

Independent External Peer Review for the Clear Creek, Texas Flood Risk Management General Reevaluation Report and Preliminary Draft Environmental Impact Statement

Prepared by

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for

U.S. Army Corps of Engineers
Flood Risk Management Planning Center of Expertise
Sacramento District

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SHORT-TERM ANALYSIS SERVICE (STAS)

on

**Final Independent External Peer Review Report for
Clear Creek, Texas Flood Risk Management General Reevaluation Report
and
Preliminary Draft Environmental Impact Statement**

by

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**FINAL
INDEPENDENT EXTERNAL PEER REVIEW REPORT
for the
Clear Creek, Texas Flood Risk Management General Reevaluation Report
And Preliminary Draft Environmental Impact Statement**

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) has been directed by Congress to develop the Clear Creek General Reevaluation Report (GRR). Clear Creek drains an area south of and partially within the City of Houston, Texas. The Clear Creek watershed is located in four counties, includes 16 cities, and covers approximately 260 square miles of land. The watershed is composed of relatively flat coastal plain with elevations varying from near sea level at Clear Lake on the eastern edge of the watershed to about 75 feet above mean sea level (MSL) on the western watershed boundary. Clear Creek receives flow from 17 principal tributaries. The Clear Creek watershed 1 % (100-year) annual exceedance probability (AEP) floodplain contains an area of approximately 19,000 acres. Many communities and subdivisions along the creek are subject to flooding, and recent floods (1973, 1976, twice in 1979, 1989, October 1994, and June 2001) have caused extensive property damage.

The Flood Control Act of 1962 authorized the initial investigation of flood problems on Clear Creek. In 1968, Congress authorized the Clear Creek Flood Control project which consisted of an improved 31-mile-long grass-lined channel which would replace approximately 41 miles of existing winding channel. This channel was designed to contain flood flows up to and including the 1 % (100-year) AEP flood event. Subsequent Congressional actions, administrative changes to water resources planning policies, changes in the project area, and changes in public attitudes required a comprehensive restudy of the Clear Creek project.

A restudy was initiated in the early 1970s. In 1982, a modified project was recommended that changed the previous 1 % (100-year) AEP flood event level of protection in the 1968 authorization to a 10 % (10-year) AEP flood event level. The new plan required less channel modification and included nonstructural measures. Construction began in the mid-1990s. Subsequently, public concerns about potential environmental and hydraulic impacts led the project sponsors to request that construction be suspended. The Harris County Flood Control District developed a Sponsor Proposed Alternative (SPA) that is substantially different from the authorized project. Therefore, Galveston District initiated a general reevaluation study in 1999 to determine a technically effective and publicly acceptable solution to reducing flood risk in the watershed.

The Clear Creek GRR provides planning, engineering, and implementation details of the recommended restoration plan to allow final design and construction to proceed upon approval of the plan. The Clear Creek Preliminary Draft Environmental Impact Assessment (PDEIS) was conducted in compliance with the National Environmental Policy Act (NEPA) (40 CFR §§1500-1508) to evaluate the potential environmental impacts of the proposed actions and alternatives. The goal of the reevaluation study is to prepare a decision document that identifies several plans

for reducing flood risks in the Clear Creek watershed as Congress intended and in a manner that is cost effective and minimizes environmental impacts.

In accordance with the Water Resources Development Act (WRDA) 2007 (Public Law 110-114), Section 2034 dated November 8, 2007, the USACE is conducting an independent external peer review (IEPR) of the Clear Creek, Texas Flood Risk Management General Reevaluation Report and Preliminary Draft Environmental Impact Statement (Clear Creek GRR and PDEIS). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the Clear Creek GRR and PDEIS. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR will be external to the agency and conducted following guidance described in the Department of the Army, USACE guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008; CECW-CP Memorandum dated March 30, 2007; and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

This final report describes the IEPR process, summarizes the final comments of the IEPR panel, and describes the panel members and their selection. The results of this IEPR report will be taken into consideration in preparation of the final Clear Creek GRR and PDEIS.

Six panel members were selected for the IEPR from 31 identified candidates. Corresponding to the technical content of the Clear Creek GRR and PDEIS, the areas of technical expertise of the six selected peer reviewers included: geotechnical engineering and risk assessment; economics; hydraulic engineering; ecology; and NEPA impact assessment. It was also emphasized that both geotechnical peer reviewers should be familiar with geotechnical engineering practices used in Texas, and that all reviewers be active in their related professional societies.

The peer reviewers were provided with electronic versions of the Clear Creek GRR and PDEIS documents, along with a charge that solicited their comments on specific sections of the documents that were to be reviewed. Approximately 500 individual comments were received from the IEPR panel in response to the charge questions. There was no communication between the IEPR panel and the authors of the Clear Creek GRR and PDEIS during the peer review process.

Following the individual reviews of the Clear Creek GRR and PDEIS documents by the IEPR panel members, a panel review teleconference was conducted to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the final comments to be provided to USACE. The final comments were documented according to a four-part format that included description of: (1) the nature of the comment; (2) the basis for the comment; (3) significance of the comment (high, medium, and low); and (4) recommendations on how to resolve the comment. Overall, 27 Final Panel Comments were identified and documented. Of the final 27 comments, 4 were identified as having high significance, 14 were identified as having medium significance, and 9 comments were identified as having low significance. Table ES-1 summarizes the final comments by level of significance. Detailed information on each comment is contained in Appendix A of this report.

The IEPR panel members generally agreed on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” in the reports. The following statements provide a broad overview of the panel’s findings, which are described in more detail in the individual Final Panel Comments.

Plan Formulation Rationale: The rationale provided for developing and comparing alternatives is not implemented adequately. Public health and safety, life cycle factors, and risk and uncertainty have not been comprehensively considered or adequately communicated.

Economics: Overall, the economic analyses presented in the GRR and the PDEIS are weak. It appears that the reports may overstate the benefits from the project. Everything is presented for 2020 conditions, but current conditions (at the time the assessment was done) also need to be considered and presented. The uncertainty with respect to first-floor elevations seems to be overstated and the analysis didn’t follow Section 575 (WRDA 1996) Implementation Guidance.

Environmental: The PDEIS is generally comprehensive; however, additional pieces of information should be provided for clarification. The potential for physical disturbance during construction and the impacts to wetlands (not including those evaluated through the Habitat Evaluation Procedures [HEP]) are not discussed until the end of the document, and these are important components of any PDEIS. Very few ecological data are presented, and those presented are flawed and not scientifically defensible (e.g., species lists are inaccurate and incomplete). The models used are not suitable for predicting habitat loss under different scenarios, and there is no realistic plan for managing and restoring ecosystems. Furthermore, the costs for ecosystem restoration and maintenance are too low.

In the PDEIS, the Purpose and Need is weak in establishing the basis for comparison of the adequacy of the project alternatives. The alternatives analysis would benefit from additional detail about how each of the individual project elements was evaluated and ultimately determined to be feasible (or not) for inclusion in the proposed project. The effects of connected actions, particularly those related to the numerous pipelines that would require realignment, should be included in the EIS.

Engineering: The hydrology and hydraulics portions of the report are covered well and appear to be well done. The geotechnical portion of the documents is weak considering the potential geological hazards associated with the Beaumont Clay Formation.

Table ES-1. Overview of 27 Final Comments Identified by the Clear Creek IEPR Panel.

Significance – High	
1	Section 575 guidance of the Water Resources Development Act (WRDA) of 1996 requires four distinct steps for an evaluation of economic benefits and costs for projects, and these steps are not followed for the Clear Creek GRR..
2	Information in the Economic Evaluation needs to be updated and rely less on appraisals from October 2005 price levels.
3	The rationale provided for developing and comparing alternatives is not complete. Public health and safety, life cycle factors, and risk and uncertainty have not been comprehensively considered or adequately communicated.
4	The habitat model has fundamental deficiencies in many areas.
Significance – Medium	
5	The Purpose and Need should clearly describe how past rain events that have resulted in flooding compare with more recent rain events and explain how flooding is likely to increase. It should also include information about how this system has and will interact with hurricane storm surges.
6	The Formulation Objectives, Constraints, and Criteria of the GRR should explain why only NED is used for decision making in this study and refer readers to the EIS for the RED, EQ, and OSE accounts.
7	The rationale for excluding the second outlet from the Without-Project conditions should be clarified.
8	Without-Project conditions should cover the period from 2000 to 2070.
9	It is unclear if the methodology used to estimate flood damages includes damages from the 1-year event.
10	The future conditions assumptions for HEC-1 models appear to be inconsistent with those used for the HEP analysis.
11	Clearing and Snagging has the highest rate of return, yet it is dismissed as the first added alternative and never seems to receive any further study.
12	The assumption that increased runoff will result from development needs to be justified to make sure that it is consistent with floodplain regulations and in compliance with federal law.
13	The potential geological hazards associated with the Beaumont Clay Formation underlying this region (e.g., sinkholes, salt domes, active faults, subsidence, expansive clays, organic soils, etc.), including the stability of cut slopes, need to be considered and discussed in the report regarding how they may impact the project.
14	It is unclear what percentage of impacted landcover categories is wetland, and the area of affected wetland should be more accurately defined to compare to mitigation plans and ensure no net loss.
15	The impacts from the connected action of relocating pipelines should be included in the analysis.
16	There needs to be additional discussion and reference to specific historic data to support the geotechnical design assumptions.
17	Please clarify how benchmarks for survey elevations will be established and maintained over the estimated 10-year construction schedule, given regional subsidence.
18	The restoration and management plan currently being proposed may not be feasible.

Table ES-1, continued

Significance – Low	
19	The explanation in the Appendix regarding the shift from 2010–2060 to 2020–2070 needs to be discussed in the main text.
20	A comparison between new models and old models should be included, as well as a discussion of why the modeling was updated.
21	The GRR should clearly identify that the channel and detention basin slopes will be globally stable but may be subject to shallow slides periodically that will require long-term maintenance.
22	The erosion threshold of 6 fps needs to be documented.
23	The implementation of “Setback Zones” for structural improvement near the tops of slopes and areas that receive sediment and soil from detention excavations should be considered.
24	The discussion of contributions to the Clear Creek watershed would benefit from a figure that demonstrates the difference in the extent of the 100-year or other floodplain areas.
25	The Purpose and Need should include the physical characteristics of the watershed that contribute to flooding problems, as well as quantification of the costs of flood damage.
26	Best Management Practices that would be employed to mitigate construction impacts to water quality, sediment quality, air quality, and noise impacts should be addressed.
27	The interest cost and benefits from the completed features should be calculated for each year during the construction period.

