclamation considers this area at risk due to the presence of the BN&SF railroad line. In the event of a catastrophic flood, Reclamation believes there is the potential for public health and safety risks to the railroad workers and operators in the event a train is derailed due to failure of their embankment."

Alternative K should include additional benefits, but it does not. The USACE does not include economic benefits of saving lives in their benefit-cost analysis. However, there might be significant and unusual transportation and emergency costs associated with loss of the railroad line.

From page 20

It should be noted that many intangible damages (such as loss of life, disruption to community services, and increased health risks) that could occur because of flooding are not represented in these damage values.

From page 54 and 55 and Table 4-12 it appears that potential health and safety benefits of

alternative K have not been included. Potential loss of life could be an "overriding reason" to select Alternative K.

2) From Page 4-25

> "As shown in this table, the analysis indicates that the levee that maximizes benefits is the Base Levee + 4 ft plan."

Table 4.7 suggests that perhaps the Base plus 4.5 foot would be a better alternative. However, no inference should be made because a large share of the benefits are not being counted in this table.

The text states

> "Remaining benefits are from the severe and rare events, which are only captured through levee height increases. However, the remaining benefits are not enough to offset increases in cost."

From Table 4.6, there appears to be a 32 percent chance that this levee will fail in a 1 in 10 year event and a 44 percent chance that is will fail in a 1 in 50 year event. Therefore, remaining benefits are NOT obtained only from severe and rare events.

Information is not provided that could be used to confirm that "the remaining benefits are not enough to offset increases in cost." Was the Base Levee + 5 ft option even evaluated?

From Page 4-25

> "Since transporting soil is a costly process, any levee plan that minimizes spoil of borrow is efficient."

This sentence should probably be removed since it is not true.

Does the base plus 4 feet precisely use all of the spoil and requires no borrow?

Significance HIGH

Selection of the tentatively selected plan may be affected

Recommendation for Resolution:

Regarding 1), explain why Alternative K has less economic benefits than Alternative A. If Alternative K actually has less benefits, Expand the GRR discussion page 4-31 and 4-42 using text from Appendix F-10, page 104 to 105 to explain why Alternative A should be preferred to K.

The last cell of Table 4.12 on Page 4-35 appears to be in error. Alternative K would provide a significant public health and safety effect that is NOT provided by Alternative A.

Regarding 2), Table 4.7 is flawed. A better analysis is needed to support the contention that the Base plus 4 foot levee is the best. The Panel suggests trying analysis at Base plus 3.5 and Base plus 4.5, with ALL benefits included, to ensure that neither of those heights is more economical.

Comment #8:

The economic analysis may be unnecessarily conservative for two reasons:

1) **It does not appear to include appropriate consideration of sediment damages or an appropriate amount of sediment clean-up costs.**
2) **It does not include LFCC maintenance cost savings**

Basis for Comment:

1. It appears that sediment damages on agricultural lands and refuge lands following a flood are not included or discussed in appropriate detail.

More discussion of sediment damages and clean-up costs is justified given the history of extreme sediment deposits from past floods. The analysis includes sediment costs as part of emergency costs, but this amount of sediment costs is believed to be inadequate.

The USFWS opined that "the refuge would receive substantial benefits if a large magnitude flood is contained by the proposed project." A large share of these perceived benefits may be related to sediments.

Regarding the LFCC, from page 40

> "Cost engineering has indicated that channel REPLACEMENT involves additional activities, such as clearing sediment from damaged portions as needed, which would drive this cost up."

2. From Page 42

> "Reclamation will save LFCC OMRR&R costs (estimated in the without project condition at $150,000-$700,000), but was unable to provide a figure for the with-project condition."

LFCC maintenance costs of $150,000 to $700,000 annually would be reduced by the levee. The reduced maintenance cost with the new levee should be a relatively easy benefit to document.

Significance: MEDIUM

Clean-up costs associated with sediment could be significant for agricultural and refuge lands. However, it seems unlikely that additional sediment costs could have much effect on the economic justification.

Maintenance cost savings might also be a small fraction of EAD of around $18 million annually.

Recommendation for Resolution:

Provide estimates of urban, refuge, and agricultural acreage flooded. Discuss the history of sediment damages from floods in this region. Discuss how flood events would deposit sediments. Discuss how the methodology realistically captures sediment clean-up and land re-grading costs, or not. If possible, include explicit accounting for sediment clean-up costs. At a minimum, note that some benefits may be conservative because of this exclusion.

Provide a paragraph that explains why LFCC maintenance costs will be reduced and provide a range of cost saving estimates.

Comment #9:
Subsection 4.7.6.3 provides inadequate detail in support of the findings presented.
Basis for Comment:
Subsection 4.7.6.3 entitled Ecological Contributions states "*Ecological improvements that would be generated by the proposed alternatives include additional floodplain habitat within the floodway. Since the footprint of the proposed levee feature has a smaller total footprint than the existing spoil bank, additional floodplain may be provided from implementation of a Federal project*." Note that "floodplain" is not an ecological term and does not in itself speak to the habitat that would be created. Without an assessment of the frequency or depth of inundation, it is difficult to envision whether this habitat would succeed into riparian conditions or remain upland habitat degraded by occasional rapid erosive forces from severe flood events. More detailed clarification is necessary if the reader is to be convinced that this is an ecological contribution.
Significance: MEDIUM
The project benefits and impacts cannot be fully understood without further clarification.
Recommendation for Resolution:
Subsection 4.7.6.3 should be revised to describe the specific habitat to be created by the proposed project design so that the conclusion that it will have an ecological contribution can be verified.

Comment #10:

The GRR/SEIS document should make it clear the extent to which alternative bank and channel stabilization designs that incorporate vegetation were considered, or could be considered under NEPA.

Basis for Comment:

Section 5.1.2. The text on p. 5-3 describes stabilization measures as follows: "*A soil cement veneer applied to the existing embankment would prevent scour of the river bank and seepage. Mixing cement with the existing soil forms a stronger, less permeable matrix. The soil cement would be used to accommodate the space limitations because it can be applied to the l-foot vertical to 1-foot horizontal slope of the existing embankment. Soil cement armoring would begin at the SADD and continue along the west bank of the river for approximately 4,000 feet, where it would transition to the typical earthen levee section used for the remainder of the levee alignment. Self-launching riprap would be placed along the toe of the soil cement armoring and for approximately 600 feet of the earthen levee. The riprap would launch or fall into scour holes as they might develop from channel scouring or incision.*" In addition to the alternatives analysis used to determine the appropriate means to address the project purpose, once a preferred alternative is tentatively selected, an analysis of construction alternatives should also be undertaken (and described in the GRR/SEIS). While the proposed design may well turn out to be the best way to achieve the project purpose, the analysis should describe what other designs or methods might be used that are equally valid, superior or inferior, that were rejected. For example, in the example above, rip-rap and soil cement armoring are proposed. Federal planning criteria cited on p. 5-4 include the following "*Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse and sustainable condition is necessary to support life.*" It is not clear from the text whether "greener" slope stabilization measures (i.e., bioengineering) were considered such as the use of articulated concrete blocks to allow vegetation to be incorporated above the water, which would provide habitat for wildlife.

There is no discussion in the text regarding whether rip-rap and cement are essential within this reach or if alternative measures could be employed to manage erosion and sedimentation more effectively while preserving habitat. Granted, using vegetation may increase the Manning's roughness coefficient and potentially influence water elevations, but there is no convincing analysis presented as to why it would be infeasible as an alternative.

Later in the document it is stated "*The Corps' Engineer Technical Letter 1110-2-571 (10 April 2009) requires that no 'woody' vegetation be allowed to grow on the levee or within 15 feet of the riverward and landside toes of the levee. In this case, 'woody' vegetation is considered tree or shrub plants with trunk diameter greater than ½ inch. During construction, existing vegetation would be removed adjacent to the riverward and landside toes by root plowing or clearing and grubbing to create a vegetation management zone.*" The question raised is whether the text complies with NEPA. Granted, the Engineering Technical letter may reflect USACE policy; from a technical perspective the reason why vegetation is not allowed to grow at the base of the levee is not fully explained or justified on the basis of past studies/results. Are there "greener" approaches that could potentially be safely accommodated into the design but were apparently not discussed? For example, could concrete blocks be used that allow some vegetation to grow between them and, therefore, address both stabilization and habitat issues?

While the IEPR panel is not focused on policy, the concern here is that the text is both NEPA-compliant and represents a scientifically valid and supportable look at all alternatives.

The USACE memorandum in GRR/SEIS indicates that vegetation policy on levees should also consider other environmental factors and statutes, such as the Endangered Species Act, in choosing a final design (http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2011-129_Memo_USACE-SWIF.pdf). Reference specifically para. 3b, and item 10, which refer collectively to the District's ability to obtain a vegetation variance in order to comply with the Endangered Species Act, for example.

It is not clear from the text whether alternative approaches were considered, and if so, why they were rejected. The USACE has a vegetation variance policy (that is currently being updated) that might allow vegetation to be incorporated into sections of the levee design to help minimize loss of habitat and mitigate for potential impacts to Southwest willow flycatchers and other riparian species.

Significance: MEDIUM

Additional detail is required to determine if the document is NEPA-compliant and addresses impacts to the degree practicable.

Recommendation for Resolution:

Further discussion seems warranted within the USACE regarding the extent to which vegetation can be incorporated further in the design in order to increase habitat quantity and quality along the 43-mile proposed levee.

Comment #11:
The GRR/SEIS does not show the top of the levee and bosque access roads or ramps.
Basis for Comment:
The reference to stations in Notes 6 and 7 on Sheet C-106, in App. F-1, is the only mention of how high the levees should be raised, and even that is qualitative. a graphical representation of the existing and the recommended plan on a longitudinal profile view of the levee would help illustrate how much higher or lower the before and after water surface and top of spoil bank and levee elevations would be. This may also address some of the public comments on the project.
Significance: MEDIUM
A clear understanding of how much the levee height is changing is needed. For example, with the addition of 4 feet above the design flood water surface, the top of levee is still close to the top of spoil bank. This needs to be verified.
Recommendation for Resolution:
The profile view, to be included in App. F-2/F-3, would graphically show select data presented in Tables 10 through 16. This graphic would show design water surface elevations and the increase in levee height as a result of the risk analysis would then be evident for any location along the project reach. A short paragraph referring to this graphic in the Appendix could be added to the SEIS.

Comment #12:

The various sections of the report are not consistent with respect to assumptions regarding the size of events in which damages begin.

Basis for Comment:

GRR Page 4-29.

> "For the without-project conditions, it was assumed that all existing spoil banks did not contain flood flows. Therefore, the spoil bank breach option was not used in the FLO-2D model. Rather, spoil banks were completely removed from the without-project model."

From Appendix F-10 Page 24

> "For purposes of determining damages and benefits for this appendix, the existing spoilbank levee provides no protection from any of the flood events evaluated."

Compare these quotes to the following quote from Appendix F-10, Section F-05 Page 19,

> "Therefore, a beginning damage depth was applied in HEC-FDA corresponding to the present condition, 10%- chance water surface elevation. This ensures that events more frequent than the 10%-chance event doesn't damage the floodplain inventory, as the flows are expected to be contained within the banks of the Rio Grande. to be contained within the banks of the Rio Grande. The PDT feels this assumption is conservative, as it assumes the existing spoil bank levees provide some degree of protection."

This assumption is equivalent to assuming that the existing spoilbank levee provides protection for all events more frequent than the 10%-chance event. If so, then the GRR Page 4-29, Appendix F-10 Section F-05, and other text should be modified to reflect what was actually done for the analysis.

From Appendix F-10 Section F-11 page 35

> "As a means to test whether modeling existing levee performance would have an impact on LFCC damages and benefits, two scenarios were developed to model in HEC-FDA. A beginning damage depth was applied in HEC-FDA corresponding to the present condition, 20%-chance water surface elevation. This ensures that events more frequent than the 20%-chance event doesn't damage the floodplain inventory, as the flows are expected to be contained within the banks of the Rio Grande. A second beginning damage depth was applied to the LFCC corresponding to the present condition, 10%-chance water surface elevation, to evaluate the impact of the start of damages condition on LFCC damages and benefits."

Which of these options for the LFCC was ultimately used? From Page 36, the second part of Table 4-11 shows LFCC EAD 5-year start of damages from the RGMCC curve, 1990 FIRM rate review of $6366.73. This is identical to the LFCC EAD in Table F-6C Page 148. So, the 5-year start of damages was used for the LFCC?

Significance: MEDIUM
Inconsistent statements regarding the size of events in which damages begin should be reconciled.
Recommendation for Resolution:
Review the documents for related text and modify as appropriate.

Comment #13:
Appendix F-10 (the economics appendix) is not especially well organized or written. Some tables and data are absent. This inhibits the ability of the expert panel to evaluate the economic analysis and creates uncertainty about the economic analysis.
Basis for Comment:
Attention should be paid to producing a clean, more complete, stand-alone document that provides appropriate weight to the important economic, hydrologic/hydraulic, and geotechnical analysis. Figure F-1 is missing Table F-14, page 56 to 57, is missing.
Significance: MEDIUM
Economic justification may be in doubt if the documentation is not of sufficient quality to support it.
Recommendation for Resolution:
Appendix F-10 should be modified to address the issues identified above and in other IEPR Comments so that the economic analysis is readable.

Comment #14:
The GRR/SEIS is difficult to evaluate because of numerous errors and omissions; wrong data provided in tables, outdated text, updates needed, unclear definitions, better example needed, incorrect internal references
Basis for Comment:
Lack of data, incorrect statements, and other errors mean that the selection of alternatives cannot be fully and fairly evaluated. Page 2-30 Wrong data in table > Table 2.4 shows the total value of damageable property by category within the various flood event floodplains. In total, the study area has about $98 million (August 2010 price level) worth of estimated damageable property within the 1-percent chance event. But Table 2.4 is labeled "Table 2.4 Single Occurrence Damages – Without-Project Conditions" not the value of damageable property. Table 2.4 reproduces Table F-5A, so it is event damages, not value of damageable property.
Page 2-33, Outdated text The text on this page does not appear to be consistent with the current, actual operations of the LFCC. On page 2-33: > "The diversion of river flows (up to 2,000 cfs) into the LFCC assists in conserving water and making water deliveries required by the Rio Grande Compact and the 1906 Treaty with Mexico, which requires annual delivery of 60,000 acre-feet." One of the questions for Reclamation (Appendix F-10, page 48 states: > "Surface water diversions into the LFCC are no longer occurring." It appears that the GRR text involving the LFCC should be revised to reflect actual, current conditions. At a minimum, "In the past, diversion of river flows. . . . assisted in conserving…."
Page 4-4, Section 4.3.1.1. Update for 2007 WRDA or at least mention This section should probably reference the 2007 WRDA and address comments from WildEarth Guardians that "The Water Resources Development Act of 2007 promotes a new federal policy for water projects."
Page 4-6 Unclear meaning of "planning constraints" It might be useful to reference the source or reason for these "planning constraints."
Page 4-6 Unclear meaning of "complete protection" > "The alternatives eliminated from further consideration have in common the fact that individually and collectively they do not provide complete protection for agricultural land, BDANWR and the LFCC."