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1. INTRODUCTION

1.1 Background of Report Reviewed

The U.S. Army Corps of Engineers (USACE) has been directed by Congress to develop the Clear Creek General Reevaluation Report (GRR). Clear Creek drains an area south of and partially within the City of Houston, Texas. The Clear Creek watershed is located in four counties, includes 16 cities, and covers approximately 260 square miles of land. The watershed is composed of relatively flat coastal plain with elevations varying from near sea level at Clear Lake on the eastern edge of the watershed to about 75 feet above mean sea level (MSL) on the western watershed boundary. Clear Creek receives flow from 17 principal tributaries. The Clear Creek watershed 1% (100-year) annual exceedance probability (AEP) floodplain contains an area of approximately 19,000 acres. Many communities and subdivisions along the creek are subject to flooding, and recent floods (1973, 1976, twice in 1979, 1989, October 1994, and June 2001) have caused extensive property damage.

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In accordance with the Water Resources Development Act (WRDA) 2007 (Public Law 110-114), Section 2034 dated November 8, 2007, the USACE is conducting an independent external peer review (IEPR) of the Clear Creek, Texas Flood Risk Management General Reevaluation Report and Preliminary Draft Environmental Impact Statement (Clear Creek GRR and PDEIS). Battelle, as a 501(c)(3) non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the IEPR of the Clear Creek GRR and PDEIS. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR will be external to the agency and conducted following guidance described in the Department of the Army, USACE, guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008; CECW-CP Memorandum dated March 30, 2007; and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

This final report describes the IEPR process, summarizes final comments of the IEPR panel, and describes the panel members and their selection. The results of this IEPR report will be taken into consideration in preparation of the final Clear Creek GRR and PDEIS.

1.2 Purpose of Independent External Peer Review

To ensure that USACE documents are supported by the best scientific and technical information, a peer review process has been implemented by USACE that utilizes Independent External Peer Review (IEPR) to complement the Agency Technical Review (ATR), as described in the Department of the Army, U.S. Army Corps of Engineers, guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008; and CECW-CP Memorandum dated March 30, 2007.

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

In this case, the IEPR of the Clear Creek GRR and PDEIS was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) eligible under 501(c)(3). Battelle is an independent objective science and technology organization with experience conducting IEPRs.

This final report describes the IEPR process, summarizes final comments of the IEPR panel, and describes the panel members and their selection. The results of this final IEPR report will be taken into consideration in preparation of the final Clear Creek GRR and PDEIS. Detailed information on the final comments of the panel is provided in Appendix A.

2. METHODS

This section describes the methodology followed in selecting independent external peer reviewers, and in planning and conducting the IEPR. The IEPR was conducted following procedures described in USACE's guidance cited above (Section 1.2 of this report) and in accordance with the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. Supplemental guidance on evaluation for conflicts of interest used the National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports*, dated May 12, 2003.

2.1 Planning and Schedule

Table 1 defines the schedule followed in execution of the IEPR.

2.2 Identification and Selection of Independent External Peer Reviewers

Battelle initially identified 31 potential peer reviewers, confirmed their availability, evaluated their technical expertise, and inquired about potential conflicts of interest. Of those initially contacted, 19 independent peer review candidates confirmed their interest; it was eventually determined that 1 candidate had a conflict of interest. Seven candidates declined either due to scheduling conflicts or because they did not possess the precise technical expertise being sought. Of the remaining 11 candidates, 6 were proposed as the final panel and 5 were proposed as backup reviewers.

Corresponding to the technical content of the Work Plan and the overall scope of the Clear Creek GRR and PDEIS, the technical expertise areas for which the peer reviewers were evaluated focused on five key areas: geotechnical engineering and risk assessment; economics; hydraulic engineering; ecology; and NEPA Impact Assessment. It was also emphasized that both geotechnical peer reviewers should be familiar with geotechnical engineering practices used in Texas, and that all reviewers be active in their related professional societies.

Table 1. Clear Creek GRR and PDEIS IEPR Schedule.

Task	Action	Due Date
	Pre-Award Funding authorization	February 13, 2009
	Receipt of review documents	March 4, 2009
	Notice to Proceed	March 5, 2009
A1/A3	Submit draft work plan to USACE, including draft charge	March 18, 2009
	Receive comments from USACE on draft work plan and charge	March 19, 2009
	Conduct conference call to discuss USACE comments	March 23, 2009
	Submit final work plan, including final charge	March 26, 2009
	Receive approval from USACE on final work plan, including final charge	March 26, 2009
A2	Recruit and screen up to 11 potential peer reviewers; prepare summary information	March 5, 2009
A4	Submit list of no more than seven external peer reviewers and their credentials to USACE	March 5, 2009
	Receive comments from USACE on peer reviewer list	March 9, 2009
	Complete subcontracts for peer reviewers	March 18, 2009
A5	Conduct kick-off meeting with USACE and peer review panel	March 27, 2009
A6	Review documents and charge sent to external peer reviewers	March 26, 2009
	External peer reviewers complete their review and provide comments to contractor	April 21, 2009
	Collate comments from peer reviewers	April 23, 2009
	Convene panel review teleconference call	April 24, 2009
A6	Prepare Final Panel Comments	May 4, 2009
A7	Submit Final IEPR Report to the USACE	May 12, 2009

Table 1, continued

Task	Action	Due Date
A8	Input Final Panel Comments to DrChecks	May 19, 2009
	Conduct conference call to discuss USACE clarifying questions	May 22, 2009
	Receive USACE Evaluator response to Final Panel Comments in DrChecks	June 5, 2009
	Respond to USACE comments in DrChecks (i.e., Back Checks) and close out DrChecks	June 10, 2009

The peer reviewers were also screened for the following *potential* exclusion criteria or conflicts of interest.^a Participation in previous USACE technical peer review committees and other technical review panel experience was also considered, as follows:

- Involvement in any part of the Clear Creek General Reevaluation Study, including the Clear Creek, Texas General Reevaluation Report (GRR), Preliminary Draft Environmental Impact Statement (PDEIS), supporting appendices, related technical data, and models pertaining to the Study
- Involvement in any part of the development of the two community-based index models developed to evaluate alternatives for the Clear Creek GRR Study
- Current USACE employee
- Current or previous employee or affiliation with other project sponsors, including Galveston County or the Harris County Flood Control District
- Current or future interests in the project or future benefits from the project
- Current personal or firm involvement with other USACE projects, notably if those projects/contracts were with the Galveston District
- Previous employment by the USACE as a direct employee or contractor (either as an individual or through a firm) within the last 10 years, notably if those projects/contracts were with the Galveston District
- Previous experience conducting technical peer reviews
- A significant portion (*i.e.*, greater than 50%) of personal or firm revenues within the last 3 years came from USACE contracts
- Any publicly documented statement made advocating for or against the subject project
- Other possible perceived conflict of interest for consideration, for example:
 - Repeatedly served as USACE technical reviewer

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

- Paid or unpaid participation in litigation related to the work of the USACE.
- Any other perceived conflict of interest not listed.

In selecting final peer reviewers from the list of potential peer review candidates, an effort was made to select experts who best fit the expertise areas and criteria described above. Based on these considerations, six peer reviewers were selected from the potential list (see Section 3 of this report for names and biographical information of the selected peer reviewers). The six reviewers selected were from academic institutions or were independent engineering consultants. Battelle established subcontracts with the peer reviewers when they indicated their willingness to participate and confirmed the absence of conflicts of interest (through a signed conflict of interest form).

2.3 Preparation of the Charge and Conduct of the Peer Review

A peer review charge was developed to assist the IEPR panel members, which included specific questions and discussion points on the Clear Creek GRR and PDEIS which the panel members were instructed to use to guide their review. The draft charge was prepared by Battelle with guidance provided in USACE's guidance *Peer Review of Decision Documents* (EC 1105-2-410) and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. A draft charge was submitted to the USACE for evaluation, and finalized by Battelle after minor clarifications were incorporated. In addition to a list of 68 charge questions/discussion points, the final charge included general guidance for the IEPR panel members on the conduct of peer review (as provided in Appendix B of this final report).

The IEPR panel members were provided an electronic version of the Clear Creek GRR and PDEIS documents and the final charge. A full list of the Clear Creek GRR and PDEIS documents that were reviewed by the IEPR panel is provided in Appendix B of this report. The IEPR panel members were instructed to address the charge questions/discussion points within a comment-response form table provided by Battelle. In addition, USACE held a panel Kick-Off Meeting via teleconference during which Battelle and the panel members received an overview of the project.

Approximately 500 comments were received from the individual IEPR panel members in response to the charge questions/discussion points. There was no communication between the IEPR panel and the authors of the Clear Creek GRR and PDEIS during the review process, but communication between Battelle and the reviewers, and among the reviewers, was conducted as needed.

2.4 Review of Individual Panel Comments

In response to the charge questions/discussion points, approximately 500 individual comments were received from the IEPR panel members. Battelle reviewed these comments to identify overall recurring themes, potential areas of conflict, and other overall impressions. As a result of this review, Battelle developed a preliminary list of 87 overall comments and discussion points that emerged from the IEPR panelists' individual comments. Each reviewer's individual comments were shared with the full IEPR panel in a merged individual comments table.

2.5 Independent Peer Review Panel Teleconference

Battelle facilitated a teleconference with the IEPR panel members to provide for the exchange of technical information among the panel experts, many of whom are from diverse scientific backgrounds. This information exchange ensured that this final IEPR report would accurately represent the panel's assessment of the project and would avoid isolated or conflicting opinions and analyses. The panel review teleconference consisted of a thorough discussion of the overall negative comments, positive comments, and comments that appeared to be conflicting among reviewers. In addition, Battelle used the teleconference to confirm each comment's level of importance to the IEPR panel members, add any missing issues of high-level importance to the findings, resolve whether to "agree to disagree" on the conflicting comments, and to merge those individual comments with similar foundations into one "Final Panel Comment." The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments and decide which panel member would serve as the lead author for the development of those final comments.

The panel discussion resulted in 27 overall Final Panel Comments. Following the discussion, a summary memorandum documenting each final comment identified by the panel (and organized by level of significance) was prepared by Battelle and distributed to the IEPR panel. The memorandum provided detailed guidance on the approach and format to be used in the development of the Final Panel Comments for the Clear Creek GRR and PDEIS and is further described in Section 2.6 below.