I do not understand why alternatives should be eliminated because they do not provide "complete protection" "Complete protection" was not mentioned as a planning objective or constraint. Indeed, the phrase does not appear elsewhere in the document. Perhaps this paragraph needs to be reworded? I this the same as "completeness" on page 4-37?

Page 4-9. Costs should be updated

The costs of the Rio Puerco and Rio Salado dams might be updated to 2010 levels to make the point that the costs of these dams are now much more than the recommended plan.

Page 4-25 Better example needed; text not justified by table.

> "As shown in this table, the analysis indicates that the levee that maximizes benefits is the Base Levee + 4 ft plan."

Table 4.7 is a poor example. It suggests that the net economic benefit of any alternative is less than zero. Some benefits have not been included. It suggests that perhaps the Base plus 5 feet or maybe Base plus 4.1 foot would be a better alternative.

Page 4-26 states

> "Remaining benefits are from the severe and rare events, which are only captured through levee height increases. However, the remaining benefits are not enough to offset increases in cost."

From Table 4.6, there appears to be a 32 percent chance that this levee will fail in a 1 in 10 year event and a 44 percent chance that is will fail in a 1 in 50 year event. Therefore, remaining benefits are NOT obtained only from severe and rare events. Information is not provided that could be used to confirm that "the remaining benefits are not enough to offset increases in cost." Apparently, the Base Levee + 5 ft option was not actually evaluated.

Page 4-31 Incorrect references

Table 4.9 shows net benefits and the benefit-to-cost ratio for each alternative.

Table 4.9 does not include the benefit-to-cost ratio.

Table 4.10 is not introduced or discussed.

Table 4.10 bottom row should probably be labeled "Annualized Costs" not "Average Annual Costs"

This page should be re-written so that the sources of benefit and cost information are summarized

Page 4-32 to 4-33 Content should be changed

Sections 4.5.7.2, 4.5.7.3 and 4.5.7.4 should be populated with a summary of effects information from the tables that follow.

Table 4.12 does not include a section for the "Other Social Effects" accounts. It appears there should be one; isn't "Public Health and Safety" under "Other Social Effects"?

Significance: MEDIUM

Errors and omissions make the documents hard to evaluate

Recommendation for Resolution:
Address comments regarding incorrect, misleading, misplaced and missing information.

Comment #15:
GRR/SEIS Section 6.8 (Socioeconomics) should address potential regional economic impacts generated by the project to the community.
Basis for Comment:
It seems unusual that, outside of Table 4.12, the GRR/SEIS does not mention potential jobs growth (at least in short-term construction jobs) and other local economic impacts that would result from such a large project. Constructing 43 miles of levee over a 10–14-year period would almost certainly provide economic spillovers to the local economy, which in addition to jobs could include local services such as hotels/housing, restaurants, mechanized equipment rental, landscaping, and other goods and services.
Significance: LOW
USACE is missing an opportunity to demonstrate positive project impacts. The RED section in Appendix F-10 might also include more discussion of economic impacts during construction.
Recommendation for Resolution:
The decision regarding whether to proceed with the proposed project is dependent on whether the project is deemed in the public interest. The economic feasibility of the project itself has been focused on in detail. However, the project has the potential to create positive local effects that do not appear to be addressed in Section 6.8. The District should review the *Proposed National Objectives, Principles and Standards for Water and Related Resources Implementation Studies* document dated December 3, 2009, which describes how economic impacts to the regional economy should be addressed: *"b. Regional Economic Subcategory. This subcategory includes the changes in the distribution of regional monetary effects that result from each alternative shall be displayed when they are significant to local, state, and regional decision making, or needed to address other concerns of the public. A region may be defined as needed to address these concerns. Regional effects include the National effects that accrue within the region, plus transfers of income into or out of the region relative to the rest of the Nation. The monetary effects of an alternative not occurring within the defined region shall be displayed in a "Rest of Nation" category. Regional changes include National effects, income transfers, and employment effects."*

Comment #16:
Assertions regarding water quality from flood events on p. 6-11 require further support or modification.
Basis for Comment:
P. 6-11 states “Although periodic floodplain inundation outside of the existing spoil bank alignment has the potential for providing allochthonous material to the Rio Grande, historic and existing land uses west of the spoil bank also present potential threats to water quality. Following a spoil bank breach, floodwaters would likely be of low quality and would result in the introduction of potential contaminants (sewage, petroleum products) to the river, and, therefore, would not be considered beneficial to aquatic habitat and organisms.” Without measuring the actual contribution of contaminants or allochthonous material, the overall conclusion of low-quality contributions is unsupported.
Significance: LOW
Additional detail is warranted or the paragraph should be deleted.
Recommendation for Resolution:
Consider modifying the text to reflect the issue raised in the Comment.

Comment #17:

The GRR/SEIS should contain more figures to support statements and conclusions made in the text. The aesthetics sections (existing conditions and future action) would greatly benefit from photographs or photomontages to provide an objective analysis of project impacts.

Basis for Comment:

In general, the existing conditions section is well-written and provides a sufficiently comprehensive basis for comparison with project alternatives. However, certain sections of the existing conditions and impacts sections would benefit from the inclusion of figures indicating the location of features referenced in the text.

A. This applies to Section 3 on HTRW, Section 2.4.1 on Riparian Plant Communities (a table is provided), Subsection 2.4.4.1 critical habitat for the silvery minnow, Subsection 2.4.4.2 critical habitat for the Southwestern willow flycatcher.

B. The text on p. 2-24 states "*In 2010, 27 of the flycatcher territories in this reach were located on the west bank of the river, adjacent to the alignment of the current spoil bank and proposed engineered levee*." A figure would be very helpful here or in the impacts section showing the location of the area (not specific nests) to the proposed levee construction.

C. Section 3.5.4 Land Use and Classification (under Future No-Action conditions). This section would benefit from a zoning map if one exists of the area, to support the conclusion of no anticipated land use changes.

Many of these figures would be easy and cost-effective to produce and would greatly aid in understanding the potential project impacts (or lack thereof). These can easily be 8.5-in x 11-in figures and incorporated into the body of the text.

The aesthetics section as written sounds contradictory: "*As discussed in the 1992 SEIS, the evaluation of visual qualities is a value judgment and is subjective, differing according to the perception of each individual. The general visual setting of the proposed project area is thought to be of high aesthetic quality, with the exception of the sporadic litter and domestic garbage.*" It might be easier to avoid the value judgments entirely and include photographs of the project site under existing conditions from different views. For the impacts section, it would be useful to have photomontage views (to scale) of what the newly-constructed berm would look like from major vantage points such as along I-25, from Socorro, or from the Bosque del Apache NWR.

Significance: LOW

The clarity of the GRR/SEIS would be much greater with figures and enable the reader to verify the conclusions and other statements made within the text. This is important to do if the document is going out to public comment. Aesthetics is often not a major issue, but with a 43-mile-long levee, a more effective and objective analysis is warranted.

Recommendation for Resolution:
It is recommended that the District add the suggested figures to allow the reader to corroborate findings of the GRR/SEIS. Consider preparing photomontages of the study area under existing and future conditions to show the public views of the levee to scale. This can be done economically by many commercially available services and would make an understanding of the project much more accessible to the public.

A.3 Editorial Comments on the GRR/SEIS

Editorial comments are provided below as a reference for USACE. Some of the comments listed do have some significance to the technical understanding of the project; however, the actions necessary to address the comments only involve editorial changes.

Table A.3-1. Editorial Comments

No.	Comment	Notes
1	The levee details do not correspond to the GRR/SEIS.	Figures 5.1 and 5.2 in the SEIS do not match Sheet C-106 in Appendix F-1. Upon more detailed examination, it appears that only the figure labels (Northern and Southern) vs. Stationing (Notes 6 and 7); and the size of the flap gate on the drain pipe outlet are different.
2	On p. 5-16, para. 5.1.14, Line 1, an incorrect reference is given. Also, at Line 6, indicate that July–April are the months of the year when the low flows can be expected.	Update the GRR/SEIS to reflect the correct reference and identify the months of the year when the low flows can be expected.
3	GRR/SEIS text should be consistent in the treatment of wildlife habitat impacts based on comparisons with historical and current conditions.	The text in Subsection 3.5.4.3 (b) (Bosque del Apache NWR, p. 3-16) as written is somewhat contradictory to the tone and description of the existing conditions section of the text, which emphasizes existing degraded ecological conditions in the watershed resulting from man's attempts at preventing the Rio Grande from doing what it would naturally: form meanders and flood regularly. Based on that description, one could argue that flooding the refuge would be the best thing possible for wildlife habitat, by restoring sediment and indigenous biota including wetland plant seeds, organic matter, and nutrient support to the remaining wetlands in the system. In contrast, the text on p. 3-16 implies significant adverse impacts to ecological resources would occur from flooding of the refuge. This section might be rewritten to emphasize the impacts on *infrastructure* (e.g., water level regulating structures, dikes, roadways) in the refuge that has been implemented through the years to maintain a highly artificial situation in order to attract wildlife through planting crops, etc., and to provide recreational opportunities for visitors. (It is actually stated similarly in Section 4.2 on p. 4-2, third bullet).

Appendix B – IEPR Panel Members

Noblis selected five panel members to conduct an IEPR of the GRR and SEIS for Design Deficiency Corrections for the Rio Grande Floodway Levee System, Illinois. Consistent with the requirements of the USACE SOW, the panel members provided expertise in six areas: civil works planning, biology/ecology, hydrologic and hydraulic engineering, geotechnical/structural engineering, economics, and civil engineering/cost engineering. All panel members met and exceeded the minimum requirements for each specified areas of expertise, as outlined in Table 3 of this IEPR Report. The panel represented a well-balanced mix of individuals from academia, large companies and small consulting firms, and individual consultants.

B.1 Résumés of Panel Members

The résumés of the panel members follow.

Paul Bovitz, PWS, LSRP, CEM, LEED AP

Qualifications Summary

- Over 28 years experience in the environmental field, including assessment of environmental impacts under NEPA. Project experience includes complex multi-objective public works projects such as the Meadowlands Mills EIS for the New York District of USACE, which evaluated a developer's plans to fill over 300 acres of wetlands for a mixed use development, as well as other projects requiring evaluation of different alternatives with trade-offs (i.e., the Fresh Kills Landfill EIS, Kensico Reservoir EIS and EAs for multiple projects), dredged material management plans for the Baltimore and San Francisco Districts of USACE, and the New Jersey Intracoastal Waterway project for the Philadelphia District which evaluated habitat restoration alternatives using dredged material.
- B.S. degree in Wildlife Biology from Colorado State University; MS degree in ecology from Rutgers University; BS degree in wildlife biology. Certified Professional Wetland Scientist.
- More than 28 years technical experience in ecological assessment and natural resources management in public, private, and academic sectors, engaging in both theoretical and applied aspects of ecological research and encompassing a variety of geographic regions and habitats. Mr. Bovitz has served on IEPR panels for peer review of USACE flood control projects, and has managed millions of dollars of work for the USACE as a project manager for remedial investigations, including ecological risk assessments, EAs, EISs and feasibility studies, as well as civil works projects such as 1135 projects. He has worked directly for the following USACE Districts on similar projects: Kansas City District, New England District, New York District, Philadelphia District, Baltimore District, Norfolk District, Omaha District, San Francisco District and St. Louis District. He currently serves on the New Jersey Governor's Science Advisory Board, ecological sciences subcommittee as an invited panel member.
- As an experienced field ecologist, Mr. Bovitz has worked throughout the country, including within the study area of interest. Mr. Bovitz has conducted ecological assessments at Bandelier National Monument outside of Los Alamos, at the Calwest Metals Superfund Site in Lematar, NM, outside of Socorro, and at a mining site near Grants, NM. He has evaluated stream and riparian habitats in Colorado, Wyoming, and Montana and is familiar with flora and fauna of the southern Rocky Mountains, including endangered species.
- Managed and participated as principal investigator for the following types of work:
  - Environmental assessments under NEPA
  - Water quality and stormwater studies
  - Wetlands delineation, assessment, mitigation and permitting
  - Essential fish habitat investigation and fisheries studies.
- Member of Society of Wetland Scientists, U.S. Green Building Council, Licensed Site Remediation Professionals Association**,** SAME New Jersey Chapter, Hudson-Raritan Chapter of SETAC
- Experienced with National Environmental Policy Act (NEPA) Environmental Impact Statement requirements as well as Endangered Species Act, essential fish habitat, Selected projects include: Meadowlands Mills EIS, USACE New Jersey, Intercostal Waterway FS and EA, USACE, New Jersey, evaluated dredged material management alternatives for USACE; San Francisco Bay Dredged Material Management Plan, USACE, San Francisco; and Cape May EA for Wind Turbine Development, U.S. Coast Guard, New Jersey.
- Project management, field supervisory experience, expert testimony, proposal preparation, client negotiation, and budget management.
- International experience in ecological assessment.

Education

- M.S., Ecology, Rutgers University, 1992
- B.S., Wildlife Biology, Colorado State University, 1982
- Habitat Evaluation Procedures – Virginia Tech, 2005

Certifications and Licenses

- Certified Professional Wetland Scientist #0023, Society of Wetland Scientists (1995)
- Licensed Site Remediation Professional, New Jersey
- Certified Energy Manager, American Association of Energy Engineers (2009)
- LEED® Accredited Professional, U.S. Green Building Council (2009)

Summary of Professional Experience

WESTON

The Hudson Partnership, Inc.

Rutgers University

Mariah Associates, Inc.