In addition to identifying which issues should be carried forward as Final Panel Comments, the IEPR panel discussed responses to 24 specific charge questions where there appeared to be disagreement among the reviewers. The conflicting comments were resolved based on professional judgment of the panel members; each comment was either incorporated into the final comments or determined to be a non-significant issue (i.e., either a true disagreement did not exist, or the issue was not important enough to include as a final comment).

2.6 Preparation of Final Comments

A memorandum was distributed to the IEPR panel providing detailed guidance on the approach and format to be used in the development of the Final Panel Comments.

- **Lead Responsibility:** For each Final Panel Comment, one of the panel members was identified as the lead author responsible for coordinating the development of the final comment and submitting it to Battelle. Lead assignments were modified by Battelle at the direction of the IEPR panel. To assist each lead in the development of the final comments, Battelle distributed merged individual comments in the comment-response form table, a summary detailing each draft final comment statement (in the memorandum), an example final comment following the four-part structure described below, and a template for the preparation of the final comments.

- Directive to the Lead: Each lead was encouraged to communicate directly with other reviewers, as needed, to contribute to a particular panel comment. If a significant comment was identified that was not covered by one of the original 27 Final Panel Comments, the appropriate lead was instructed to draft a new panel comment.
- Format for Final Comments: Each Final Panel Comment was presented as part of a four-part structure, including:
 1. Nature of comment (i.e., succinct summary statement of concern)
 2. Basis for comment (i.e., details regarding the concern)
 3. Significance (high, medium, low; see description below)
 4. Recommendation for resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
 1. *High*: Describes a fundamental problem with the project that could affect the recommendation or justification of the project
 2. *Medium*: Affects the completeness or understanding of the reports/project
 3. *Low*: Affects the technical quality of the reports but will not affect the recommendation of the project.
- Guidance for Developing the Recommendation: The recommendation was to include specific actions that the USACE should consider to resolve the comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

As a result of this process, 27 Final Panel Comments were prepared. Battelle reviewed and edited all Final Panel Comments for clarity and adherence to the requested format. There was no direct communication between the IEPR panel and the authors of the Clear Creek GRR and PDEIS documents during the preparation of the Final Panel Comments. The Final Panel Comments were assembled and are presented in Appendix A.

3. PANEL DESCRIPTION

Potential peer review candidates were identified through Battelle's Peer Reviewer Database, targeted internet searches using key words (e.g., technical area, geographic region), search of websites of universities or other compiled expert sites, and through referrals from candidates who declined. A draft list of potential panel members (which were screened for availability, technical background, and conflicts of interest) was prepared by Battelle and provided to USACE. The final list of peer reviewers was determined by Battelle.

An overview of the credentials of the six reviewers selected for the IEPR panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each candidate and their technical area of expertise is presented in the text that follows the table.

Table 2. Clear Creek GRR and PDEIS Independent Peer Review Panel: Technical Criteria and Areas of Expertise

	Gilbert	Bruggers	Mantey	Freeman	Siemann	Henry
Geotechnical Engineer (two experts needed: one in fluvial processes and geomorphology and one in geotechnical risk analysis)						
Experience in geotechnical studies and design of flood control works, including channel modifications	✓	✓				
Familiar with geotechnical practices used in Texas	✓					
Site investigation planning and implementation including:	✓	✓				
• Modification of stream channels for flood risk management purposes		✓				
• Minimizing environmental impacts	✓	✓				
Fluvial processes		✓				
Geomorphology		✓				
Geotechnical risk analysis	✓					
Application of probabilistic methods to geotechnical aspects of flood damage reduction planning studies	✓					
Economics (up to two experts needed)						
Water resource economic evaluation or review (<i>years of experience needed: 10</i>)			✓			
			Years of exp: 30			
Experience working directly for or with USACE (<i>years of experience needed: 5</i>)			✓			
			Years of exp: 25			
Experience with the HEC-FDA model (<i>years of experience needed: 5</i>)			✓			
			Years of exp: 8			
Experience reviewing federal water resource economic documents justifying construction efforts (<i>years of experience needed: 2</i>)			✓			
			Years of exp: 8			
Understanding of social well-being and regional economic development			✓			
Understanding of traditional natural economic development benefits			✓			
Hydraulic Engineer (one expert needed)						
Registered professional engineer				✓		
Experience working with large public works projects				✓		
Extensive background in hydraulic theory and practice (if from academia)				✓		

Table 2. Clear Creek GRR and PDEIS Independent Peer Review Panel: Technical Criteria and Areas of Expertise (continued)

	Gilbert	Bruggers	Mantey	Freeman	Siemann	Henry
Familiar with USACE application of risk and uncertainty analyses in flood damage reduction studies				✓		
Familiar with standard USACE hydrologic and hydraulic computer models				✓		
Coastal Prairie and Riparian Ecology (one expert needed)						
Experience in describing and evaluating the complex relationships and dynamics of coastal prairie and/or riparian ecosystems (<i>years of experience needed: 10</i>)					✓ Years of exp: 18	
Experience assessing the consequences of altering environmental conditions					✓	
NEPA Impact Assessment (one expert needed)						
Experience in evaluating and conducting NEPA impact assessments (<i>years of experience needed: 10</i>)						✓ Years of exp: 10
Conducting cumulative effects analyses						✓
Experience with complex multi-objective public works projects with competing trade-offs						✓
Experience determining the scope and appropriate methodologies for impact assessment and analyses for a variety of projects with high public and interagency interest						✓
Experience determining the scope and appropriate methodologies for impact assessment and analyses for projects having impacts to nearby sensitive habitats						✓

Robert Gilbert, PhD., P.E.

Role: This reviewer was chosen primarily for his expertise in the area of geotechnical risk analysis.

Affiliation: University of Texas

Dr. Robert Gilbert is the Brunswick Abernathy Professor of Civil, Architectural, and Environmental Engineering at the University of Texas-Austin. He holds a Ph.D. in civil engineering from the University of Illinois at Urbana-Champaign and is a licensed professional engineer in Texas and Illinois. He currently teaches a short course on risk and reliability analyses for levees and dams, and teaches geoenvironmental and geotechnical engineering as well as risk-based decision making and probability and statistics at the university. Dr. Gilbert served as a technical reviewer for the New Orleans Levee Failures in Hurricane Katrina and the California Delta Risk Management Strategy, and was on the Science and Engineering Review Team for Louisiana's Master Plan for Coastal Protection and Restoration. He was a member of the editorial board for the journal *Georisk*. He has also worked on risk assessments for such varied projects as tailings dams, offshore oil and gas production and transportation systems, and hazardous and nuclear waste landfills. Dr. Gilbert has provided private engineering consulting services for the past 16 years to numerous agencies and companies, including the USACE.

Donald Bruggers, P.E.

Role: This reviewer was chosen primarily for his geotechnical expertise in fluvial processes and geomorphology

Affiliation: ENGE0, Incorporated

Donald Bruggers has an M.S.C.E. in geotechnical engineering from Michigan State University and has more than 30 years of diverse geotechnical engineering experience. He is currently a principal with ENGE0 Incorporated in San Francisco, CA, and is a registered geotechnical engineer in California and a registered P.E. in four states. He has managed large-scale, complex projects throughout the western United States. His areas of expertise include land stability assessment and mitigation; tunneling, pier, port, marina and levee projects; transportation and public works projects; and environmental remediation, compliance, and permitting. Mr. Bruggers has provided technical direction/review of several stream restoration projects that have required an understanding of the fluvial processes and geomorphology of watersheds, as well as design and construction of drop structures and channel modification. Specifically, San Ramon Creek at El Capitan Bridge required widening and realignment intervention because the channel had migrated laterally into the existing bridge abutment, threatening its integrity. Mitigation included grading to provide stable channel dimensions for the creek, toe scour protection with biotechnical stabilization at creek bendways, and the installation of an active floodplain with riparian planting. Mr. Bruggers also provided principal technical review for the Main Branch of Alamo Creek, which had eroded heavily into its historic floodplain and was largely devoid of riparian habitat features or beneficial water quality mechanisms. The project included the construction of a series of rock vortex weir grade-control structures to adjust the over-steepened creek bed slope to an 'equilibrium' that would balance the sediment transport throughout the project reach after restoration. Mr. Bruggers also provides principal review services for the geotechnical evaluation of levees protecting California urban areas and is currently assessing

whether 12 miles of levee along the Sutter Bypass and Wadsworth Canal meet the applicable standards.

Joseph Mantey

Role: This reviewer was chosen primarily for his expertise in evaluating the social, regional, and traditional economic benefits of water resource development programs.

Affiliation: Oakland Community College

Joseph Mantey has 30 years of experience in water resource economics and has an M.S. in agricultural economics from the University of California at Davis. Before taking his current position as an adjunct economics faculty member at Oakland Community College, Mr. Mantey worked as an economist for the USACE for 20 years. His fields of expertise include economic and social impact studies, benefit-cost analyses, risk and uncertainty analyses, environmental impact assessments, and peer reviews. He has 8 years of experience with HEC-FDA software, most recently using it to conduct detailed technical reviews of three large flood control projects for USACE-Galveston District. His experience with federal water resource economic documents includes a review of an Institute of Water Resources estimate of vessel operating costs used in the reanalysis of the Delaware River Main Stem and Channel Deepening Project. He has also conducted an independent technical review of the cost effectiveness and incremental cost analyses for the Belle Isle Piers Environmental Restoration Feasibility Study in the Detroit River. Mr. Mantey has experience managing a multi-disciplinary GRR team that earned a national award for reducing construction costs of a new shipping lock at the Soo Canal, and he led the economic analysis team in estimating project impacts on deep-draft navigation in the Great Lakes.

Gary Freeman, PhD. P.E.

Role: This reviewer was chosen primarily for his expertise in the area of hydraulic engineering, and his familiarity with the USACE risk and uncertainty analysis and hydrologic/ hydrodynamic computer models.

Affiliation: River Research and Design, Inc.

Dr. Gary Freeman is a principle and majority owner of River Research and Design (R₂D) with more than 20 years of experience in dealing with water-related engineering issues. He received his Ph.D. in civil engineering from Texas A&M University, is a registered Civil Engineer in seven states, and has taught stream restoration courses for ASCE. With a wide range of experience in water resources engineering, Dr. Freeman has been intricately involved in performing and directing hydraulics, hydrology, sediment transport, and geomorphology studies across the United States and internationally. Dr. Freeman's training and broad background in hydraulics and sediment transport also qualify him as a fluvial geomorphologist. Dr. Freeman spent 7½ years with the U.S. Army Waterways Experiment Station in Vicksburg, MS as a Research Hydraulic Engineer. While at the Corps, Dr. Freeman modified and applied the Corps' RMA-2 hydrodynamic model to a wide variety of projects and helped train Corps personnel in the use of two-dimensional hydrodynamic and sediment transport models. He served as principal investigator on several large research projects including the development of stage-discharge uncertainty methodology for the risk and uncertainty approach to flood damage

reduction studies, hydraulic roughness of floodplains due to shrubs and other woody vegetation, and the modeling of sediment transport in bottomland hardwood wetlands.