Colorado State University

Various state and federal agencies in Colorado, Wyoming and Montana (U.S. Fish and Wildlife Service, Colorado Division of Wildlife, U.S. Forest Service)

KEY PROJECTS

- **EA, New Mexico, Mariah Associates, Inc., Research Associate.** Conducted habitat evaluation studies and censusing for evidence of endangered black-footed ferrets in an area proposed for coal mining. Nightlong spotlight checks for ferrets over a 15-sq-mile area and searched prairie dog colonies for evidence of ferrets.
- **EA, New Mexico, USEPA/Environmental Response Team, Senior Field Team Member.** Collected data on small mammals, vegetation structure, and soils for use in an ecological risk assessment of lead contamination at the CalWest Superfund site. Contributed toward preparation of the ecological risk assessment that recommended soil lead clean up levels on the site and in adjacent arroyos.
- **Ecological Studies, New Mexico, Natural Resource Ecology Laboratory, CSU, Field Team Member.** Collected data on vegetative cover, productivity, and soils as part of a study on the effects of fire on deer and elk populations in Bandelier National Monument.
- **NEPA Environmental Impact Assessment, Meadowlands Mills Development, USACE, New York District, Project Manager.** Directed preparation of draft and final environmental impact statements (EISs) on behalf of the USACE, New York District, evaluating impacts of a proposed 206-acre wetland fill project in the Hackensack Meadowlands District as part of a larger proposal to build a mixed-use regional retail/office/entertainment center ("megamall"). Critical technical issues evaluated by WESTON included compliance with Section 404(b)1 guidelines and NEPA; the accuracy of the Indicator Value Assessment method as a means of functional assessment of wetlands on the site; the derivation of appropriate mitigation ratios for the site; the potential success of the applicant's mitigation plan in offsetting potential development impacts; and the evaluation of wildlife habitat, including threatened and endangered species, avian studies, water and sediment quality of tidal creeks and the adjacent lower Hackensack River, flood storage and hydrological and hydraulic modeling, management of contaminated sediment, and other wetland values under existing and proposed alternative conditions.
- **Peer Review and Grant Reviewer, U.S. Army IMCOM (Installation Management Command).** As part of an interdisciplinary panel, reviewed and made funding recommendations regarding proposals advanced by individual military installations throughout the western United States (including New Mexico) for fish and wildlife habitat improvements and investigations (including endangered species management issues).
- **Peer Review, IEPR, Noblis and USACE St. Louis District.** Acted as peer reviewer regarding ecological and HTRW issues pertinent to an EA prepared by the District for improvements to a series of levees along the Mississippi River near St. Louis.

- **FS and Integrated Environmental Assessment, New Jersey Intracoastal Waterway, New Jersey, U.S. Army Corps of Engineers (USACE), Philadelphia District (CENAP), Project Manager.** Directed identification of dredged material placement alternatives, habitat restoration sites, and beneficial reuse options for maintenance dredging of approximately 70 miles of New Jersey's Intracoastal Waterway. Major project tasks included evaluation of existing data (e.g., sediment quality, land use, bathymetry, aerial photographs); coordination with regulatory agencies including NJDEP, U.S. Fish and Wildlife Service (USFWS), and National Marine Fisheries Service (NMFS); and development of geographic information system (GIS) maps for potential restoration sites. Identified viable habitat creation, restoration, and enhancement opportunities to improve degraded ecological conditions on historic dredge spoils sites and potentially upgrade water quality in the project area. WESTON also continued development of a GIS-based site selection model that incorporated multiple site selection criteria simultaneously.
- **Ecological Risk Assessment, Nyanza Superfund Site, Sudbury, MA, USACE New England District, Project Manager.** Directed preparation of a baseline ecological and human health risk assessment addressing potential risks to Sudbury River biota from organic compounds and metals present in groundwater. Initially prepared a SLRA that identified contaminants of concern in groundwater entering the river. Subsequently worked with reviewing agencies on behalf of USACE to develop a work plan/study design to address toxicity of groundwater using bioassay tests. Subsequently analyzed the data and prepared a report that formed the basis of a follow-up work plan to address in situ toxicity of groundwater entering the river via pore water. Integrated results with hydrogeological data to develop a conceptual model of ecological exposure, and prepared a final report used by USACE and EPA Region 1 to evaluate risk management alternatives regarding contaminated groundwater at the site.
- **Remedial Investigation/Risk Assessment (RI/RA), Housatonic River Superfund Site, MA, USACE New England District and U.S. EPA, Principal Scientist.** Assisted in study design and coauthored soil, sediment, and surface-water sampling plans for RI of PCB-contamination along a 30-mile stretch of the Housatonic River. Developed sediment sampling methodology using hand-held corers to a depth of 4 feet, and directed its implementation. Prepared sampling plans for collection of biota tissue (e.g., frogs and soil invertebrates) for use in the risk assessment, including literature reviews of PCB effects. Directed field activities for collection of frog tissue. Assisted in field processing fish tissue for over 900 individual fish caught along the river.
- **Remedial Investigation (RI) and Ecological Risk Assessment, Edison, NJ, USACE, New England District (CENAE), Project Manager.** Directed focused RI and baseline ecological risk assessment (BERA) of the former Raritan Arsenal, a 3,200-acre site in Edison, NJ, located along the tidal Raritan River. All work was conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and in accordance with New Jersey Department of Environmental Protection (NJDEP) technical requirements for site remediation. Directed extent of contamination study of surface water and sediment and prepared physical characterization report for the Phase II remedial investigation/feasibility study (RI/FS) for the site, which described contaminant migration patterns and potential bioavailability of surface water and sediment. Directed screening level ecological risk assessment (SLERA) of all media used to identify contaminants of potential concern (COPCs), and integrated it with site-specific ecological data from the site to develop a conceptual model of ecological exposure pathways. Directed the BERA, which evaluated over 30 areas of concern (AOCs) divided among 8 different drainage areas. The BERA included field studies of potential impacts of contaminated sediment, surface water, and soil on ecological receptors. Field studies included bioassay testing of freshwater and tidal sediments, histopathology of fish and mammal tissue, benthic macroinvertebrate community analysis, and tissue analysis of fish, amphibian, and mammalian receptors used for food chain modeling of contaminant impacts. The study also evaluated impacts of contaminated site sediment and surface water on the Raritan River, and vice versa. Directed implementation of database integrating over 330,000 data points. Also, as Project Manager for the RI, directed investigations including delineation of 8 groundwater plumes, supplemental soil RIs, preparation and execution of remedial action work plans (RAWPs) for contaminated soil removal activities, investigation of vapor intrusion impacts to site buildings from contaminated groundwater, and issuance of no further action (NFA) letters for over 20 AOCs.
- **Project Management, Various Locations, USACE, New York District (CENAN), Biological, Environmental, and Cultural Resources (BECR) Contract, Project Manager.** Managed several projects, including environmental site assessments (ESAs) under the hazardous, toxic, radioactive waste (HTRW) and Defense Environmental Restoration Program – Formerly Used Defense Sites (DERP-FUDS) programs,

community relations plans for site cleanups, wetland mitigation studies and plans, and assessment of environmental impacts.

- **Sediment Quality Investigation, Baseline Ecological Inventory, Essential Fish Habitat (EFH) Investigation, and Wetland Restoration, Delaware River, PA, Confidential Client, Task Manager.** Directed a baseline aquatic resources survey for a 50-acre area adjacent to an oil refinery consisting of tidal mudflat, adjacent tidal emergent wetlands, and open water areas. The study consisted of a year-long investigation of sediment quality, fisheries, benthos, and other aquatic resources in the immediate vicinity of the refinery to be used as a basis for evaluating potential environmental impacts associated with different dredged material management alternatives presently under consideration at the site. The study involved collection of over 20,000 fish using a variety of methods, as well as characterization of benthic macroinvertebrate community structure, ecological screening of sediment analytical data, and comparison of fish stomach contents to available benthos as a measure of habitat quality using the Benthic Resources Assessment Technique (BRAT) model developed by USACE. Analyzed results and presented them to reviewing agencies in a final report. The baseline data were used to develop conceptual design plans for a proposed tidal wetland creation project.
- **Ecological Risk Assessment and Remedial Investigation, Atlantic City Reservoir, USACE, New York District.** Acted as quality assurance officer responsible for input on design and review of soil and sediment sampling plans. Reviewed existing site information and developed work plan to supplement prior ecological and human health risk assessments by collecting background data on sediment and fish tissue mercury concentrations in order to facilitate risk management decisions at the site. The site is an existing reservoir and risk management decisions are necessary in order to evaluate the feasibility of different remedial alternatives for addressing mercury-contaminated sediment.
- **Ecological Risk Assessment, Suffolk, VA, Former Nansemond Ordnance Depot, James River Beachfront. CENAB, Task Manager.** Directed preparation of a baseline ecological risk assessment (BERA) for remaining areas of concern on the former military site that were contaminated by metals and organic compounds. Of particular concern was the James River Beachfront, an area subject to severe coastal erosion where ordnance and munitions constituents posed potential risks to human health and ecological receptors. The BERA assessed risks from metals and organic contaminants to the ecological communities present within this area, as well as the Horseshoe Pond and Main Burning Ground areas. Results were used to make risk management decisions in the context of shoreline stabilization measures necessary to address existing beach losses
- **Dredged Material Management Plan (DMMP), San Francisco Bay, USACE, San Francisco District**. Reviewed information regarding sediment volumes, dredging methods and evaluated potential environmental impacts from potential dredged material management alternatives within different portions of the regional management area encompassing ports and shipping channels within the San Francisco Bay. Provided input to the DMMP document.
- **DMMP, Preliminary Assessment (PA), and FS, Baltimore Harbor and Approach Channels, Maryland and Virginia, USACE, Baltimore and Norfolk Districts, Principal Scientist.** Identified and analyzed dredged material placement alternatives, habitat restoration sites, and beneficial reuse options for the Port of Baltimore, MD. Coauthored sections of the (DMMP, with specific focus on the Virginia approach channels. The DMMP study identified, evaluated, screened, prioritized, and will ultimately optimize placement alternatives resulting in the recommendation of a plan for the placement of dredged materials for at least the next 20 years. Major project tasks included communication and coordination with federal, state, and local regulatory agencies; evaluation of existing data (e.g., historical reports, bathymetry, sediment characteristics and chemistry, aerial photographs, degraded wetlands, fisheries data, benthic surveys, and water quality data); identification of potential beneficial-use placement sites; and development of a matrix of placement alternatives.
- **Hurricane Ike Emergency Response, Lafayette, LA, U.S. Environmental Protection Agency (EPA) Region 6, Superfund Technical Assessment and Response Team (START), Senior Wetland Scientist.** Directed technical approach and preparation of work plans for removal activities associated with extraction of tanks, drums, and chemical totes from freshwater and tidal wetlands along the southern coast of Louisiana. Worked with Louisiana Department of Environmental Quality (LADEQ) and EPA in a planning meeting to ensure that wetland impacts were avoided and minimized to the maximum extent practicable. Assisted teams in field reconnaissance by road and airboat in locating tanks and other objects, and advised teams on appropriate removal procedures in conjunction with LADEQ representatives.

- **EA, Paulsboro, NJ, Gloucester County Improvement Authority (GCIA), Paulsboro Marine Terminal.** Conducted environmental assessment evaluating the existing quality of wetland and aquatic habitats potentially impacted by different port redevelopment alternatives for inclusion in the NEPA EIS document, and calculation of state and federal wetland mitigation requirements. Reviewed the existing wetland delineation and negotiated remapping of the area to save GCIA over $4M in wetland mitigation costs by having over 9 acres of area mapped as freshwater wetland reclassified as upland. Also assisted GCIA in negotiations with the New Jersey Department of Environmental Protection (NJDEP) to reduce requirements for sampling under Section 106 requirements for a historical/ archaeological resources survey, resulting in significant reduction in the sampling required over what the agency was requesting.
- **Port Authority of New York and New Jersey, Program Manager.** Acted as program manager overseeing eight call-in contracts, including one for Engineering Services that emphasized hazardous soil, sediment and groundwater investigations under NJDEP Technical Requirements for Site Remediation. I have been managing this contract for over 5 years, and participating on it for over 10 years. Other contracts I supervise include a call in for Ecological Services, and another for Lead/Asbestos Design Services, each with a capacity of $1.5M. Supervised staff in management of various projects ranging from underground storage tank investigations, remedial investigations of contaminated sediment and soil, evaluation of stormwater impacts and flood hazard area permitting, preparation of stormwater pollution prevention plans, wetland delineations, mitigation and permitting, evaluation of potential wetland mitigation banking sites in New York and New Jersey, NEPA consulting, air quality impacts from harbor dredging operations, development of an electronic environmental compliance monitoring system, and consulting regarding emissions offsets and purchase of carbon credits to offset air quality impacts from port operations. As program manager my responsibilities also included oversight of a Bioassay contract we held for 3 years under which Weston completed several task orders involving collection and analysis of contaminated sediments within the Port Newark and Elizabeth area.
- **RI and Natural Resources Damage Assessment, Confidential Client, Woodbridge, NJ.** Developed work plan approach for delineation of contaminated sediment at the site, which is an industrial facility that produces plasticizers and other industrial chemical products. Conducted review of pertinent site information and data, and performed an analysis of wetland impacts attributable to historical development to develop a baseline upon which to derive estimates of contamination-related injuries to the site. Was part of the team that negotiated the ultimate natural resources damages settlement with NJDEP, reducing settlement costs 40% from what was initially proposed by NJDEP. Prepared wetland permit applications for remedial activities.
- **Hurricanes Katrina and Rita Emergency Response, Kiln, MS, Plaquemines Parish, LA and Lake Charles, LA, EPA Regions 4 and 6, START, Team Member.** Primary duties involved field reconnaissance and identification of environmental hazards posed in the wake of the two hurricanes, which hit the Gulf Coast in 2005. Performed vehicle, airboat, and helicopter surveys in search of debris. Trained field crews on the use of Personal Digital Assistants (PDAs) used to collect data. Provided recommendations to EPA regarding the handling and extraction of tanks posing environmental risks within sensitive wetland habitats, including the Sabine National Wildlife Refuge.
- **Columbia Shuttle Recovery, Nacogdoches, TX, EPA Region 6, START-2, Team Member.** Field duties included directing field crews in locating shuttle debris using a grid system superimposed on topographic maps and aerial photography; logging debris onto evidence tag and into logbook; and entering related data into handheld computer (PDA). Data included latitude/longitude, evidence and picture number, type of debris, and comments relating to debris.
- **RI and Ecological Restoration, Wall Township, NJ, Confidential Client, Project Manager.** Served as Project Manager for site cleanup of a forested wetland contaminated with polychlorinated biphenyls (PCBs). Responsible for delineation of the extent of contamination, assisting with development and negotiation of a remedial action work plan acceptable to NJDEP, and preparation of wetland restoration plans and permit application documents for the excavation and restoration of 6.5 acres of forested wetlands impacted by PCB contamination. The wetland permit application for excavation and restoration is currently under NJDEP review.
- **RI and Ecological Risk Assessment/Wetlands Restoration, New Jersey, Precision Roll Products, Inc., Principal Scientist.** Directed preparation of a BERA and derivation of ecologically based site cleanup criteria for remediation of forested wetland soils contaminated with metals and PCBs. Negotiated site cleanup levels and risk management decisions with NJDEP based on risk assessment results. Developed a site restoration plan

for contaminated sediments within an adjacent stream and cooling pond that recommended in situ capping of sediments. Directed preparation of necessary wetland and stream encroachment permit applications and wetland/stream restoration plans for three forested wetland areas of the site that required excavation of contaminated soil and sediment.

- **Remedial Investigation, Feasibility Study and Natural Resources Damage Assessment, Corfu, NY, Confidential Client, Principal Scientist.** Conducted baseline remedial investigation of saline impacts from a pipeline rupture that resulted in a brine spill over 3.5 acres of forested wetlands in western New York. Collected sufficient samples to delineate the extent of saline contamination in the wetland, sampled adjacent potable wells, measured salinity levels in surface water, and prepared a report summarizing the extent of project impacts. Subsequently evaluated remedial alternatives from the perspectives of regulatory requirements, long-term likelihood of success, logistical considerations, and costs. Prepared a natural resources assessment summarizing the extent of damages from the loss of trees at the site, and different methods of ascertaining damages.
- **Sediment/Soil Characterization and Dredging Permitting, Norfolk Naval Shipyard - Pier 3 and Dry Dock 8, Virginia, U.S. Navy, Project Manager.** Directed environmental investigations to address issues posed by proposed redevelopment of a large pier and drydock in order to accommodate larger aircraft carriers. Investigation included soil and sediment sampling to characterize material to be removed from beneath existing pier and dry dock surfaces or beneficially reused as part of activities to reconstruct the existing pier. Directed screening and data analysis of constituents found in the sampled soil and developed cost and volume estimates for soil and sediment removal and disposal options. Prepared specifications drawings for multiple hazardous waste streams (e.g., toxicity characteristic leaching procedure [TCLP] lead, asbestos, PCBs) and general environmental controls. Prepared permit applications (USACE/VMRC/VADEQ Joint Permit, Federal Coastal Consistency Determination, etc.) needed to conduct the reconstruction activities associated with pier renovation.
- **Call-In Contract for Environmental and Engineering Services, Port Authority of New York and New Jersey, Project Manager.** Directed several environmental investigations involving evaluation of contaminated soils and groundwater within the proposed corridor of the Second Lead Rail project on Bay Avenue in Port Elizabeth, and the Corbin Street Rail and Realignment project at Port Newark. In addition, directed wetland investigations at Teterboro Airport, Ports Newark and Elizabeth as a basis for permit applications filed on behalf of the Port Authority for proposed projects. Evaluated potential sites within the vicinity of Port Newark for potential use as a wetland mitigation bank. Potential sites were screened and ranked by multiple parameters, i.e., size, location, suitability for a mitigation bank, assessed real estate value, ownership, site use, type of wetland community, accessibility, and elevation range. A summary report was prepared including recommendations for preferred sites and restoration potential.
- **Environmental Impact Assessment (EIA) and Permitting, Philadelphia, PA, Metro Machine Corporation, Project Manager.** Conducted an assessment of potential environmental impacts from a proposed 100,000-cubic yard (yd^3) dredging project at the Philadelphia Naval Yard. Directed collection of core samples used to characterize sediment quality via chemistry and elutriate testing. Prepared permitting documents, interfaced with federal and state regulatory agencies, and successfully received applicable permits. Conducted an evaluation of disposal alternatives for dredged material, and received approval for disposition of the material at a confined disposal facility operated by USACE.
- **EIA and Ecological Restoration, Clarkstown, NY, Town of Clarkstown, Principal Scientist.** Conducted assessment of environmental impacts associated with dredging a section of the Hackensack River, including floodplain effects and wildlife habitat impacts. Designed and executed study plan for investigation and characterization of sediment quality within the river. Developed stream bank stabilization/restoration plan, and provided input/recommendations regarding nature trail construction and recreational potential of the riverine corridor.
- **EIA and Permitting, Biogenesis Soil Washing Pilot Demonstration Project, Permitting Coordinator.** Evaluated environmental impacts and obtained necessary permitting documents for a pilot-scale soil washing facility for treatment of contaminated dredged material from the New York-New Jersey Harbor.
- **RI, Risk Assessment, New Jersey, Confidential Client, Task Manager.** Directed ecological risk assessment of two approximately 30-acre forested wetland sites and one 5-acre site impacted by paint waste from a former manufacturing facility. The sites encompass several streams within the same watershed that have been contaminated with metals and organic compounds. Prepared ecological and human health risk assessment

portions of the Phase I RI report, and made recommendations regarding remedial design alternatives.

- **EIA and Permitting, Bronx, NY, American Marine Rail, Principal Scientist.** Conducted assessment of sediment quality and environmental impacts associated with dredging and construction of a proposed marine transfer solid waste handling facility on the East River. Prepared sampling and analysis plan for sediments to be dredged, evaluation of potential aquatic habitats and estuarine biota affected, final report, and environmental assessment (EA) for the facility. Coordinated with regulatory review agencies (USACE and New York City Department of Environmental Protection [NYCDEP]).
- **Environmental Permitting and Compliance, New York, Consolidated Edison, Principal Scientist.** Researched, developed, and prepared Corporate Environmental Procedures, General Environmental Instructions, and Technical Bid Specifications for the client's corporate environmental policy. Prepared corporate documents summarizing regulatory issues and corporate procedures in several areas: wetlands and dredging impacts and permitting; fish and wildlife impacts; and State Pollutant Discharge Elimination System (SPDES) permitting, including construction dewatering, and pesticide application.
- **Ecological Restoration, Clarkstown, NY, Town of Clarkstown, Principal Scientist.** Conducted investigation of watershed impacts on Swartout Lake, an approximately 24-acre lake within a suburban/rural environment. Conducted lake sampling, survey of aquatic vegetation and habitat types, and watershed analysis, including impacts of non-point source pollution sources. Provided recommendations regarding lake restoration.
- **Brownfields Development, Staten Island, NY, Confidential Client, Principal Scientist.** Conducted a field wetlands delineation and preliminary environmental survey to identify issues and provide recommendations pertaining to future development of an industrial site, including stormwater management and wetlands restoration along a tidal creek.
- **Environmental Impact Assessment (EIA), New York City, New York City Department of Sanitation (NYCDOS), Task Manager.** Prepared or directed the preparation of several documents in support of the 6 NYCRR Part 360 permit application for the Fresh Kills Landfill. Provided technical direction and preparation of the natural resources and water resources sections of the draft EIA, including supervision of staff in data collection, analysis, and review; interpretation of data and impacts analysis; client/agency negotiation; and authoring report sections. A major focus of the analysis was on impacts of the landfill to sediment and surface water in the adjacent tidal water bodies of Fresh Kills and the Arthur Kill. Provided direction/preparation of the draft and final surface-water quality/wetland sections of several major permitting documents. These tasks involved extensive data interpretation and summary of results of water quality and sediment data, including relationships between surface-water quality and contaminant hydrogeology; study design for environmental monitoring; review of water quality modeling results and integration with surface-water quality data; preparation and review of reports for consistency with federal, New York State, and New York City regulations; and integration of report sections with other disciplines (e.g., human health risk assessment, land use, landfill engineering, and surficial geology).
- **EA, Tennessee, EPA/Environmental Response Team (ERT).** Directed field ecological assessment of contaminant risks at a former charcoal producing facility. Studies focused on effects of polynuclear aromatic hydrocarbons (PAHs) and metals on soil invertebrates and small mammals in order to determine cleanup levels.
- **EA, New Jersey, EPA/ERT, Task Leader.** Developed standard operating procedures (SOPs) for small mammal trapping and tissue processing for use by EPA.
- **EA, Tennessee, EPA/ERT, Task Leader.** Conducted ecological risk assessment modeling of contaminant risks using the Hazard Quotient Method at a former landfill site. Identified contaminants of concern and indicator species, derived lowest-observed-effect level (LOEL) data from the literature, and determined potential toxicological effects in order to establish site soil cleanup levels.
- **Wetland Assessment/Mitigation, New Jersey, EPA/ERT, Project Team Member.** Provided development and oversight of a wetlands mitigation plan for the Zshiegner Refining Company Superfund site. Characterized site vegetation, delineated wetlands, and helped develop site soil removal and revegetation plan.
- **EA, Wisconsin, EPA/ERT, Subtask Leader.** Developed sampling design and directed extent of contamination study of surficial soils at a former wood-treating facility. Collected baseline data for ecological risk assessment.
- **EA, Connecticut, Town of Stratford, EPA/ERT, Task Leader.** Coordinated field activities for an emergency

response investigation focusing on the risks of asbestos and PCB contamination to local residents in the Town of Stratford. Acted as liaison with several federal agencies and their support teams, and supervised the collection and screening of soil samples. Monitored subcontracted surveying team, and assisted with the development of a base map of areas investigated.

- **EA, Colorado, EPA/ERT, Senior Field Team Member.** Conducted an assessment of freshwater wetlands potentially affected by groundwater contamination from an abandoned industrial facility, and performed a vertebrate species inventory for use in determining if the site qualified for National Priorities List (NPL) ranking. In addition, assisted with the collection of groundwater data.
- **EA, Michigan, EPA/ERT, Task Leader.** Prepared a quality assurance (QA) work plan and supervised the dissection, processing, and analysis of muskrat tissues collected from a potentially contaminated stretch of the Kalamazoo River. Tissue was analyzed for histopathology, metals, PCBs, and semivolatile organic compounds (SVOCs).
- **EA, New Jersey, EPA/ERT, Task Leader.** Directed an off-site extent of contamination study of arsenic contamination in the vicinity of a former chemical plant facility to determine health risks to the public. Sampled surface and subsurface soils, as well as groundwater within residential areas potentially affected by runoff from the site. Presented results in a final report to EPA.
- **EA, Maryland, EPA/ERT, Task Leader.** Prepared and implemented an emergency response plan for the biomonitoring of white phosphorus release from sediment at the Aberdeen Proving Ground (APG) from a major storm event. The plan was implemented in March 1993 to determine if white phosphorus was released into the water column following a winter storm and if it was available for uptake by a representative fish species (sheepshead minnow). An in situ technique was used for this purpose. Interpreted results and presented conclusions in a final report to EPA. This plan has since been used as a contingency plan for any major storms affecting the APG area.
- **EA, New Jersey, EPA/ERT, Task Leader.** Directed a broad-scale field investigation of the terrestrial and aquatic impacts of lead contamination at a former smelting facility. Developed and implemented the work plan, and directed a field crew in the collection of data on soils, water, and target biota (small mammals, fish, and frogs). Used an in situ technique to measure the bioaccumulation of lead in two species of earthworms. Additional responsibilities included statistical analysis and interpretation of contaminant data, interpretation of results, and preparation of a final report to EPA for use in determining ecologically relevant remedial levels. In a follow-up study, evaluated soil slated for removal using the Toxicity Characteristic Leaching Procedure (TCLP) to determine if soils met Resource Conservation and Recovery Act (RCRA) criteria.
- **EA, Utah, EPA/ERT, Subtask Leader.** As part of a larger integrative study, conducted an inventory of small mammals present in a wetland adjacent to a former silver mine. Directed field crew members in the collection of specimens and subsequent necropsy work to determine if gross pathological effects were evident in indigenous populations. In addition, assisted with a vegetative inventory of the site. Prepared results in a final report to EPA/ERT for use in evaluating the potential ecological risks posed by the site.
- **EA, Washington, EPA/ERT, Subtask Leader.** Directed an inventory of small mammal populations in a landfill area within a tidal wetland adjacent to Puget Sound. Collected and analyzed data aimed at describing the resident small mammal and bird communities of the site. In addition, prepared a site vegetation map.
- **EA, New York, EPA/ERT, Project Team Leader.** Assisted with the design and analysis of seed germination and root elongation studies to measure the effectiveness of bioremediation techniques for treatment of creosote-contaminated soils.
- **EA, New Jersey, EPA/ERT, Task Leader.** Directed a field ecological assessment of the impacts of contamination on the bog community at the Burnt Fly Bog Superfund site. Responsibilities included assisting EPA/ERT in study design; directing a field crew in the collection of small mammals, vegetation, and soils; analyzing and interpreting results; and presenting the findings in a report to EPA/ERT to be used in site remedial recommendations.
- **Risk Assessment Modeling, New York, EPA/ERT, Subtask Leader.** Working independently, adapted a food chain model described in the literature to predict the effects of contamination on four selected target vertebrate species (black duck, great-blue heron, muskrat, and red-winged blackbird) inhabiting a freshwater marsh. Derived model inputs from the literature, calibrated the model, and presented the results in a report to EPA/ERT

for use in site remedial recommendations.