Evan Siemann, PhD.

Role: This reviewer was chosen primarily for his expertise in the area of coastal prairie and riparian ecology.

Affiliation: Rice University

Dr. Evan Siemann is a Professor in the Rice University Dept. of Ecology and Evolutionary Biology and holds a Ph.D. from the University of Minnesota in ecology. He teaches a variety of ecology and biology courses, including a field ecology lab. His research interests include population, community, and ecosystem ecology. He has spent many years studying the exotic Chinese tallow tree, which has invaded much of the Texas coastal prairie and aggressively invades southeastern forests. Particular areas of emphasis include understanding the role of biotic interactions (for example, insects or soil fungi) in tallow tree success and their role in driving post-introduction evolutionary changes. In addition, he has conducted research on invasive ants, aquatic plants, snails, and feral hogs. Dr. Siemann has researched the effects of nutrient loading, extreme rainfall events, and fire regimes on coastal tallgrass prairie ecosystems. He also studies management and restoration of southeastern forests and grasslands.

Kelly Henry

Role: This reviewer was chosen primarily for her expertise in evaluating and conducting NEPA impact assessments for projects and programs with interagency interests and potential impacts to nearby sensitive habitats.

Affiliation: Short, Elliott, Hendrickson, Inc.

Kelly Henry is the director of the Natural Resources Group at Short, Elliott, Hendrickson, Inc. in St. Paul, MN, and is a certified Professional Wetland Scientist. She has an M.S. in ecology and water resources and is experienced in environmental reporting and documentation including Environmental Impact Statements (EISs), Environmental Assessments (EAs) and Environmental Assessment Worksheets. She also is experienced in wetland regulation and in obtaining permits from federal, state and local wetland regulatory agencies, including wetland delineation, impact analysis and mitigation. Her project experience includes conducting numerous EAs and EISs for the Federal Aviation Administration (FAA) for a variety of airports in Minnesota. Many of these projects included assessing the potential impacts of airport changes to nearby sensitive habitats, including threatened and endangered plant species as well as wetland habitat, which required coordinating with the USACE, Minnesota Department of Natural Resources, and local regulatory agencies. Ms. Henry was the project manager for a recently-completed EIS for the proposed expansion of mining activities at Ispat Inland Mining East Reserve. Project issues included the assessment of potential effects to municipal water supplies, impacts to streams from dewatering activities, and treatment for mercury in accordance with the Great Lakes Initiative.

4. RESULTS — SUMMARY OF PEER REVIEW COMMENTS

The IEPR panel members generally agreed on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” in the reports. The following statements provide a broad overview of the panel’s findings, which are described in more detail in the individual Final Panel Comments.

Plan Formulation Rationale: The rationale provided for developing and comparing alternatives is not implemented adequately. Public health and safety, life cycle factors, and risk and uncertainty have not been comprehensively considered or adequately communicated.

Economics: Overall, the economics analyses presented in the GRR and the PDEIS are weak. It appears that the reports may overstate the benefits from the project. Everything is presented for 2020 conditions, but current conditions (at the time the assessment was done) also need to be considered and presented. The uncertainty with respect to first-floor elevations seems to be overstated and the analysis didn’t follow Section 575 (WRDA 1996) Implementation Guidance.

Environmental: The PDEIS is generally comprehensive; however, additional pieces of information should be provided for clarification. The potential for physical disturbance during construction and the impacts to wetlands (not including those evaluated through the Habitat Evaluation Procedures [HEP]) are not discussed until the end of the document, and these are important components of any PDEIS. Very little ecological data are presented, and what is presented is flawed and not scientifically defensible (e.g., species lists are inaccurate and incomplete). The models used are not suitable for predicting habitat loss under different scenarios, and there is no realistic plan for managing and restoring ecosystems. Furthermore, the costs for ecosystem restoration and maintenance are too low.

In the PDEIS, the Purpose and Need is weak in establishing the basis for comparison of the adequacy of the project alternatives. The alternatives analysis would benefit from additional detail about how each of the individual project elements were evaluated and ultimately determined to be feasible (or not) for inclusion in the proposed project. The effects of connected actions, particularly those related to the numerous pipelines that would require realignment, should be included in the EIS.

Engineering: The hydrology and hydraulics portion of the report are covered well and appear to be well done. The geotechnical portion of the documents is weak in considering the potential geological hazards associated with the Beaumont Clay Formation.

As a result of the comment/review process, the IEPR panel identified 27 final comments, segmented into rankings of high, medium, and low significance. In total, as shown in Table 3, 4 were identified as having high significance, 14 were identified as having medium significance, and 9 comments were identified as having a low level of significance. The final IEPR comments in their entirety are included in Appendix A.

Table 3. Overview of 27 Final Comments Identified by Clear Creek IEPR Panel.

Significance – High	
1	Section 575 guidance of the Water Resources Development Act (WRDA) of 1996 requires four distinct steps for an evaluation of economic benefits and costs for projects and these steps are not followed for the Clear Creek GRR.
2	Information in the Economic Evaluation needs to be updated and rely less on appraisals from October 2005 price levels.
3	The rationale provided for developing and comparing alternatives is not complete. Public health and safety, life cycle factors, and risk and uncertainty have not been comprehensively considered or adequately communicated.
4	The habitat model has fundamental deficiencies in many areas.
Significance – Medium	
5	The Purpose and Need should clearly describe how past rain events that have resulted in flooding compare with more recent rain events and explain how flooding is likely to increase. It should also include information about how this system has and will interact with hurricane storm surges.
6	The Formulation Objectives, Constraints, and Criteria of the GRR should explain why only NED is used for decision making in this study and refer readers to the EIS for the RED, EQ, and OSE accounts.
7	The rationale for excluding the second outlet from the Without-Project conditions should be clarified.
8	Without-Project conditions should cover the period from 2000 to 2070.
9	It is unclear if the methodology used to estimate flood damages includes damages from the 1-year event.
10	The future conditions assumptions for HEC-1 models appear to be inconsistent with those used for the HEP analysis.
11	Clearing and Snagging has the highest rate of return, yet it is dismissed as the first added alternative and never seems to receive any further study.
12	The assumption that increased runoff will result from development needs to be justified to make sure that it is consistent with floodplain regulations and in compliance with federal law.
13	The potential geological hazards associated with the Beaumont Clay Formation underlying this region (e.g., sinkholes, salt domes, active faults, subsidence, expansive clays, organic soils, etc.), including the stability of cut slopes, need to be considered and discussed in the report regarding how they may impact the project.
14	It is unclear what percentage of impacted landcover categories is wetland, and the area of affected wetland should be more accurately defined to compare to mitigation plans and ensure no net loss.
15	The impacts from the connected action of relocating pipelines should be included in the analysis.
16	There needs to be additional discussion and reference to specific historic data to support the geotechnical design assumptions.
17	Please clarify how benchmarks for survey elevations will be established and maintained over the estimated 10-year construction schedule, given regional subsidence.
18	The restoration and management plan currently being proposed may not be feasible.
Significance – Low	
19	The explanation in the Appendix regarding the shift from 2010–2060 to 2020–2070 needs to be discussed in the main text.

20	A comparison between new models and old models should be included, as well as a discussion of why the modeling was updated.
21	The GRR should clearly identify that the channel and detention basin slopes will be globally stable but may be subject to shallow slides periodically that will require long-term maintenance.
22	The erosion threshold of 6 fps needs to be documented.
23	The implementation of "Setback Zones" for structural improvement near the tops of slopes and areas that receive sediment and soil from detention excavations should be considered.
24	The discussion of contributions to the Clear Creek watershed would benefit from a figure that demonstrates the difference in the extent of the 100-year or other floodplain areas.
25	The Purpose and Need should include the physical characteristics of the watershed that contribute to flooding problems as well as quantification of the costs of flood damage.
26	Best Management Practices that would be employed to mitigate construction impacts to water quality, sediment quality, air quality and noise impacts should be addressed.
27	The interest cost and benefits from the completed features should be calculated for each year during the construction period.

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APPENDIX A

Final Panel Comments

**on the
Final Independent External Peer Review Report
For Clear Creek, Texas Flood Risk Management General Reevaluation Report
and
Preliminary Draft Environmental Impact Statement**

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Comment 1:

Section 575 guidance of the Water Resources Development Act (WRDA) of 1996 requires four distinct steps for an evaluation of economic benefits and costs for projects and these steps are not followed for the Clear Creek GRR.

Basis for Comment:

The assumption that the FEMA buyout with some Federal funds is eligible for Section 575 as a non-Federal project is not clearly justified. The amended authorization states that “nonstructural actions by non-Federal interests” are eligible for Section 575 consideration and how a FEMA buyout is a non-Federal action is unclear.

The assumption that detention on the Mary’s Creek tributary is eligible for Section 575 is not clearly justified. Neither the original authorization nor Section 354 refer to tributaries. If the detention is eligible for Section 575, the report seems to only account for 75% of its capacity.

The four steps required by Section 575 should be clearly laid out.

- Step 1 correctly excludes the non-Federal works from the Without-Project condition
- Step 2 requires that the non-Federal works be excluded from the With-Project condition. However, the relocations and a portion of the Mary’s Creek detention are included in that condition.
- Step 3 identifies the target output, which is not in the GRR. This should provide lower residual damages than Step 2.
- Step 4 reformulates the plan to achieve the same target output as Step 3 at the least cost. If this includes tributaries, there does not seem to be a requirement that the outputs need to be on the same stream.

The GRR does not seem to comply with any of the steps 2 through 4.

Significance – High:

Plan formulation is incomplete because the recommended plan is likely to change after completing all four steps.

Recommendations for Resolution:

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

- Display the non-Federal and Federal cost sharing actually incurred for the FEMA buyout
- Demonstrate that Section 575 applies to the Clear Creek tributaries
- Conduct Steps 2 through 4 in compliance with Section 575.

Comment 2:

Information in the Economic Evaluation needs to be updated and rely less on appraisals from October 2005 price levels.

Basis for Comment:

The replacement value of development increased by 68% from 2001 to October 2005 based on an appraisal of 50 structures. According to the Harris County Appraisal District (<http://www.hcad.org/resources/default.asp?resources=protests>), their residential appraisals averaged 98% of true value in 2001. The *Engineering News Record* (ENR) building cost index increased by only 17% from 2001 to 2005. The update to 2005 seems to be about 50% too high. The concern is that Hurricane Katrina in August 2005 affects October 2005 prices levels in Houston.

The 2005 values are then updated by the Marshall and Swift Estimator and some form of regression was used to update to 2008 for a total value increase of 73% since 2001. An increase of only 25% to 30% during this 7-year period seems more reasonable.

The description at the bottom of page B-2 of how structures were valued in 2001 is insufficient. Basing values on tax appraisals is appropriate. However, the study area involves several counties. If each county performs its own appraisals, then the analysis should at least investigate adjusting appraisals to replacement values by county.

About 10% of structures and value are nonresidential. No justification is given for updating the values of all types of development by the same index.

Significance – High:

Benefits are directly related to valuation. If valuations are too high, then so are benefits. Justification for many of the project features is in question.

Recommendations for Resolution:

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

- Update value of development from 2001 directly to 2008.

Comment 3:

The rationale provided for developing and comparing alternatives is not complete. Public health and safety, life cycle factors, and risk and uncertainty have not been comprehensively considered or adequately communicated.

Basis for Comment:

Scarce mention is made of life safety risk due to flooding, and no information is provided as to how the various alternatives may impact this risk.

The main text of the GRR (Section VII. Risk and Uncertainty Analysis) refers to what is being done to consider risk and uncertainty, not what has been done in evaluating the alternatives. It is not clear how risk and uncertainty were considered explicitly in comparing alternatives.

Information about uncertainty is not conveyed in the summary results presented to justify the NED Plan (Table 21 of the GRR). Table B-40 shows that there is a 50% chance that damages reduced are somewhere between \$6.1 million and \$18.4 million. The uncertainty in the estimated 1.3 benefit-to-cost ratio for the NED Plan needs to be assessed, conveyed and discussed.

A formal analysis of risk and uncertainty for project costs is described in Attachment X (Baseline Cost Estimate) of the Engineering Appendix. However, similar information about uncertainty and risk is not provided for estimating the benefits, including possible modes of failure beyond excessive rainfall and uncertainty in the consequences of flooding.

Life cycle costs and benefits are not presented in comparing alternatives.

The existing risk of flooding and the residual risk of flooding with the preferred alternative in place are not communicated clearly in the main text.

The values used for the hydraulic (stage-discharge) uncertainty are very close to the minimum values obtained from the various methods. These values may be too low for a stream with significant amounts of debris in the channels and floodplains.

No information is provided about how this flood protection system does and will interact with hurricane storm surges.

The values used for the hydraulic (stage-discharge) uncertainty are very close to the minimum values obtained from the various methods. These values may be too low for a stream with significant amounts of debris in the channels and floodplains. The sensitivity of the final results to the selection of the stage-discharge uncertainty parameters should be investigated.

Significance – High:

The GRR states that the rationale for formulating and developing alternative solutions will include a Comprehensive Systems Approach, Risk-Informed Decision Making, and Communication of Risk to The Public. However, these factors are not adequately included in

the analysis and in the presentation of the results, and the treatment of risk and uncertainty could affect the final recommendation.

Recommendations for Resolution:

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

- Rewrite the main text of the GRR to describe how risk and uncertainty were considered in comparing and evaluating the alternatives
- Provide greater detail about how uncertainty was considered in estimating benefits. For each variable with quantified risk, give the type of distribution assumed and the value of its characteristics and any relationships to other variables. Stratify the uncertainty estimate of first-floor elevations by type of survey and land use. Limit the range of vehicle damage uncertainty using more defensible assumptions.
- Present the probability that the benefit-cost ratio of the NED Plan is greater than 1.0
- Discuss how life-safety risk is impacted by the potential alternatives
- Discuss how life cycle costs are affected by the potential alternatives
- Show the risk of flooding in terms of flood depths and frequencies across the area for the existing condition and with the NED Plan in place in the main text of the GRR
- Run the HEC-FDA model with a higher level (and perhaps also with the maximum values) of hydraulic uncertainty to view the sensitivity of the model to stage-discharge uncertainty values used and to evaluate whether these assumptions are crucial to the final results
- Explain how the risk of flooding is affected by hurricane storm surges for the alternatives.

Comment 4:

The habitat model has fundamental deficiencies in many areas.

Basis for Comment:**Overview**

Overall, the few data presented suggest poor quality work in the field, data collection by unqualified personnel, and/or sloppy assembly of the report. Habitat suitability model parameters do not seem to be appropriate and quantitative. No scientific argument or evidence is provided to substantiate that they are predictive or informative. They are not motivated by scientific hypotheses or relevant empirical literature. The combination of these parameters into the indexes appears arbitrary and standard model validation steps were apparently not undertaken. No estimation of error was included and there was no exploration of the sensitivity of model outputs to inputs or model assumptions. The combination of indexes into an overall index also appears arbitrary and the consequences of that particular choice for model output were not rigorously explored. In sum, the habitat modeling portion of the report did not meet the standards of peer-reviewed science.

The assumptions used to generate predicted habitat areas under the Without-Project and With-Project scenarios are not well justified. They seem to be arbitrary, and so the results derived from those assumptions may not be reliable. Had there been an attempt to explore the sensitivity of model outcomes to variation in assumptions, the importance of the details of these assumptions for future scenarios and conditions could be quantified. As this report stands, this cannot be done, and it is possible that there may be large errors and uncertainties in these estimates. Depending on the nature of the errors in estimation, the projected small net gain in floodplain and coastal prairie habitat could in fact be a large net gain or net loss.

Botanical errors are common in the plant community data tables. They include:

Table 2:

- "*Quercus stellata* Wangenh. post oak" appearing as a distinct species in floodplain forest together with "*Quercus similis* bottomland post oak"
- -"*Quercus falcate*" — perhaps *falcata*?
- "*Triadica loureiroi* tallow", "*Triadica, chinese* chinese tallow", "*Sapium sebiferum* Chinese tallow", and "*Triadica sebifera* Chinese tallow" appearing as four separate species [between table 2 and 4] when the first two are nonsense names and the second two are synonyms for a single species.
- "*Celtis occidentalis* hackberry" — very unlikely to be *occidentalis*.

Table 4:

- "*Sabal Adans.* palmetto" There are only two species on Palmettos in Texas. Only one occurs in this area (*S. minor*) which is already in the table. The other is *S texana*.
- "*Oligoneuron Small*" What is this?
- -"*Andropogon* bluestem" Is this the classic tallgrass prairie indicator *Andropogon gerardii*?
- "*Sorghastrum* Nash partridge pea" — correctly appears earlier in the table as Indian Grass (*Sorghastrum nutans*)

- "*Rubus* dewberry vines" and "*Rubus trivialis* Michx. southern dewberry" are two listings — are there two species?
- "*Eleocharis*" appears on page 2 and 3 of the table
- "*Caetegis marshallii*" — perhaps *Crataegus* (Hawthorn)
- "*smut grass rusty seed Paspalum*" – what is this?
- "*Trifolia orange*" *Trifolium* is a genus (if that is the genus that was meant) but there is no species "*orange*"
- "*Polygonum*" — perhaps *Polygonum*? If so, which one? Some are native and some are nasty invasives. Also, there is a separate entry for *Polygonum* on the second page of the table.
- "*Alternanthera* joyweed" and "*Alternanthera philoxeroides* alligatorweed" - two *Alternanthera* species? Unlikley.
- sweetgum (*Liquidambar styraciflua*) and blackgum (*Nyssa sylvatica*) each appear twice, and neither is often found in a tallgrass prairie. Blackgum basically never occurs in a prairie and sweetgum would be a very rare observation.
- "*slender woodoats* poison ivy" What is this?
- "*Tradescantal albiflora* wandering Jew" — perhaps *Tradescantia*?

There are errors of omission (i.e., missing species) and inclusion in the plant community data tables:

- In the description of dominant species [PDEIS vol 1], black willow (*Salix nigra*) and sweetgum (*Liquidambar styraciflua*) are listed but they are lacking from the list of species sampled in floodplain forest. In fact, they are almost certainly there.
- Fig 13 [Fig 11 in PDEIS] shows a canopy dominated by willow! There are no species identified that grow in standing water - cypress (*Taxodium distichum*) and tupelo (*Nyssa aquatica*) are also absent. Tupelo could be missing - but also cypress? Blackgum (*Nyssa sylvatica*) was almost certainly there too. In fact sweetgum and blackgum appear in the prairie species list!
- The relatively uncommon but classic bottomland hardwood species *Carpinus caroliniana* (American hornbeam) appears as a prairie species (table 4) but not a forest species. Walnut (*Juglans nigra* L.) also is in the prairie but not the forest. There is either a serious problem with the sampling design such that they are not gathering useful data on forest composition and/or they cannot identify trees (but presumably the same personnel did the forest and prairie?). From the description of the sampling protocols, it is not clear how all these tree species were in the prairie samples but not in the forest samples. These data need to be checked and, if the tables are accurate, a new sampling procedure should be devised such that the floodplain forest data sample all the dominant characteristic species and that the coastal prairie data reflect coastal prairie species.

There are problems with the construction of the Floodplain model - The input data are of little use. For instance, "CANTREE" is described as "Starting from streambank edge, run a transect tape perpendicular to stream across the polygon for 300 m or until you reach the end of the cover type (keep a minimum width of 100 m between transects). Stop every 10 - m, use 1 - m² quadrant and record the percent tree canopy cover; or in addition to quadrant, use an optic tube and record "hit" (leaf) or "miss" (sky). Then calculate percent in the office." How do you use a 1 m² quadrant to accurately measure canopy cover? "INSTRMCOV" lumps forest cover,

aquatic plants and debris together. Please justify the feasibility of this approach. The “INVASIVES” variable is only for the prairie and not for the forest - why? Invasives in the canopy can be inferred from the “NATIVE” variable but no understory data were collected. For a floodplain forest, the width of the stream changes through the season. Please justify how the variable “OVRHDCOV” is a proper measurement given this fluctuation in stream depth. Same for “WATERDEPTH” and “SUBSTRATE”. There is no natural gravel in this area; why measure this? (Also, the top category is almost certainly 300 mm not 300 m.). Overall, the input parameters need to be justified by reference to relevant literature and linked to scientific hypotheses.

The combination of model parameters into summary indices appears arbitrary and varies between the floodplain and coastal prairie models without any justification for either approach.