- **EA, New Jersey, EPA/ERT, Senior Field Team Member.** Conducted a study of the impacts of contamination on a freshwater tidal marsh at the Kin-Buc Landfill Superfund site, and later directed an extended investigation of the lower Raritan River watershed. Assisted with the development of a field sampling design for the collection of muskrats and sediment samples. Collected, dissected, and processed muskrats for tissue analysis. Reviewed histopathological results, and assisted with data interpretation and report review.
- **EA, Wisconsin, EPA/ERT, Senior Field Team Member.** Collected soil and water samples used to determine the extent of contamination and sediment toxicity in a freshwater marsh at the OECI Superfund site. Directed field activities during one phase of the project, and prepared a report for EPA/ERT based on Geosoft contour mapping of site contamination.
- **EA, Delaware, EPA/ERT, Task Leader.** Assisted EPA/ERT with study design and decision-making flow chart to ascertain potential effects of contamination from a chemical facility on a freshwater tidal marsh at the Halby Chemical Superfund site. Directed a field crew in the collection of sediments for analysis and toxicity testing. Prepared a final report for use by EPA/ERT in determining future activities on-site.
- **Emergency Response/Ecological Assessment, Minnesota, EPA/ERT, Task Leader.** Provided field support to EPA/ERT in determining the extent and potential impacts of submerged drums found in Lake Superior. Used a remotely operated vehicle (ROV) to determine the number, extent, and condition of submerged drums found off-shore. Presented the results in a technical report submitted to EPA.
- **Ecological Assessment, Ohio, EPA/ERT, Senior Field Team Member.** Collected small mammals and soils, mapped vegetative cover types, delineated wetlands at the Ormet Superfund site. Assisted with report.
- **Wetland Delineation/Assessment, New Jersey, EPA/ERT, Task Leader.** Co-directed a wetland delineation of an area adjacent to the Lone Pine Landfill Superfund site using the federal jurisdictional procedure. Conducted a functional wetland assessment of surrounding wetlands using the Wetland Evaluation Technique (WET) modeling procedure. Provided remedial and mitigation recommendations to EPA/ERT.
- **EA/Site Characterization, Various Locations, EPA/ERT, Field Team Member/Senior Field Team Member.** Participated in site characterization projects geared at evaluating potential threats to human health. Responsibilities included direction of field staff; establishing and implementing field sampling designs; data collection using screening measurements or techniques such as immunoassay test kits, X-ray fluorescence (XRF) spectrometry, portable magnetometer, Hach kits, etc.; as well as sample collection from the following matrices: surface and subsurface soils, soil gas, surface water, and groundwater. Experienced in a variety of geographic areas throughout the continental United States.
- **Wetland Delineation/Assessment, New Jersey, Probst Enterprises, Inc., Project Manager.** Directed a large-scale wetlands delineation of a 3,000-acre site in the Pine Barrens region. Collated natural resources data assembled from several agencies with satellite and aerial photographs, collected field data to determine the wetlands boundary and state resource classification, and to make land use recommendations.
- **EIA/Review, Walkill, NY, Town of Walkill, Task Manager.** Reviewed data on wetlands, wildlife, stormwater management, and vegetation impacts; and provided critical comments for the development of a shopping mall.
- **EIA, New York, Saccardi and Schiff, Inc., Project Manager.** Evaluated wildlife habitat and provided vegetation cover map for use in environmental impact statement (EIS) for a proposed health care center in the Long Island Pine Barrens.
- **EA, New York, RPPW, Inc., Project Manager.** Evaluated wildlife habitat, prepared a vegetation cover map, and conducted a wetlands delineation for use in an EIS for a proposed residential development on a 200-acre deciduous forested site.
- **EA, New York, RPPW, Inc., Project Manager.** Evaluated wildlife habitat for an endangered turtle and migratory bird species, prepared a vegetation cover map, and conducted a wetlands delineation for use in an EIS for a proposed residential development in an urban forested area.
- **Wetland Delineations/Assessments, New Jersey and New York, Multiple Clients, Project Manager.** Conducted or assisted with wetland delineations at more than 80 sites. Authored proposals, directed field work, managed budgets, prepared reports for clients, met with regulatory agencies, advised clients, prepared

regulatory permits, and negotiated collections.

- **EISs, New Jersey, Multiple Clients, Project Manager.** Prepared EISs for municipal and state agencies on several projects. Collected or assisted with the collection of data on traffic impacts, air pollution, vegetation, wildlife, wetland impacts, and infrastructure impacts. Modeled noise impacts from highway improvements.
- **Ecological Studies, New Jersey, Rutgers University, Research Associate.** Independently designed study, trapped and mistnetted bird species, monitored their movements and behavior using radiotelemetry to test hypotheses regarding adaptive significance of communal roosting. Analyzed data and presented results in thesis.
- **Wildlife Damage Assessment, New Jersey, Confidential Client, Research Associate.** Assisted in the field collection of data on populations of three species of toads and assessed potential agricultural damage impacts. Censured toads by direct observation, pitfall trapping, and mark-recapture techniques.
- **Environmental Education, New Jersey, Rutgers University, Educator.** Taught general biology laboratory principles and assisted with the development of new curricula. Led a variety of age groups, ranging from elementary school to college groups, on field trips to the university experimental field station. Assisted with field vegetation sampling used for long-term monitoring of ecological succession of old field habitat.
- **Ecological Studies, Kenya, East Africa, Natural Resource Ecology Laboratory/Colorado State University (NREL/CSU), Research Associate.** Supervised field crew in collection of data on soils, hydrology, vegetative productivity, community structure, and plant physiology. Results were input into a model of ecosystem energy and nutrient flow used to study the grazing ecology of pastoral nomads inhabiting semiarid savanna regions.
- **Natural Resources Management, Colorado, USFWS, Research Assistant.** Assisted development of nationwide computer-based information system on in-stream flow considerations affecting freshwater fish habitat. Contacted agency personnel nationwide, prepared abstracts of technical articles, entered them into database.
- **Ecological Studies, Colorado, Colorado Division of Wildlife, Research Assistant.** Collected data on vegetative productivity as part of a long-term study on the nutritional ecology of sagebrush to large herbivores.
- **EA, Colorado, Colorado Cooperative Wildlife Research Unit (CCWRU), Research Assistant.** Interpreted LANDSAT satellite imagery and mapped vegetation types for use in the development of habitat evaluation models for the northern Rocky Mountain region.
- **EA, Wyoming, USFWS and Shoshone-Arapahoe Tribes, Contract Biologist.** Conducted an intensive vegetative inventory and animal census of a big game winter range on the Wind River Indian Reservation. Used a variety of vegetation sampling techniques to characterize community structure, evaluate grazing impacts, and assess habitat quality for ungulates.
- **Ecological Studies, Wyoming and Montana, CCWRU, Research Assistant.** Sampled vegetation using a variety of techniques and conducted measurements of other habitat variables for use in the development of wildlife habitat evaluation models for eight indicator species in the northern Great Plains region.
- **Ecological Studies, Colorado, U.S. Forest Service (USFS), Intern.** Assisted with censusing and behavioral observations of an introduced mountain goat population in the Sawatch Range. Responsibilities included hiking to and camping in remote areas, collecting data through a spotting scope, and filing monthly reports.
- **Natural Resource Management, Colorado, USFS, Intern.** Assisted with the administration, planning, and public relations of winter recreation programs. Collected hydrological data and censured elk populations. Assisted with a mark-recapture study of bighorn sheep.

Related Publications and Presentations

- Bovitz, P. and R. Brown. 2005. “Ecological Risk Assessment of the Former Nansemond Ordnance Depot.” Society of Environmental Toxicology and Chemistry, 26th Annual Meeting, Baltimore, MD.
- Bovitz, P. and R. Brown. 2003. “An Essential Fish Habitat (EFH) Assessment of a Tidal Mudflat in the Delaware River.” American Fisheries Society, 133rd Annual Meeting, Quebec City, Quebec.
- Kim, P.Y., P. Bovitz, B. Vanderveer, M. Donohue, K. Munney, and M. Sprenger. 1994. “The Use of Chemical, Histopathological, and Toxicity Evaluations To Investigate a Wildlife Kill.” Society of Environmental Toxicology and Chemistry 15th Annual Meeting, Denver, CO.

- Bovitz, P. and M. Sprenger. 1993. "A Bioaccumulation Study of Earthworms at a Superfund Site." Society of Environmental Toxicology and Chemistry 14th Annual Meeting, Houston, TX.
- Sprenger, M., K. Kracko, and P. Bovitz. 1993. "An Ecological Risk Assessment for Lead Ingested by Biota at a New Jersey Superfund Site." Society of Environmental Toxicology and Chemistry 14th Annual Meeting, Houston, TX.
- Sprenger, M., R. Bennett, R. Knight, and P. Bovitz. 1991. "Assessment of Contaminant Migration into a Delaware Tidal Marsh." Society of Environmental Toxicology and Chemistry 12th Annual Meeting, Seattle, WA.
- Bovitz, P., G. Buchanan, and M. Sprenger. 1991. "A Food Chain Model of Cadmium Accumulation in a Tidal Freshwater Marsh." Society of Environmental Toxicology and Chemistry 12th Annual Meeting, Seattle, WA.
- Munney, K. and P. Bovitz. 1991. "The Use of Muskrats as Bioindicators of Environmental Contamination." Society of Environmental Toxicology and Chemistry, 12th Annual Meeting, Seattle, WA.
- Beltman, D., M. Sprenger, R. Henry, P. Bovitz, and M. Huston. 1991. "Screening Field Bioassessment Tools at a Hazardous Waste Site." Society of Environmental Toxicology and Chemistry 12th Annual Meeting, Seattle, WA.
- Munney K. and P. Bovitz. 1991. "An Ecological Investigation of PCBs and Metals Contamination in a New Jersey Freshwater Tidal Marsh." Water Environment Federation Annual Conference, Toronto, ON.
- P. Bovitz. 1988. "Communal Roosting Behavior in American Robins and European Starlings as Related to Foraging Considerations." First International Conference of Behavioral Ecology, Vancouver, BC.

Professional Associations

- New Jersey Department of Environmental Protection Science Advisory Board, Ecological Sciences Committee, Standing Member (2010–present)
- New Jersey Department of Environmental Protection, Comparative Ecological Risk Project, Technical Committee (2001–2003)

Patrick J. Creegan, D.Eng., C.E., G.E., S.E.

Qualifications Summary

- Registered Civil, Structural, and Geotechnical Engineer in California. D.Eng. in Civil Engineering (UC Berkeley)
- More than 60 years' experience in the planning and design of heavy civil works, with principal emphasis on water development projects, embankment dams, and associated hydraulic structures and water conveyance and storage facilities.
- Specialized Expertise: Dam and Earthwork Engineering, Structural/Geotechnical Design of Heavy Civil Works, Construction Management
- In addition to having his own practice (Creegan and D'Angelo} for 21 years he was Junior Engineer with California Division of Highways (1 year) ; Engineer with Peter Kiewit in Alaska (1 year) ; Engineer with the Santa Clara Valley Water Conservation District on Anderson and Lexington dams (3 years) ; Senior Engineer with Bechtel (3 years) ; Chief Engineer of SOVIPE (Nicaragua), at the time the largest construction company in Central America (2 years) ; and was Projects Director / Regional Manager / Vice President / Chief Engineer then Dam Engineer with Parsons (31 years).
- Demonstrated experience in performing cost engineering/construction management for all phases of flood risk management related projects, to include: WPRR railroad bridge over the Feather River, Calif.; Coleman-Market Overpass, San Jose; number of bridges in San Jose, Santa Clara, and Saratoga.
- Has experience in the design and construction of bridges and large control structures in cold climates, including interaction with ice conditions. For years held a license as Civil Engineer in Alaska,
- Experience and familiarity of geotechnical practices associated with foundations and dams, fishways, earthworks, and/or pavement subgrades required for the construction of projects on and around navigation dams, specifically in exploration/testing and design.
- Past Chairman of ACI Committee 355. Years as active Member of ACI 350 (now a consultant Member). Past Member of Earthquake Committee and Materials Committee of USCOLD/USSD.
- Capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects.

Education

- D. Eng. (Civil Engineering) ,University of California, Berkeley, 1991
- M.S.(Geotechnical Engineering) , University of California, Berkeley, 1987
- B.C.E., Civil Engineering, University of Santa Clara, 1948

Certifications and Licenses

- Civil Engineer, California, #C8616
- Structural Engineer, California, #S 1044
- Geotechnical Engineer, California, #GE 248

Summary of Professional Experience

GENTERRA Consultants, Inc.– *Senior Associate Engineer (2011–present)*

- Provides technical review and technical input for the design and evaluation of existing dams and other facilities, for issues related to Civil Engineering, Geotechnical Engineering and Structural Engineering.

E-2 Consulting Engineers–*Casual, Dam Engineer (2003–2011)*

- Rehab and upgrade of Forest Lake Dam (Design and CM Team)

- Upgrade of spillway at Nacimiento Dam (CM Team)
- Construction of the Lower Salinas River Diversion (CM Team)

Parsons. Retired and Casual–*Dam Engineer (1996–2011)*

- Design review, rising of San Vicente Dam.
- Technical advisor, Arabian Canal, Dubai.
- Point Loma Outfall studies.
- Structural review Olivenhain-Lake Hodges penstock.
- Design review of Calaveras Dam, S.F.P.U.C.
- Member of the Core Review Team, Mosul and Adheim dams; Diyala Weirand Ramadi Barrage, Iraq.
- Senior Technical Advisor (foundations) on theParsons-Harza design team for Olivenhain Dam, San Diego County, the highest RCC dam in the U.S.
- Engineer-of-Record, San Sevaine Dam
- Engineer-of-Design, Lake Lanier tap, water conveyance tunnel and Lake Outfall, Gwinnette County, Georgia.
- Napanoch Diversion, MARCH III (Peru)
- Technical Advisor on Parson's water development projects

1979-1996 Vice President/Dam Engineer (1992-1996), Vice President – Dam Engineer (1990-1991), Vice President and Chief Engineer (1982-1987), Vice President/Technical Manager (1987-Date), Vice President and Northwest Regional Manager (1981-1982), Projects Director (1979-1980).

- Senior Technical Advisor to Metropolitan Water District of Southern California on the design of the Eastside (Diamond Valley) Reservoir Project. (4 years, full time).
- Technical Director of Northern California Water Resources and Ocean Engineering Department - Technical Director (company-wide) of Water Storage and Conveyance Projects.
- Quality Control Engineer for the firm's construction related projects, worldwide. Engineer-of-Record on all ES dam projects including the 240-foot (73 m) Ramona Dam, the 125-foot (38 m) Red Mountain Dam, and the 40 foot (12 m) San Sevaine Flood Control Dam, all under the U.S. Bureau of Reclamation Small Reclamation Project funding program. Served as Project Manager for water distribution, stormwater drainage, and sewerage collection and treatment system feasibility studies for five northern cities in the Hashemite Kingdom of Jordan. Engineer-of-Record for the twin-barreled 2,800 mm diameter sewage siphon under the Straits of Themistokleous near Athens, Greece. Project Manager and Engineer-of-Record for the A.C.W.D. Rubber Dam No. 3.
- Responsible for business development and technical direction of all projects performed in the northwest U.S. Projects included the Monterey outfall and 21 MGD, ADWF (80,000 cu. m/d) regional wastewater treatment plant, pump stations, pipelines, four small hydropower facilities and three dams.
- Responsible for all water and wastewater design projects emanating from the Alameda office. Consultant to the International Division on a river intake and three ocean outfalls in Sri Lanka. Served on the basis-of-design team for the Greater Bombay sewage project. Functioned as Engineer-of-Record on all ES dams.

SOVIPE Group –*Chief Engineer (1977–1979)*

- Largest general contractor in Central America.
- Chief Engineer/General Manager for Julio Villa y Asociados, Arquitectos-Ingenieros, S.A. (1977-1979)

Creegan&D'Angelo Civil Engineers– *Founding Partner and Chief Structural Engineer (1956–1977)*

- Served as Engineer-of-Record on a wide variety of projects involving heavy civil works, investigations and reports, and regional water studies for domestic and agricultural supply including the Master Plan of Water Importation for Santa Clara County (which has been implemented).
- Designs included 12 embankment dams and appurtenant facilities; over 150 structures including heavy foundations, commercial buildings, and industrial structures; port facilities; pipelines, pump stations, and reservoirs; roads and streets; and highway and railroad bridges.

- From 1973-1977, managed the Managua office (Creegan y D'Angelo, Ingenieros Civiles) This was exclusively a structural practice involving important new designs of housing, churches, hospitals, schools, theaters, a country club, hotels, and office buildings; and engineering the repair of over 4,000 residences and commercial buildings damaged by the 1972 earthquake.

Bechtel Corporation *–Engineer/Senior Engineer (1952–1956)*

- Participated in the design of the Pittsburg and Morro Bay steam plans for PG and E; U.S. Naval Station port facilities at Subic Bay, Philippines; and the Edmonton Pipe Mill.
- Responsible for preliminary planning for four major hydroelectric projects.
- Served on the team that reviewed the California Water Plan for the State legislature.

Santa Clara Water Conservation District *–Engineer (1950–1952)*

- Engineer on construction of Leroy Anderson Dam (365-foot [111 m] high earth and rock fill) and related works. Assistant Resident Engineer on the design and construction of the Lexington Dam (200-foot [61 m] high earth fill) complex of projects.

Peter Kiewit Sons Company, Inc.*–Field Engineer (1949–1950)*

- Engaged in projects totaling $8 million of building construction in Fairbanks, Alaska.

California State Division of Highways *–Engineer (1948–1949)*

- Responsible for surveying and construction inspection on a 5.6-mile (9 km) section of the four-lane U.S. Highway 101 between Miles Station and Pismo Beach.

Publications

- "Design Process - Anchor Bolts" (discussion), Pumping Station Design for the Practicing Engineer, Ann Arbor Press, 1981 (Editor Dr. Robert L. Sanks; Coauthors W. R. Kirkpatrick and N. L. Presecan).
- "Pipe Restraints: Design Fallacies," Journal of Transportation Engineering, American Society of Civil Engineering, November 1983.
- "Anchorage to Concrete: A Checklist for Proper Design," A.C.I. Concrete International, September 1987.
- "Newell Dam and the Loma Prieta Earthquake", U.S.C.O.L.D. Newsletter, March 1990.
- "Properly Coping With the Low Water-Cement Ratios Required by ACI 350R-83", A.C.I. Concrete International, April 1990.
- "The Uses and Potentials for Use of Asphalt in Embankment Dams and Elements of Embankment Dams." Doctoral Dissertation, November 1991.
- "Asphalt Concrete Water Barriers for Embankment Dams": Creegan&Monismith. ASCE Press, 1996.

PAPERS AND PRESENTATIONS

- "Damage Report on the Managua Earthquake of December, 1973," presented at Earthquake Engineering Conference, San Francisco, California, 1973 (Coauthor Pereira).
- "A Structural Engineer Reports on Five Years of Experience in Building Reparation in Post-terremoto Managua," presented at Earthquake Conferences at St. Louis, Missouri, and Santiago, Chile, 1977.
- "Anchorage to Concrete - Construction Considerations," presented at the Committee 355 Seminar, American Concrete Institute Convention, Los Angeles, California, March 1983.
- "Properly Coping with the Low Water - Cement Ratios Required by ACI 350R-83" presented at the Committee 350 Constructability Seminar, American Concrete Institute Convention, Atlanta, Georgia, February 1989.
- "Whitfield Reservoir Inlet-Outlet Pipeline" (w/Blair, Lynch and Weinbrenner), presented at the A.S.C.E. International Conference on Pipeline Design and Installation, Las Vegas, Nevada, March 1990.
- "Construction Considerations - Anchorage to Concrete," presented at the American Concrete Institute Convention, San Juan, Puerto Rico, November 1992.
- "The Asphalt Concrete Core for Embankment Dams", U.S.C.O.L.D Annual Lectures, 1997.

Professional Associations

- Life Member, Fellow American Society of Civil Engineers (ASCE)
- Fellow, American Concrete Institute (ACI)
- Life Member, Structural Engineer's Association of Northern California (SEAONC)
- Member, United States Society on Dams (USSD)

Elvidio V. Diniz, P.E., D. WRE

Qualifications Summary

- 42 years' professional experience in hydrology, civil engineering, and water resources for federal, state, local, industrial, and tribal clients, with 29 years on Mid. Rio Grande. Completed course work for PhD in Civil/Water Resources Engr. Served as Program Manager for Southwest Valley (Mid. Rio Grande) flood Damage Reduction Study for USACE, and for sediment control dams feasibility study on Rio Puerco and Rio Salado plus Drainage Management Plans for eight more tributaries to the Mid. Rio Grande
- Registered Professional Engineer in New Mexico and Texas for 32 years
- Diplomate, American Academy of Water Resources Engineers, Certificate No. 367
- Extensive experience associated with the six-step planning process, which is governed by ER 1105-2-100. Served as Program Manager for Southwest Valley (Mid. Rio Grande) flood Damage Reduction Study for USACE. PM for Borderland and Highway Diversion Channels H&H Study in El Paso TX for USACE.
- Experience related to the identification and evaluation of structural flood risk management alternatives for projects located in the southwestern U.S. PM for flood plain mapping along Mid. Rio Grande for FEMA. PM for levee and bosque (riprarian) improvements along Mid. Rio Grande for City of Albuquerque and Bernalillo, Sandoval and Valencia counties. PM for Southwest Valley (Mid. Rio Grande) flood Damage Reduction Study for USACE.
- Project Manager of record for six large-scale FEMA FIRM mapping studies.
- Expert witness in over 25 water-resources-related federal and state court cases.
- Preparation of large-scale regional land use and water planning studies (including water conservation plans).
- Design and construction supervision of stormwater management facilities.
- Thorough understanding of hydraulic, hydrographic and hydrologic principles and practice, derived from many years of water resource analyses, modeling, and construction plan development.
- Served for three years as Flood Plain Management Branch Chief at the Texas Water Development Board.
- Completed over 50 reports for USACE for planning feasibility and construction of water conservation, stream restoration, irrigation and flood control dams, and for safety evaluation of existing dams.
- Adjunct professor at University of New Mexico. Lectured on water resource issues in flood hydrology and hydraulics short courses, University of Texas at Austin; presented at numerous professional conferences.
- Adjunct Faculty, Civil Engineering Department, University of New Mexico, Hydrology and Hydraulics courses
- Instructor for HEC-1 and HEC-2 courses at University of Texas at Austin, and HEC-6 training at New Mexico DOT and U.S. International Boundary and Water Commission.
- Instructor, HEC-RAS, HEC-6, HEC-1, HEC-2, USEPA SWMM software packages, Austin and El Paso, TX, and Albuquerque and Santa Fe, NM
- Instructor, Sediment Sampling Protocols, El Paso, TX
- Instructor, Porous Pavement Analysis and Design, Austin, TX, Southampton, UK, and Singapore
- Instructor, various short courses on Flood Plain Management, Association of State Flood Plain Managers, Albuquerque and Socorro, NM, Phoenix, AZ, and Madison, WI.
- Author of Version 3.0 of the U.S. EPA Storm Water Management Model and the U.S. Bureau of Reclamation's Program BURDAT; and Beta tester for USACE Hydrologic Engineering Center Programs HEC-1, HEC-2, HEC-RAS and HEC-RMA, AMAFCA'S AHYMO, and for U.S. Office of Water Resources Technology Programs SIMYLD-II, RESOP-1, SIM-IV, QUAL 2E, HYD-1, HYDTID and SEDMT.
- Author of Porous Pavement, Phase I, Design and Operational Criteria, EPA 600 2-80 135 for Municipal Environmental Research Laboratory, USEPA
- Expert, capable and efficient computer modeler in all of the models listed above as well as FLO-2D,

MODFLOW, BOSS-DAMBRK, FLDWAV, QUICK-2.0, UNET 2.1, FESWMS, TR-20, TR-55 ILLUDAS, and QUAL-ILLUDAS.

Education

- Ph.D., Civil Engineering (course work complete, dissertation pending)—University of Texas at Austin
- M.S., Civil Engineering, University of New Mexico, 1970
- B.S., Civil Engineering, Catholic University of America, 1968

Certifications and Licenses

- Professional Engineer, State of New Mexico (No. 7111, 2010)
- Professional Engineer, State of Texas (No. 35485, 2010)

Summary of Professional Experience

Weston Solutions, Inc., Albuquerque, N.M. *–Senior Client Service Manager (2009–Present)*

Resource Technology, Inc., Albuquerque, N.M. *–President, Principal Engineer (1981–2009)*

Key Projects

- **Southwest Valley Flood Damage Reduction Feasibility Study (FS) and Drainage Facility Design, Albuquerque, NM, Project Manager.** Project Manager for 181-square mile area Drainage Management Plan and drainage facilities design. Conducted hydrologic and hydraulic analysis of detention ponds, drainage channels, storm drains, and culverts. Designed erosion control structures at critical locations, and a new outfall channel to the Rio Grande, with flood control gates at the river levees.
- **Drainage Management Plans and Drainage Facility Design for Pueblo of Isleta, NM, Enterprise Area and Golf Course, Pueblo of Isleta, Project Manager.** Completed Drainage Management Plans for this 6.5-square mile area using AHYMO and HEC-RAS programs. Drainage facilities included three new detention ponds, rehabilitation of three existing detention ponds, diversion channels, storm drains, culverts, and erosion control structures. Resolved dam safety issues on all ponds and coordinated future land use development projects to be initiated after drainage improvements are constructed.
- **Boca Negra Arroyo Drainage Management Plan, Albuquerque, NM, Albuquerque Metropolitan Arroyo Flood Control Authority, Project Manager.** Conducted the Albuquerque Metropolitan Area Flood Control Authority funded hydrologic study of Boca Negra/Mariposa Arroyo drainage basin. Used results to conduct hydraulic analysis and floodplain mapping of existing arroyo, channel, and detention dam system downstream of Petroglyph National Monument resulting in a Drainage Management Plan. Designed naturalistic channels and detention dams to control flood and erosion damage to protect the monument. Coordinated project, including public meetings, with National Park Service (NPS), planning, and environmental groups, and all local government agencies.
- **North Albuquerque Acres/Sandia Heights Drainage Study, Albuquerque, NM, Project Manager**. Conducted extensive hydrologic (AHYMO) modeling, analysis, and evaluation of major arroyos; HEC-RAS-based hydraulic analysis; analyzed potential avulsion locations; calculated sediment transport capacity; designed channel linings, storm drain systems, and new crossing structures; and developed erosion control plan. Included street, drainage, and stormwater conveyance design, public meetings, and environmental documentation.
- **Various Conservancy District Projects, Sandoval, Bernalillo, Valencia, and Socorro Counties, NM, Middle Rio Grande Conservancy District, Project Manager.** Conducted several projects in the middle Rio Grande valley including water reclamation projects at San Felipe, Santa Ana, and Isleta Pueblos; design of high groundwater drainage improvements at Pena Blanca and Isleta Pueblo; and development of Bosque Management Plan for the entire valley. Design projects include diversion dams, erosion control, ditch lining,

drain rehabilitation, irrigation works, and system operations and maintenance (O&M).

Espey, Huston and Associates, Inc., Albuquerque, N.M. –*Senior Staff Engineer (1978–1981)*

Espey, Huston and Associates, Inc., Austin, Tex. –*Staff Engineer (1975–1978)*

Texas Department of Community Affairs, Austin, Tex. –*Civil Engineer (1974–1975)*

Texas Water Development Board, Austin, Tex. –*Water Resources Engineer (1970–1974)*

District of Columbia Department of Water Resources (1967–1969)

LITIGATION AND EXPERT WITNESS EXPERIENCE

Federal and State Courts

U.S. Court of Federal Claims

- Isleta Pueblo Surface and Groundwater Drainage Mismanagement Claims – for Sonosky, Chambers, Sachse, Endreson, & Mielke, P.C.

U.S. District Court for New Mexico

- Isleta Dam Trespass Claim, Isleta Reservation, NM – for Sonosky, Chambers, Sachse, Endreson, & Mielke, P.C.
- Bank Erosion at Elephant Butte Reservoir, Sierra County, NM – for U.S. Attorney Office
- Church Drainage Ponds and Groundwater Problems, Sandoval County, NM – for Bennie Lovato et.al.
- Quemado Dam Spillway Slope Erosion, Catron County, NM – for U.S. Attorney Office
- Arroyo Chinguage Bank Erosion and Flooding, Ohkay Owingeh, NM – for U.S. Attorney Office
- La Puente Dam Failure and Acequia Erosion Damage, Rio Arriba County, NM – for U.S. Attorney Office
- Soda Dam Erosion/Sedimentation, Sandoval County, NM – for U.S. Attorney Office
- Ambrosio Chavez Ditch Operation, Lincoln County, NM – for U.S. Attorney Office
- Ever Ready Oil Company, Inc. Gasoline Contamination of Groundwater, Corrales, NM – for Civerolo, Hansen and Wolf, P.A.

U.S. District Court for Arizona

- Hydraulic, Erosion, and Sediment Yield/Transport for Santa Cruz River, Maricopa and Pinal counties, AZ – for Jones, Skelton, & Hochuli, PLC

U.S. District Court for the Central District of California

- Hydrology and Hydraulics Modeling for Orcutt Creek and Wetlands Preservation, Santa Barbara County, CA – for Adam Brothers Farming, Inc. et al.