- Coastal prairie model — For biotic integrity, eight subjective variables of arbitrary scale are simply averaged together: this needs to be justified. The range of variation in each variable should be described. If some are especially important in determining model outcomes, this should be presented. The choice of index formulas should be linked to scientific principles or previous published studies. The choice of unequal weighting is apparently rejected without justification. Two other indices are also linear averages. Spatial ones are combined in a non-linear fashion and then all four summary indices are brought together in a non-linear combination for an overall index — why?
- Floodplain forest model — A totally different way of combining (often the same) biotic variables is chosen. Please provide justification for the difference in approaches. There does not appear to be any sensitivity analysis (despite the assertion that this was done on GRR p 87). The variability of each factor should be explored to determine whether one or some are driving model outcomes. Some variables are likely to be driven by physical characteristics of sites while others may reflect site history, site management, or time since disturbance. It would be useful to distinguish among these possibilities since this links project activities to habitat impacts. It does not appear that the habitat model was validated by comparing predicted outcomes to actual communities. This could be difficult since the same variables are predictors and response variables. It is very difficult to validate, test, or reject a model with circular structure.
- Examination of area data vs. conclusions from habitat model — If one examines the data in table 5 and simply asks the question — which reaches have large areas in floodplain forest? — (without any reference to the Habitat Model), the answer is that there is lots of floodplain forest in reaches 1, 2, and 4. So, the fact that the model tells the same thing as the initial obvious conclusion makes one question what the utility of this model is in terms of conclusions. The identification of areas of greatest risk (1, 2 and 4) or benefit (the rest) is related to percent in floodplain forest and habitat suitability, but the answers are all driven by area! Likewise, one would conclude from the simple area approach that the Reach 5 is by far the most risky (i.e., the most prairie could be lost) and the others present more opportunities. Same conclusion as with the model results again. This is suspicious. The construction of the habitat model needs be grounded in scientific principles and standard explorations of input data structure and model sensitivity need to be conducted.

The conclusions on page 79 of vol II (beginning with “The implications of these findings are rather straightforward...”) are not scientific, have no support from data, and are irrelevant to the aims of the report. Moreover, the use of the term “likelihood” is not conventional (since it usually refers to probabilities of outcomes). Replace this paragraph with one grounded in data.

The scenarios on page 84 of vol II need to be supported by references to relevant literature and based on scientific principles. Currently, there is a preamble that describes possible scenarios in the future in the Without-Project case. They are merely assertions in the absence of data and references to relevant literature. Because the entire set of conclusions of the PDEIS for the With-Project vs. Without-Project scenarios rest on these assumptions, this is critical to address. Moreover, since there was no sensitivity analysis conducted, it is not possible to judge the effect of different assumptions on model outcomes. It may be that variation in some of the assumptions has little effect on net habitat loss. But, as it stands, the short statement “*In an effort to capture the significant land use changes within the study area the E-Team developed a table to project quality changes in the model’s variables on a TY basis for each Eco-Reach (Table 14- Table 19).*” is insufficient for such a critical component of the report. The sources of data in Tables 14-19 need to be properly documented and justified.

Significance – High:

Without a habitat model that has been properly constructed, rigorously tested, and parameterized with reliable data, it is not possible to assess the likely extent of habitat losses associated With-Project activities and extensive losses of floodplain forest and coastal prairie may occur.

Recommendations for Resolution:

To resolve these concerns, the report would need to be revised as follows:

- Plant community input data need to be verified and 1) new data should be collected if errors in summary tables of plant community data accurately reflect the data collected in the field, and 2) new sampling procedures should be developed if the summary data accurately reflect the plant species that were sampled in each habitat type.
- Sensitivity analyses should be conducted to demonstrate how errors in model inputs and differences in model assumptions impact model outcomes.
- The choice of a baseline model from western rangelands needs to be justified.
- The choice of model parameters and summary indices needs to be justified by reference to the literature or revised to be more relevant to scientific hypotheses.
- The assumptions for future scenarios (Tables 14-19) need to be justified by reference to the literature or revised to be more relevant to scientific hypotheses.
- Speculation on outcomes unrelated to the model (e.g. naturalness, wildness, and beauty) should be removed such that outcomes are supported by data.
- Use of technical terms such as “likelihood” should be restricted to their conventional usage.

Comment 5:

The Purpose and Need should clearly describe how past rain events that have resulted in flooding compare with more recent rain events and explain how flooding is likely to increase. It should also include information about how this system has and will interact with hurricane storm surges.

Basis for Comment:

Section 1.3 of the PDEIS describes in relative terms the history of flooding along Clear Creek and how development growth has increased the severity of flooding related to less severe and more frequent rainfall events. It makes reference to the extent of damages incurred historically and the fact that development has resulted in more flood-prone structures in an area that now floods more frequently. However, it doesn't quantify or compare the area affected, the number of structures affected, the frequency of flooding, or the severity of rainfall events that cause measurable damages now or in the past. Section II of the GRR includes a description of the flooding that resulted from specific large rainfall events, but doesn't define the areal extent of the flooding or the cost of the damage incurred. Nor does it use more common and less severe events to put the large, catastrophic events into perspective. Quantification of the area of the watershed affected by flooding from rainfall events of different intensity and frequency, at least currently if not historically, would provide a point of reference to which the effects of the Proposed Action and alternatives could be compared.

The GRR provides measures of the damages expected under the Without Project condition and with implementation of the GRR, and much of the evaluation of the alternative project elements is based on the economic benefits provided by each individual and combinations of improvements. However, there is no valuation of damages that have occurred from past events for comparison.

Consideration should be given to the interaction of this system with hurricane storm surges. While the intent of this system is not to reduce flooding due to storm surges, it could affect how storm surges move inland and then subsequently drain. Also, there could be an interaction between flooding caused by rainfall from a hurricane with a storm surge.

Significance – Medium:

The Purpose and Need of the Proposed Action should quantify the problem in order that the benefits of the intended solution (and alternatives thereto) can be compared.

Recommendations for Resolution:

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

- Description and exhibit of the areal extent of flooding that currently results from a variety of rainfall events
- Description of the experienced frequency of damaging flood events and the intensity of the associated rain event
- Quantification of damages from experienced damaging flood events
- Description of how this system has and will interact with hurricane storm surges.

Comment 6:

The Formulation Objectives, Constraints, and Criteria of the GRR should explain why only NED is used for decision making in this study and refer readers to the EIS for the RED, EQ, and OSE accounts.

Basis for Comment:

The currently proposed project is more environmentally friendly than the authorized project. The Draft GRR at first reads as though this is a multipurpose planning process. Then, suddenly the ecosystem restoration (NER) concept is dropped. It seems as though NER considerations are, in fact, carried through the report because the most cost-effective initial plan, Clearing and Snagging (CS), is dropped and we presume it is because of impacts on environmental quality. If that is why CS is dropped, instead of the cost of mitigation, then it would seem that the NER purpose needs to be carried forward.

The Draft GRR alludes to the ecological importance of the riparian habitat in the project area and the opportunities for mitigation. There should also be recognition of the overall scarcity of these habitats and the likelihood for impact because of the location within the project area. This would acknowledge both the potential for impact and the opportunities for restoration as is provided in the HEP assessment.

Although no sponsor was found for an NER plan, that does not mean that such problems don't exist. ER 1105-2-100 E-3.a(4)(a)(1) states that "The non-Federal partner's willingness or unwillingness to sign a Project Cooperation Agreement should not be the test of whether a plan is acceptable or not."

The RED & OSE accounts disappear from the GRR. To avoid confusion, the GRR should explain why only NED is used for decision making in this study and refer to the EIS for the EQ, RED, and OSE accounts.

Significance – Medium:

The Study seemed to give consideration to the EQ account that is not reflected in the Draft GRR, which makes the report seem incomplete.

Recommendations for Resolution:

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

- Provide more of a rationale for using only NED than stating there is lack of a sponsor
- Indicate how many organizations were asked to sponsor the NER purpose
- Give the range of costs for the preliminary NER alternatives for which no sponsor could be found.

Comment 7:

The rationale for excluding the second outlet from the Without-Project conditions should be clarified.

Basis for Comment:

The purpose of a GRR is to reflect changed conditions or assumptions since the project was initially authorized. Together, the second outlet and gated structure is a changed condition that has to be reflected in plan formulation.

It seems that the second outlet is assumed not to exist in order to evaluate the full impact of the authorized project. In this case, the GRR serves to plan a different project than that previously authorized. There seems to be no reason to base the new plan on the artificial condition that the second outlet and gated structure do not exist

On page 36, it is stated that “The effect of the second outlet will be illustrated later in the report for information purposes only.” It is not clear, however, that there is any value to providing a comparison of costs and benefits for a structure (i.e., second outlet) that is already constructed (i.e., sunk costs).

Significance – Medium:

Including the second outlet and the gated structure in the without project conditions is not likely to affect project justification or the final recommendation, but will improve the understanding of the project.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include the second outlet and gated structure in the Without-Project condition.

Comment 8:

Without-Project conditions should cover the period from 2000 to 2070.

Basis for Comment:

Draft GRR only displays conditions in 2020 and 2070. Without knowing the current conditions at the time of the inventory, it is impossible to determine the reasonableness of forecast conditions during the period of analysis.

The current condition is the known condition inventoried in 2001, the one for which empirical data have been gathered to determine existing activities. This is Step 2 of the 10 steps involved in computing benefits. The analysis then extrapolates from that known condition into the unknown with uncertainty. The Draft GRR does not explain the existing activities in terms of the extent or values of development. These existing activities need to be displayed as part of the Without-Project conditions.

From the incomplete information in the Draft GRR, it seems that Step 3 projects a significant increase in floodplain development and Step 7 projects the same for damages in 2001 and 2020.

ER 105-2-100 3-3c.(5)(f) requires estimation of flood damages under conditions at the time of the study. This is Step 6, and these are the flood damages with the least amount of uncertainty, at the time the inventory data were gathered.

The period of analysis begins in the year 2020, the first year in which the project would become completely operational. Yet, benefits do occur from partially completed projects, and these benefits need to be based on conditions prior to 2020.

Not all increases in damageable property and damages seem to result from forecast development. The flood inundation zones seem to expand over time from increased runoff, subsidence, and possibly sea level rise. This makes the analysis more difficult to follow without clearly explaining how these factors individually and collectively affect forecasting.

Significance – Medium:

While the forecast conditions seem realistic, additional documentation is needed to determine the reasonableness of the conditions used in the analysis.