U.S. District Court for Harris County, Texas

- Brickhouse Gully Flooding, Harris County, TX – for WAUSAU Insurance Company
- Turkey Creek Flooding, Harris County, TX – for Dannenbaum Engineering Corporation

New Mexico District Courts

- Loma Larga Road Flooding, Corrales, NM – for Modrall Sperling Roehl Harris & Sisk, P.A.
- Nogal Canyon Erosion, Sediment Transport, Levee Failure and Flooding, Socorro County, NM – for Riley & Shane, P.A.
- Brook Apartments Flooding, Albuquerque, NM – for Stacey A. Johnson, P.A.
- The Beach Water Park Flooding and Erosion Damage, Albuquerque, NM – for Robert Montgomery and Charles Aspinwall
- Melrose Bombing Range, Ground Water Quantity and Quality, Roosevelt County, NM – for Cannon Air Force Base
- Christine Street, House Flooding and Erosion Problem, Rio Rancho, NM – for James A. Chavez, P.C.
- Water Supply for Estancia Basin Subdivision, Torrance County, NM – for Messina, Madrid & Maynez, P.A.
- Four Hills Country Club Flooding, Albuquerque, NM – for Hatch Beitler Allen & Shepherd, P.A.

Texas District Courts

- Flooding Problems in Franklin Hills Subdivision, El Paso, TX – for Gordon Mott & Davis P.C.

Federal Agencies

International Boundary and Water Commission

- Water allocations between Texas and Mexico in Amistad and Falcon Reservoirs

Rio Grande Compact Commission (Texas)

- Water allocations between Texas and New Mexico in West Texas

U.S. Environmental Protection Agency

- National Urban Runoff Program (NURP) – for Municipal Environmental Research Laboratory

Federal Emergency Management Agency

- Flood Insurance Mapping Criteria – El Paso and Fort Bend Counties, Texas

U.S. Bureau of Reclamation

- U.S. Study Commission – Texas

U.S. Natural Resources Conservation Service

- Flood damage assessments at New Braunfels and Seguin, Texas – Award of Recognition from Governor of Texas

New Mexico State Agencies

New Mexico State Engineer Office

- Rio San Jose water rights adjudication – surface water/civil engineering expert
- Rio Jemez water rights adjudication – water resources expert
- Water rights permit applications, declarations and transfers – Los Lunas Schools, Philmont Scout Ranch, Belen Consolidated Schools, private interests

New Mexico Environment Department

- Total Maximum Daily Load (TMDL) Allocations for Jemez River Basin
- Wastewater discharge permits
- Ground water contamination hearings

Middle Rio Grande Conservancy District

- Irrigation system operations

Albuquerque Metropolitan Arroyo Flood Control Authority

- Floodplain, erosion and sediment control enforcement
- Drainage and erosion control criteria development

Other State Agencies – Testimony on Local Issues

- Texas Water Development Board
- Texas Water Commission
- Arizona Department of Water Resources
- Illinois Environmental Protection Agency
- Illinois State Water Survey
- Washington Suburban Sanitary Commission
- District of Columbia Department of Water Resources
- Harris County Flood Control District, Texas
- Lower Colorado River Authority, Texas
- Brazos River Authority, Texas
- Trinity River Authority, Texas
- Nueces River Authority, Texas

Publications and Presentations

- Diniz, E.V. 2011. “Dam Removal Impacts – Planning Considerations.” National Conference on Ecosystem Restoration, Baltimore, MD.
- Diniz, E.V. and L. Janney. 2011. “Maintenance of Stormwater Management Systems, Stream Restoration, and

Use of Native Plants." Water Management Practices for Department of Defense Installations, Carlsbad, CA.

- Diniz, E.V. 2011. "Green Infrastructure at the Site Scale." National Green Infrastructure Conference, Shepherdstown, WV.
- Diniz, E.V. 2010. "Operating Water Resources Systems to Comply with River Compact Water Deliveries." Western Coalition of Arid States, Albuquerque, NM.
- Diniz, E.V. 2008. "San Ysidro River Park and Santa Fe River Channel Restoration." New Mexico Flood Plain Managers Association, Alamogordo, NM.
- Diniz, E.V. and M. Smith. 2005. "Rainfall-Runoff Modeling in New Mexico – Where Are We and Where Do We Go?" New Mexico Water Research Symposium, New Mexico Tech, Socorro, NM.
- Diniz, E.V. 2005. "Hydraulics for Flood Plain Managers." Short Course, Association of State Flood Plain Managers Conference, Madison, WI.
- Diniz, E.V. and M. Smith. 2002. "Roswell Drainage Improvements." American Society of Civil Engineers. Fall Meeting, Roswell, NM.
- Diniz, E.V. 2002. Total Maximum Daily Load (TDML) Report for the Jemez River Watershed, Santa Fe, New Mexico. New Mexico Environment Department.
- Diniz, E.V. 2001. "Drainage and Flooding in Low Gradient Valley Bottomlands." Association of State Flood Plain Managers, Arid West Conference, Albuquerque, NM.
- Diniz, E.V. 1999. Flood Insurance Study, City of Portales, Roosevelt County, New Mexico. Federal Emergency Management Agency, Washington, DC.
- Diniz, E.V. 1999. "Facilitating Drainage Reviews in Alluvial Flooding Areas." Association of State Flood Plain Managers, Arid West Conference, Las Vegas, NV.
- Diniz, E.V. 1998. "FEMA Concerns in Flood Plain Mapping with Sedimentation in Flood Control Basins." New Mexico Flood Plain Managers Association, Fall Workshop, Albuquerque, NM.
- Diniz, E.V. and G. Nemeth. 1998. Drainage Manual, Volume II, Hydraulics, Sedimentation and Erosion. New Mexico State Highway and Transportation Department, Santa Fe, NM.
- Diniz, E.V. 1998. "Flood Plain Mapping Where No Channels Exist." New Mexico Flood Plain Managers Association, Annual Conference, Albuquerque, NM.
- Diniz, E.V., D. Eidson, and M. Bourgeois. 1995. "Sediment Supply and Transport Comparison for the Middle Rio Grande." In: Water Resources Engineering, W.H. Espey and P.G. Combs, eds., American Society of Civil Engineers, San Antonio, TX.
- Diniz, E.V. 1995. "The New Mexico State Science and Engineering Fair; Future ASCE Members?" American Society of Civil Engineers, Section Newsletter, Albuquerque, NM.
- Diniz, E.V. 1995. "When is a Diversion Dike a Dam?" American Society of Civil Engineers, New Mexico-Texas Joint Section Meeting, El Paso, TX.
- Diniz, E.V. 1994. "Regional Water Planning for New Mexico." American Society of Agricultural Engineers Annual Meeting, Socorro, NM.
- Diniz, E.V. 1994. "Sediment Study on the Rio Grande – Supply and Transport." Proceedings of the 39th Annual New Mexico Water Conference. New Mexico Water Resources Research Institute, Albuquerque, NM.
- Diniz, E.V. 1994. "Calabacillas Arroyo Erosion and Grade Control Structures." American Society of Civil Engineers Spring Meeting, Albuquerque, NM.
- Diniz, E.V. 1993. "Hydrologic and Water Quality Comparisons of Runoff from Porous and Conventional Pavements." In: Integrated Stormwater Management, K.K. Chin, ed. The Environmental Engineering Society of Singapore and U.S. Environmental Protection Agency, Singapore.
- Diniz, E.V. 1992. "Erosion Management in a Southwestern Arroyo – A Naturalistic Approach." In: Proceedings of the 1992 ASFPM Arid West Flood Conference, Association of State Flood Plain Managers, Las Vegas, NV.
- Diniz, E.V. and R.M. Oberdorfer. 1992. "Regional Water Planning: Balancing Management Constraints and Socio-Cultural Values in Macro Scale Modeling." American Water Resources Association Annual Conference,

Socorro, NM.

- Diniz, E.V. 1991. "Optimal Management of Jemez River Basin Water Resources." Conference on Rio Grande Basin Hydrology, American Water Resources Association, Socorro, NM.
- Diniz, E.V. 1991. Outstanding American Water Resources Achievement Award, Presenter. International Symposium on Hydrology and Water Resources Education and Training, Universidad Autonoma de Chihuahua, Chihuahua, Mexico.
- Diniz, E.V. 1990. "Requirements for Emergency Action Plans." Dam Safety Awareness Workshop, New Mexico State Engineer Office, Las Cruces, NM.
- Diniz, E.V. 1989. "Dam Breaks on Alluvial Fans." In: Proceedings from the Sixth Annual Conference, Association of State Dam Safety Officials, Albuquerque, NM.
- Diniz, E.V. 1987. "The Prudent Line for Arroyos – What is it?" Civil Engineering Seminar, University of New Mexico, Albuquerque, NM.
- Diniz, E.V. 1987. "Flood Potential on Urbanized Alluvial Fans as a Result of Dam Breaks." Fourteenth Annual Conference, Water Resources Planning and Management Division, American Society of Civil Engineers, Kansas City, MO.
- Diniz, E.V. 1984. Stormwater Hydrological Characteristics of Porous and Conventional Paving System. U.S. Environmental Protection Agency Publication, Washington, DC. EPA-600/52-83-106.
- Diniz, E.V. 1984. "Quality of Urban Runoff in Albuquerque, New Mexico." Selected Papers on Water Quality and Pollution in New Mexico. Hydrologic Report #7. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM.
- Diniz, E.V. 1982. "Design Factors for Porous Pavement Areas." Proceedings Southwest Regional Symposium and Workshop on Urban Storm Water Management. Texas A & M University, College Station, TX.
- Diniz, E.V. 1982. Ground Water Recharge and Urban Runoff Detention at Tucson, Arizona. U.S. Army Corps of Engineer, Los Angeles District, Tucson Urban Study.
- Diniz, E.V. 1981. Storm Water Management Model – Supplement to the Users Manual. U.S. Environmental Protection Agency, Washington, DC.
- Diniz, E.V. 1981. "Comparison Between Soft and Hard Lined Channels." American Society of Civil Engineers, Las Cruces, NM.
- Diniz, E.V. 1981. "Design and Operational Criteria for Porous Pavements." Proceedings of the SWMM Users Group Meeting. U.S. Environmental Protection Agency.
- Diniz, E.V. 1980. "Economic Evaluation of Erosion-Resistant Storm Water Channels." American Society of Civil Engineers, El Paso, TX.
- Diniz, E.V. 1980. Porous Pavement, Phase 1 – Design and Operational Criteria. U.S. Environmental Protection Agency, Washington, DC. Publication EPA-600/2-80-135.
- Diniz, E.V. 1979. "Enhancement of the EPA Storm Water Management Model for Use with Natural Drainage Plans." Proceedings, Hydrologic Transport Modeling Symposium. American Society of Agricultural Engineers, New Orleans, LA.
- Diniz, E.V. 1979. "Channel Stabilization Case Studies – Pueblo Colorado, and Alpine, Texas." Conference on Arroyo Stabilization in Erosive Soil, Albuquerque Metropolitan Arroyo Flood Control Authority, Albuquerque, NM.
- Diniz, E.V. 1979. "Urban Water Quality at Albuquerque, New Mexico." Soil Conservation Society of America, Albuquerque, NM.
- Diniz, E.V. 1979. "Design and Evaluation of Porous Pavement Areas." Fifteenth American Water Resources Conference, Water Resources Management in a Changing Society, Las Vegas, NV.
- Diniz, E.V. 1979. "Modeling of Non-Point Pollution Generated by Storm Water Runoff." American Society of Civil Engineers, Santa Fe, NM.
- Diniz, E.V. 1979. Maximum Utilization of Water Resources in a Planned Community – Application of the Storm

Water Management Model. U.S. Environmental Protection Agency, Washington, DC. Publication EPA-600/2-79-050C, with W.H. Espey, Jr.

- Diniz, E.V. 1979. "Water Quality Prediction of Urban Runoff – An Alternative Approach." Proceedings, Storm Water Management Model (SWMM) Users Group Meeting. U.S. Environmental Protection Agency, Washington, DC. Publication EPA-600/9/79-026.
- Diniz, E.V. 1978. Hydrology Design Memorandum, Rio Puerco and Rio Salado Watersheds, Rio Grande Basin, New Mexico. U.S. Army Corps of Engineers, Albuquerque District, with G. Guhl.
- Diniz, E.V. 1978. "Selected Approaches to Urban Watershed Response Modeling." Proceedings of the Symposium on Urban Watershed Management: Flooding and Water Quality. W.M. Rice University, Houston, TX.
- Diniz, E.V. 1978. "Modification to the Storm Water Management Model and Application to Natural Drainage Systems." Proceedings of the International Conference on Urban Storm Drainage. University of Southhampton, Southhampton, United Kingdom.
- Diniz, E.V. 1977. Flood Plain Information Report on Deer Creek and Tributaries, Crowley, Texas. U.S. Army Corps of Engineers, Fort Worth District.
- Diniz, E.V. 1977. Hydrology Design Memorandum, Alpine, West Moss and Palsano Creek Watersheds, Pecos River Basin, Texas. U.S. Army Corps of Engineers, Albuquerque District.
- Diniz, E.V. 1977. "Hydrology and Hydraulics." General Design Memorandum – Phase I, Running Water Draw Watershed, Flood Protection Project, Plainview, Texas. U.S. Army Corps of Engineers, Fort Worth District.
- Diniz, E.V. 1976. "Quantifying the Effects of Porous Pavements on Urban Runoff." Proceedings of the National Symposium on Urban Hydrology, Hydraulics, and Sediment Control. Lexington, KY. July 1976.
- Diniz, E.V. 1976. "Modeling Urban Runoff from a Planned Community." Environmental Modeling and Simulation. U.S. Environmental Protection Agency, EPA-600/9-76-016, Washington, DC.
- Diniz, E.V. and J.C. Klein. 1975. Flood Plain Information Report for Willow Fork of Buffalo Bayou Above Barker Reservoir, Fort Bend County, Texas. U.S. Army Corps of Engineers, Galveston District.
- Diniz, E.V. and W.H. Espey, Jr. 1975. "Application of the Storm Water Management Model to a Natural Drainage System in a Planned Community." Second Annual National Conference on Environmental Engineering Research, Development and Design, University of Florida– Gainesville, Gainesville, FL.
- Diniz, E.V. and W.L. Moore. 1974. "Changes in the Sedimentation Characteristics of an Urbanizing Watershed, Dallas and Collin Counties, Texas." Proceedings, National Symposium on Urban Rainfall and Runoff and Sediment Control. University of Kentucky–Lexington. pp. 189-198.
- Diniz, E.V. 1973. Program BURDAT -– A Digital Computer Model for the Computation of Runoff Depletion, User Reference Manual. Texas Water Development Board, Austin, TX. WD 9000 Phase III.