Recommendations for Resolution:

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

- Display as Current Conditions the number and value of existing structures at the time the inventory was conducted (Document Step 2)
- Define Current Conditions in terms of a time period.(e.g. the CPI is currently indexed to the time period 1982–1984)
- Display the damages associated with Current Conditions (Document Step 6)
- Clearly explain forecasting methods (Document Step 3)
- Display values and damages in roughly 10-year increments from the date of the inventory to 2070.

Comment 9:

It is unclear if the methodology used to estimate flood damages includes damages from the 1-year event.

Basis for Comment:

The Draft GRR does explain how two residential structures worth \$78,000 can have flood damages of \$1.6 million. However, the explanation is incomplete and does not adequately document how these damages are calculated (e.g., number of structures). Such a significant amount of residential damage every 2 years needs to be compared with historical data.

The analysis seems extremely sensitive to damages from stage 2 ft below the first floor. The assumptions and the nature of the damage need to be explained.

If damages in the 2-year event occur to many structures outside the 2-year floodplain, it seems probable that structures in the 2-year floodplain are damaged in lesser, more frequent events. Controls need to be in place within the HED-FDA inputs to ensure structures assumed to be damaged have water on the property.

It is not demonstrated that the Morganza area compares well to this study area in terms of wave action, salinity, and duration. Wind fetch in Houston does not appear to be long enough to allow wave action to become important. Vehicle damages would be extremely sensitive to salinity.

There is no comparison of historical damages to estimated damages.

(Note: This comment also relates to Comment #3. The first-floor elevations of structures nearest to Clear Creek are known within 0.018 ft and these should include all structures flooded in frequent events. Applying a variance of 1.26 ft to these structures would exaggerate the frequency and value of damages.)

Significance – Medium:

Damages and benefits are most sensitive to estimates of the most frequent events, and these estimates are the easiest to confirm with historical data. The GRR should clearly explain to the reader how so much damage can occur so frequently.

Recommendations for Resolution:

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

- Comparison of historical damages to estimated damages, especially for frequent events
- Comparison of Morganza wave action, salinity, and duration to Clear Creek and tributaries
- Explain measures taken to ensure HEC-FDA does not estimate damages in the 1-yr event.

Comment 10:

The future conditions assumptions for HEC-1 models appear to be inconsistent with those used for the HEP analysis.

Basis for Comment:

The Hydrologic Analysis Without-Project Conditions report describes the data and assumptions used to project future urbanization of the watershed, but does not describe the results. The HEP analysis describes the resulting projections used, but does not describe the data used and the assumptions made. It is unclear whether the projected urbanization assumed for these two models is the same or resulted in substantially different conditions. The same assumptions of urban growth should be made for the assessment of all impacts for all alternatives. Sufficient detail should be provided so that the analysis could be duplicated by a third party and the same results obtained. At the least, information about the data used and assumptions made should be stated.

Significance – Medium:

The urban growth assumptions for the Without-Project and With-Project conditions should be consistent within and between models to ensure valid comparisons and be described in sufficient detail to validate the assumptions made.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to describe if the future growth projections used for each predictive model were based on the same assumptions and define those assumptions.

Comment 11:

Clearing and Snagging has the highest rate of return, yet it is dismissed as the first added alternative and never seems to receive any further study.

Basis for Comment:

It is unclear why the alternative with the most net excess benefit of the initially identified top 10 measures was not reconsidered in the Second Added analysis when it has the best net benefit and would be constructed in one of the areas experiencing the highest flood damages. It is shown on Figure 2.3-4 of the PDEIS as one of the 24 measures that came out of the screening process, but its evaluation and apparent dismissal are not described. If the measure was eliminated due to environmental considerations it should be noted in the discussion so that the reader understands the rationale for the measure being removed from consideration.

Significance – Medium:

Clarification of the elimination of beneficial alternatives is important to establishing that the proposed action includes the most economically feasible, beneficial, and environmental sensitive elements.

Recommendations for Resolution:

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

- Explain why the clearing and snagging alternative was eliminated
- Clarify why some alternatives from the First-Added Measures were not re-evaluated in the Second-Added Measures.

Comment 12:

The assumption that increased runoff will result from development needs to be justified to make sure that it is consistent with floodplain regulations and in compliance with federal law.

Basis for Comment:

Future inundation damages increase significantly. The inundation damages in the base conditions (about 2001) are not displayed. From 2020 to 2070, expected annual damages increase from \$24 million to almost \$30 million. It is unclear how much of the unknown overall increase in damages results from additional development of damageable property, increases in the value of existing damageable property, and how much is from additional runoff from watershed development in general.

The GRR assumes that flows will increase due to development impacts for greater than the 100-year floods, which may or may not be the case. This assumption leads to higher flows and stages for future conditions, which while conservative, may overstate future damages for both the with and Without-Project conditions. This may not be as serious as it seems since both conditions are compared with the same assumptions but a discussion of the impact of these assumptions should be included. The use of the identical assumptions for both conditions should remove most of the impacts of the assumptions from the results, but a discussion would be helpful.

One of the primary reasons that communities nationwide are adopting ordinances that require stormwater detention or retention is to improve water quality. The GRR seems to ignore this non-monetary benefit.

The study constraint that “recommended plans must be formulated to comply with local stormwater management of floodplain regulations” does not comply with the Principles, which allow for plans to be formulated that change existing statutes. If any community is not in full compliance with the requirements of the NPDES or FEMA programs, it seems most reasonable to assume they will adopt retention or detention requirements to eliminate the increased impacts of future development. The threat of the loss of FEMA approval of the floodplain policies is usually enough to spur the errant jurisdiction into compliance to make affordable floodplain insurance available to their property owners. The timing of adopting future ordinances can be addressed as an uncertainty.

The planning process does not consider reducing the urban runoff from new development and redevelopment throughout the watershed. This project could be seen as an opportunity to encourage the development of a comprehensive floodplain management plan and the failure to address the regulation of any increased runoff from future development as a part of this project seems to be a missed opportunity.

As non-residential properties redevelop over the next 60 years, they may be required to detain storm waters. Thus, it seems as though upstream runoff may decrease throughout the analysis period.

Significance – Medium:

It is expected that the analysis is not especially sensitive to different future conditions scenarios, as long as they are consistent with and without a project. However, the validity of assumptions used needs to be presented in the report.

Recommendations for Resolution:

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

- Display value of development and damages in 2001
- Review the status of NPDES compliance for all communities without stormwater detention ordinances
- If increased runoff over time from new development is significant, include detention ordinances as an alternative while giving full consideration to related water quality benefits
- Explain the sensitivity of the analysis to related assumptions.

Comment 13:

The potential geological hazards associated with the Beaumont Clay Formation underlying this region (e.g., sinkholes, salt domes, active faults, subsidence, expansive clays, organic soils, etc.), including the stability of cut slopes, need to be considered and discussed in the report regarding how they may impact the project.

Basis for Comment:

The GRR and the DEIS provide a very limited discussion of geologic hazards along Clear Creek and tributary alignments. Geotechnical hazards are discussed in general terms in the DEIS but no specific locations of these hazards are identified. The only geologic hazard discussed in the GRR is the expansion characteristics of the soils. There are no specific discussion of geologic hazards such as:

- slides and slumps along the Clear Creek and its tributaries
- subsidence
- active or inactive faulting
- organic deposits
- sinkholes
- groundwater
- the presence of fissures or slickensides in clay deposits
- the erodibility potential of the soils
- the possible presence of hazardous materials.

No geologic mapping is provided. This information would guide the design phase investigations. It would also assist in identifying geologic hazards that may impact the design and cost. Phase 1 environmental assessment data should be included with this predesign work. This information would help identify if a proposed detention basin may be in an area of potential soil or groundwater contamination.

The GRR provides design shear strength values for six soil types. However, there is no discussion as to where these soil types will be encountered. The soil profile data used in the slope stability analysis was not provided in the report. Additionally, there is no discussion about the depth to groundwater and the impact that groundwater may have on slope stability and construction.

The GRR states that “Analysis was performed for the undrained condition (end of construction) and for the drained condition (steady state).” However, there is no documentation (cross sections depicting soil profiles, slope inclinations, and groundwater conditions) that stability analysis was performed for steady state, rapid draw-down, and seismic conditions. There is no discussion regarding the design parameters (soil types, corresponding shear strengths and unit weights, and the location of groundwater) used in the analysis. No safety factors for various slope and modeled conditions were provided. Rather, the report simply states that the analysis indicates that the proposed slopes are stable.

There is no discussion of the estimated settlement associated with the placement of fill. No consolidation test data is provided. This information is needed to address potential settlement of flood control structures and settlement of areas that receive fill.

The GRR only provides compaction in terms of a minimum number of passes of a tractor weighing at least 30,000 pounds. This is adequate for non-structural fills. Consideration should be given to providing the compaction criteria for structural fills in terms of minimum soil compaction at a minimum moisture content, i.e., something like...”engineered fill should be compacted to at least 90% of maximum dry density at a moisture content of at least 2 percentage points over optimum moisture. The maximum dry density and optimum moisture content should be determined in accordance with ASTM D-1557.”

In summary, insufficient data exist to identify and mitigate potential geologic and geotechnical hazards along the project alignment.

Significance – Medium:

An understanding of the potential geologic hazards that exist along the project alignment is necessary to evaluate the impact of these hazards and to develop the appropriate mitigation for the impact.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded as follows:

- Prior to preliminary engineering design, a complete evaluation of the potential geologic and geotechnical hazards should be provided. Geologic mapping within the watershed will aid in identifying the possible locations of such hazards that require additional evaluation and possible mitigation, if necessary, during design studies.
- Geologic mapping and the correlation of existing test borings should be included in the pre-design phase.
- Specific soil profile information that includes soil types with depth and their corresponding index and strength data for various sections along the creek alignment where cuts for detention are planned should be provided.
- Typical foundation design parameters should be provided for flood wall and other structure evaluation.
- The GRR should include documentation (cross sections depicting soil profiles, slope inclinations, and groundwater conditions) that stability analysis was performed for steady state, rapid draw-down, and seismic conditions. This documentation should include a comparison of the calculated stability factors to the acceptable design safety factors.
- A discussion regarding moisture conditioning during grading to reduce the adverse impacts of shrinking and swelling should be included in the GRR.

- Consideration should be given to providing keying and benching recommendations, as well as providing compaction criteria for structural fills in terms of minimum soil compaction at a minimum moisture content. Providing compaction recommendations in these terms provides better control of fill placement than specification in terms of number of passes of equipment and will help to mitigate the effects of expansive soils.

Comment 14:

It is unclear what percentage of impacted landcover categories is wetland, and the area of affected wetland should be more accurately defined to compare to mitigation plans and ensure no net loss.