Professional Associations

- American Society of Civil Engineers: Life Member, Past President – New Mexico Section; National Committee on Urban Erosion and Sediment Control, Past-Chairman; National Urban Water Resources Committee, Past-Member; New Mexico Section, Past-Water Resources Director
- New Mexico Floodplain Managers' Association, Technical Committee Chairman, Past-Vice Chair
- American Water Resources Association – New Mexico Section, Past-President
- Association of State Flood Plain Managers
- Association of State Dam Safety Officials
- International Erosion Control Association
- Presenter - Outstanding American Water Resources Achievement Award, Chihuahua, Mexico: International Symposium on Hydrology and Water Resources Education and Training, Universidad Autonoma de Chihuahua, Mexico.

David Jaffe, PhD, PE, D.WRE

Qualifications Summary

- PhD, Civil & Environmental Engineering. Registered Civil Engineer in California and Arizona.
- Diplomate, American Academy of Water Resources Engineers; Member, American Society of Civil Engineers
- Involved in hydraulic/hydrologic engineering including computational methods and alluvial/fluvial transport and flood control research and design for over 15 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. Focus is on flood control implementation and design. Areas of expertise are numerical modeling, flood control, sediment transport, hydraulic design and related permitting.
- Extensive experience associated with flood risk management projects with emphasis on diversion channel design and large river control structures. Selected projects include: Santa Clara River Levee Design, Los Angeles, CA; Callegas & Coneio Creeks Levee Improvement Design, Ventura County, CA; Mississippi River Pointe a la Heche Wetland Diversion, Pointe a la Heche, LA; Whitewater River Flood Control Improvements, Riverside County, CA.
- Extensive experience in research and professional projects involving large, urban public works, flood risk and flood control including: Research concerning mitigation of extreme flooding events in urban settings by tactical depression wave control; Santa Clara River & Tributaries buried soil cement bank protection design, Los Angeles & Ventura Counties, CA; Whittmann Study Area H-3 Fan, 2-D hydraulic and sediment transport modeling, Maricopa County, AZ; Ft. Tejon Road 2-D hydraulic modeling & flood control improvements, Palmdale, CA; Conejo & Calleguas Creek 2-D hydraulic modeling & flood mitigation design, Ventura County, CA; San Jacinto River Sediment transport numerical modeling &levee extension toe-down design, Riverside County, CA; San Juan Creek sediment transport analysis, numerical modeling & levee toe-down design, Orange County, CA; Mississippi River levee diversion and wetland restoration, Pointe a la Hache, LA.
- Conducted and led teams on numerous flood flow frequency analyses for modeling and design efforts.
- Taught professional level 1- & 2-D computational hydraulic & sediment transport courses. Author of multiple research papers, conference presentations and training manuals in hydrology, hydraulics, sediment transport, and flood control/mitigation, and numerous flood control design reports, studies and technical project analyses.
- Used USACE hydrologic and hydraulic computer models including HEC-1, HEC-HMS, HEC-2, HEC-RAS, FLO-2D, and HEC-DSS for flood control design including USACE projects such as San Jacinto River Sediment transport numerical modeling &levee extension toe-down design and others.
- Performed multiple studies for projects involved with flood risk, return interval statistics & determination, data collection & quality control, risk analysis, and related design.
- Conducted numerous modeling studies involving flood control, impacts & hazards analysis, hydrology, hydraulics, sediment transport, levee design, two-dimensional hydraulics, and basin design using HEC-FDA, HEC-HMS, HEC-ResSim, HEC-RAS, HEC-2, FLO-2D, Groundwater Modeling System (GMS), and Utexas4 software.
- 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.

Education

- PhD, Civil & Environmental Engineering, University of California, Irvine, 2002
- UC Regent's Dissertation Fellow, 2001–2002
- MS, Civil & Environmental Engineering, University of California, Irvine, 2000
- MS, Physical Marine Science, University of Southern Mississippi/Stennis Space Center, 1998
- BA, Earth Science, Johns Hopkins University, 1994

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 (563)

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.

- 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.
- 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.
- 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.
- 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.
- 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. 2011. “Channel forming discharge and historical sediment transport analysis in arid southwestern streams: implications for jurisdiction.” Floodplain Management Association Annual Conference. San Diego, California.
- 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.

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 general charge questions provided by the U.S. Army Corps of Engineers (USACE) to support the Phase 2 IEPR for the Rio Grande project are listed below. This was provided to the panel to guide its review.

C.1 Objectives

The objective of this task is to conduct an IEPR of the Rio Grande Floodway, San Acacia to Bosque Del Apache, New Mexico Flood Risk Management GRR and SEIS in accordance with procedures described in the Department of the Army, USACE EC No. 1165-2-209, dated 31 January 2010; Review of Decision Documents, dated 22 August 2008; and the OMB Final Information Quality Bulletin for Peer Review released 16 December 2004. The IEPR consists of a two-phased review: Phase 1 – review of the Alternative Formulation Briefing (AFB) Read-Ahead Material, and Phase 2 – review of the draft GRR, SEIS, and Appendices that contain the TSP subject to USACE vertical team review and approval. The scope of this charge includes only Phase 2 activities.

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.

The panel will identify, recommend, and comment upon the assumptions underlying the analyses as well as evaluating the soundness of models and planning methods. The panel should be able to evaluate whether the interpretations of analyses and conclusions are technically sound and reasonable, provide effective review in terms of both usefulness of results and creditability, and have the flexibility to bring important issues to the attention of decision makers. The panel may offer opinions as to whether there are sufficient technical analyses upon which to base the ability to implement the project. The panel will address factual inputs, data, the use of geotechnical analyses, assumptions, and other scientific and engineering tools/methodologies to inform decision-making.

C.2 Documents Provided

The following documents pertaining to the IEPR were provided:

Phase 2

- *Rio Grande Floodway, San Acacia to Bosque del Apache, Socorro County, New Mexico Draft GRR/SEIS* (approximately 230 pages)
- Appendix A (Letters of Interest) (10 pages)
- Appendix B (Section 404(b)(1) Evaluation) (approximately 10 pages)
- Appendix C (Biological Assessment) (approximately 100 pages)
- Appendix D (Final Supplemental Environmental Impact Statement-Rio Grande Floodway-San Acacia to Bosque del Apache Unit, Socorro, NM, July 1992) (approximately 500 pages)
- Appendix E Supplemental Fish and Wildlife Coordination Act Report, 1997 (89 pages)
- Appendix F Technical Appendices (approximately 263 pages)

  - F-1 (Civil Engineering)
  - F-2 to F-3 (Hydrology, Hydraulics, Sedimentation)
  - F-4 Preliminary Mitigation Plan
  - F-5 (Geotechnical Engineering)
  - F-6 (HTRW)
  - F-7 (Cost Estimates)
  - F-8 (Cultural Resources)
  - F-9 (Ecological Resources)
  - F-10 (Economics)
  - F-11 (Real Estate)
- Appendix G Review and Comment on Draft GRR/SEIS-II (Public Comments only)
- OMB's *Final Information Quality Bulletin for Peer Review* issued 16 December 2004 memorandum M-05-03
- USACE EC No. 1165-2-209, *Civil Works Review Policy*, dated 31 January 2010
- Charge questions referenced to specific sections within the report and appendices.

C.3 Charge for Peer Review

The purpose of the IEPR is to analyze the adequacy and acceptability of economic, engineering and environmental methods, models, data and analyses performed for the GRR and SEIS. The review will be limited to technical review and will not involve policy review. The IEPR will be conducted by SMEs with extensive experience in engineering, economic, and environmental issues associated with flood protection feature design. The SMEs will be "charged" with responding to specific technical questions as well as providing a broad technical (engineering, economic, and environmental) evaluation of the overall project.

C.4 General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Rio Grande Floodway GRR and SEIS. Please focus on your areas of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the panel will be asked to provide an overall statement related to 1 and 2 below per USACE guidance (Engineering Circular 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.
7. 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.5 General Charge Questions

1. To what extent has it been shown that the project is technically sound for the purposes of informing an investment and plan selection decision?
2. Are the assumptions that underlie the engineering, economic, and environmental analyses sound?
3. Are the engineering, economic, and environmental methods, models and analyses used adequate and acceptable to inform an investment and plan selection decision?
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. Does the SEIS satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
7. 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.

C.6 Safety Assurance Review Questions

1. Were the methods used to evaluate the condition of the structures adequate and appropriate given the circumstances to inform an investment and plan selection decision?
2. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
3. Do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases?
4. Are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction for the purpose of informing an investment and plan selection decision?
5. Have the hazards that affect the structures been adequately documented and described, including seismicity, subsidence, and/or other externalities?
6. Are the models used to assess hazards appropriate?
7. Are the assumptions made for the impacts appropriately documented and explained?
8. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?

9. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?
10. Does the physical data and observed data provide adequate information to characterize the structures and their performance to inform an investment and plan selection decision?
11. 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?
12. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?
13. From a public safety perspective, is the proposed alternative reasonably appropriate or are there other alternatives that should be considered?
14. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?
15. Do the engineering alternatives and their associated costs appear reasonable to inform an investment and plan selection decision? Do the benefits and consequences appear reasonable?

C.7 Specific Charge Questions

Draft GENERAL Reevaluation Report and Supplemental Environmental Impact Statement II

Section 2 – Existing Conditions

1. Was the discussion of environmental and natural resources sufficient to characterize current baseline conditions and to allow for evaluation of forecasted conditions (with and without proposed conditions)?
2. Were the analyses of the existing environmental and natural resources within the study area sufficient to support the estimation of impacts for the alternatives?
3. For your particular area of expertise, provide an in-depth review of whether the analyses of the existing social, financial, and natural resources within the project area are sufficient to support the estimation of impacts of the array of alternatives.

Section 3 – Future Without Project Conditions

1. 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?
2. Were the future conditions assumptions associated with the river geomorphology, sedimentation and aggradation, water budget and management practices, and hydraulic analyses appropriate?
3. Were the without-project conditions clearly and adequately described?
4. Has anything significant been overlooked in the evaluation of the future without-project conditions? Please explain.

Section 4 – Plan Formulation

1. Were the assumptions made for use in developing the future with project conditions for each alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?
2. Was a reasonably complete array of possible measures considered in the development of alternatives?
3. Has the criteria to eliminate plans from further study been clearly described?
4. Is each of the different alternative plans clearly described?
5. Are the changes between the without and with project conditions adequately described for each alternative?
6. Have comparative impacts been clearly and adequately described?
7. Are there any unmitigated environmental impacts not identified and if so could they impact project designs?

Section 5 – Description of the Final Array of Alternatives

1. Was the alternative evaluation process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?
2. Discuss the extent to which risk and uncertainty in the plan selection has been addressed.
3. Are future operation, maintenance, repair, replacement, and rehabilitation efforts adequately described and are the estimated cost of those efforts reasonable for each alternative?
4. Please comment on the completeness of the recommended plan and its features (i.e., will any additional efforts, measures, or projects be needed to realize the expected benefits?).
5. Are the costs adequately justified?
6. Please comment on the likelihood of the recommended plan will achieve the expected outputs.

Section 6 – Foreseeable Effects of the Proposed Action and Alternatives

1. Have impacts to significant resources been adequately and clearly described?
2. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?
3. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?
4. Have impacts from borrow and disposal areas, levees, structures and construction access areas been adequately and clearly described?
5. Are cumulative impacts adequately described and discussed? If not, please explain.
6. Are indirect impacts adequately described and discussed? If not, please explain.

7. Are unavoidable adverse environmental effects adequately described and discussed? If not, please explain.

Section 7 – Post Authorization Changes

1. Based on your experience with similar projects and using the public involvement documentation made available in the GRR/EIS, the Policy Guidance Memorandum dated June 2, 2012, and the Public Meeting Fact Sheet for San Acacia to Bosque del Apache Unit Socorro, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest? Should additional public outreach and coordination activities be conducted?

Appendix B Section 404(b)(1) Evaluation

1. Have the short-term and long-term impacts associated with the discharge of dredged and fill material been adequately and clearly described?

Appendix C Biological Assessment

1. Is the biological assessment of aquatic and terrestrial resources in the project area complete and accurate?

Appendix D Final SEIS 1992

1. Does the current GRR/SEIS consistently present information from the 1992 EIS?
2. Was the current GRR/SEIS updated from the 1992 SEIS where appropriate?

Appendix E Supplemental Fish and Coordination Act Report, 1997

1. Does the current GRR/SEIS consistently present information from the 1997 Supplemental Fish and Coordination Act Report?

Appendix F Technical Appendices

1. To what extent are the input parameters, methods, models and analyses used in the flood risk analysis appropriate to inform an investment and plan selection decision and consistent with current best management practices?
2. Have all hydrologic modeling input parameters been identified and justified?
3. Comment on the use and justification of the hydraulic model boundary conditions?
4. Have the design and engineering considerations presented been clearly outlined?
5. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?
6. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?
7. Have the impacts to existing infrastructure, such as utilities, been adequately addressed?
8. Are there other items/methods that should be included in the HTRW investigation? Please explain.
9. To what extent have significant project construction costs been adequately identified and described?

10. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequate?
11. Were the depth-damage relationships appropriate and were the generated results applicable to the study area?
12. Are the assumptions associated with the depth-damage functions explicit and justified? If not, explain.
13. Were the methods used to develop the content-to-structure value ratios appropriate and were the generated results applicable to the study area?
14. 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 to inform an investment and plan selection decision.
15. Does the Real Estate Plan adequately address all real estate interests (public and private)?

Appendix G Review and Comment on Draft GRR/SEIS-II (Public Comments only)

1. Do the comments received during the public review of the GRR/SEIS II have significant concerns regarding public safety, significant controversy or significant economic, environmental and social effects to the nation?

C.8 Final Overview Question

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?