Basis for Comment:

Section 4.9.3.2 of the PDEIS does not clearly describe impacts to wetlands habitat. The text refers to the total area of wetland summarized in Table 4.9-4 that shows 241.19 acres of wetland in the entire project footprint, 50.29 acres of which are located within the areas of the conveyance and detention features. There is no description of what types of wetland habitat would be affected by the different project features, some of which may have already occurred if the Mary's Creek detention basins are considered. The information in Appendix J appears to be the first clear description of the potential in-stream disturbance of wetland habitat, and describes up to 27.4 acres of wetland impact within the Clear Creek conveyances. However, the description of wetland habitat in the project area (Table 4.9-4) does not describe that much riverine, aquatic bed, or unconsolidated bottom habitat in the project area.

The list of species in coastal prairie includes species that are representative of upland habitats as well as those that are representative of wetland habitats. The merging of such potentially disparate habitats into one ecosystem type may make it difficult to carefully enumerate wetland area in inventories of existing habitats and may complicate comparison of current and future wetland areas.

The mitigation described in Section 4.9.3.2 of the PDEIS is not a valid wetland mitigation plan. The text states there are 190.9 acres of wetland habitat within the mitigation features of the project. There is no consideration for any impact to or loss of wetlands that could occur during implementation of the enhancement and creation activities. Instead, the entire area of existing wetland is considered mitigation for direct impacts from the conveyance and detention features and a 1:3.8 mitigation ratio is claimed in Section 8.14. Not only is it likely that some of this wetland will actually be impacted by project construction and be unavailable as mitigation of any kind, simple preservation of existing wetland habitat typically does not provide mitigation credit at a 1:1 ratio. Typical enhancement credit can be found at ratios of approximately 3:1, and typical preservation credits can be found at ratios of approximately 8:1.

There is inadequate description about how the mitigation plan will accomplish No Net Loss of wetland functions and values. The mitigation plan in Section 5 describes how mitigation of floodplain forest and wet coastal prairie habitats would be provided using a combination of three mitigation measures, two of which include a specific goal of wetland enhancement and/or creation. Measure ER-5-Xb would include enhancement of 171 acres and creation of 46 acres of wet coastal prairie with 30% of the sites preserved, enhanced, or restored to hydric wetland conditions. This would be expected to result in approximately 65 acres of wetland. Measure ER-6-A1b would include preservation of 20 acres of floodplain forest and 37 acres of wet coastal prairie creation.

At a similar 30% hydric condition, this would be expected to result in approximately 17 acres of wetland. There is no description of the amount of wetland that would be expected from the third measure (ER-4/5-C1).

The description of unavoidable impacts to wetlands is omitted from Section 9.0.

Significance – Medium:

Demonstration of No Net Loss of wetlands is required to demonstrate full compliance with the Clean Water Act.

Recommendations for Resolution:

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

- Add a description in the Proposed Action that clearly describes the extent of channel alterations
- Describe the area and type of wetland impact that would result from construction of each project feature, including construction of mitigation features
- Ensure wetland impacts are described consistently in the text and in the 404(b)(1) Analysis.
- Describe how wetland mitigation would be accomplished and demonstrate how there would be No Net Loss of wetland functions and values
- Include a description of unavoidable impacts in Section 9.0.

Comment 15:

The impacts from the connected action of relocating pipelines should be included in the analysis.

Basis for Comment:

The EIS should include consideration of the “connected action” of relocating 26 pipelines that would require relocation to accommodate construction of the proposed project. Section 1508.25 of the NEPA requires consideration of :

(1) Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:

(i) Automatically trigger other actions which may require environmental impact statements.

(ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

(iii) Are interdependent parts of a larger action and depend on the larger action for their justification.

Significance – Medium:

NEPA requires consideration of connected actions, as well as cumulative actions.

Recommendations for Resolution:

To resolve these concerns, the report should be expanded to consider the environmental impacts from relocating 26 pipelines to accommodate implementation of the proposed project, including appropriate mitigation measures.

Comment 16:

There needs to be additional discussion and reference to specific historic data to support the geotechnical design assumptions.

Basis for Comment:

The GRR mentions that “drillings and soil testing” have been performed over a number of decades but no historic data are provided or specifically referenced. The GRR and DEIS includes a very limited geologic discussion, but no geologic mapping along Clear Creek and its tributaries is provided. There is no discussion of historic groundwater conditions. No references to other geotechnical reports are provided.

The GRR provides the logs of 14 borings drilled in the eastern 1/3 of the creek alignment. It does not reference geotechnical data for other sections of Clear Creek. The Civil section lists 28 Clear Creek Bridge crossings. Geotechnical data including test borings should be available for review at these bridge crossings.

The inclusion of historic data and information will be helpful in guiding the design phase investigations and supporting conclusions related to the presence of impacts and associated mitigation and the findings of the EIS. It will assist in identifying geologic hazards that may impact the design and cost. Additionally, this information will help identify if proposed detention basins may be in an area of potential soil or groundwater contamination.

Significance – Medium:

The inclusion of historic data and information provides a basis for the need and extent of future design level studies. Historic data aid in supporting conclusions related to the presence of impacts and associated mitigation.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded as follows:

- The reports that document the drillings and soil testing performed over a number of decades reported in the GRR should be discussed and referenced.
- The GRR should include geologic maps of the floodplain area.
- Geologic mapping and the correlation of existing test borings should be included in GRR and DEIS.
- Phase 1 environmental assessment data should be included with this pre-design work of the GRR.

Comment 17:

Please clarify how benchmarks for survey elevations will be established and maintained over the estimated 10-year construction schedule, given regional subsidence.

Basis for Comment:

It is likely that the ground surface and benchmark elevations will decrease over the relatively long construction schedule due to regional subsidence. If the benchmarks are not updated during construction, then it is possible that components of the system will be constructed with as-built elevations that are lower than intended, as occurred with the New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS). If the benchmarks are updated, then it is possible that fill volumes will increase between the present cost estimate and design and between design and construction.

Significance – Medium:

This consideration may impact the effectiveness of each alternative (if the benchmarks are not updated) or the estimated cost for implementing each alternative (if the benchmarks are updated).

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to provide an explanation about how survey benchmarks will be established and maintained throughout the project life. Also, discuss if this plan will have any impact on the estimated cost.

Comment 18:

The restoration and management plan currently being proposed may not be feasible.

Basis for Comment:

Much of the successful preservation or restoration of floodplain forests and coastal prairies depends on careful management of invasive species. Indeed, the prairie species list includes a number of very noxious invaders. There is insufficient detail provided to determine whether habitat preservation or restoration is likely to be successful in the short term or long term. The few measures described are sometimes not appropriate or impossible. As it is currently written, there is no practical or realistic management plan being proposed. The costs for management appear to be much too low, leading to an overestimate of the likely net benefit of those activities. This could have implications for the cost-benefit analysis for larger aspects of the project.

Examples of areas needing revision include:

GRR p. 86 (PDEIS vol 2 p. 134) *"Newly developed (created) floodplain forest would require soil preparation for planting (disking and soil conditioner additives)."*

Is this current best practice? Are there examples of where this has been successful? The conditions created have the potential to accelerate tallow tree invasion since they out compete native trees most readily in high-light, high-nutrient, disturbed conditions.

PDEIS vol 2 p. 134 *"Intensive O&M (including reconnaissance, removal and foliar applications to control invasive, noxious, and exotic species) would be performed annually for 35 years."*

The report needs to make clear that aerial application is not being proposed for forest habitats. In addition, foliar applications in prairies could be spot treatments of individual plants or broadcast spraying — they differ widely in their costs and non-target effects. For some invasives, such as King Ranch (KR) Bluestem (*Bothriochloa ischaemum*), spraying is not a feasible method of control because they mix in with the native prairie grasses and there are no herbicides that kill KR but not the native grasses. Mowing and burning are likely to be more effective for coastal prairies; why are these not being considered?

PDEIS vol 2 p. 135 - *"Dredged material stock piled along the north bank of the creek would be removed, and the existing cleared overbank areas along the channel would be densely planted to restore the existing floodplain forest to a desired state."*

Please justify the strategy of dense plantings and describe how success will be measured.

PDEIS vol 2 p. 135 Coastal prairie - *"The ER-6-A1a,b and ER-5-Xa,b measures both proposed the creation of new wet coastal prairie. In these instances the E-Team assumed the new site would be prepared by close-to-the-ground mowings in the early to late spring."*

Please provide references that this method could be effective (it is not something that would normally be done)

"The seed mixture would be planted using "notill" planting equipment to avoid disturbing the existing ground conditions and microtopography."

Please provide some references that substantiate mowing and notill planting as a viable restoration method.

"They further assumed that the appropriate mixture of wetland and upland species would be obtained from sources no further than 150 miles away from the sites."

Why is this limit on distance being specified? What supplier exists for such seeds? They might be available from sites such as the University of Houston Coastal Center (the only large intact coastal prairie that we know could be used to collect this large amount of native coastal prairie seeds), but many years there are no seed sources, they are very limited in quantity, and not generally commercially available.

"Their intentions were to replant the areas within one year if monitoring revealed that the implementation had been unsuccessful, and that annual O&M would include reconnaissance as well as mowing and haying 1/2 of the site annually."

Please describe how success will be measured. Please provide the rationale for haying 1/2 the site.

PDEIS vol 2 Table 47 — Where do these management numbers come from? It can cost far more than \$1000 per acre to remove invasives from floodplain forest. These numbers in the report are almost certainly too low.

PDEIS vol 2 ER-4-D — Costs are only \$200 / acre — much, much too low. The management costs are not as large as the up-front costs, but this will still have a significant effect on either the effectiveness (if such small sums are spent) or the cost (if enough money will be spent to be effectively managed). The combination of these two suggests that the current cost-benefit projections overestimate the net benefit of these activities.

Significance – Medium:

The restoration and management plans are not well developed, and need to be rewritten.

Recommendations for Resolution:

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

- Provide references or data to justify cost figures
- Revise costs if current estimates differ from these costs
- Provide references or data to justify proposed restoration and management methods
- Revise restoration and management methods if current methods do not match current best practices.

Comment 19:
The explanation in the Appendix regarding the shift from 2010-2060 to 2020-2070 needs to be discussed in the main text.
Basis for Comment:
The reason for the shift in the project life and how it was done is explained in the appendix but not in the main text. The addition of the discussion to the main text would be helpful to most readers of the document since it is unlikely they will also read the appendix (unless they are water resources engineers). The other alternative is to simply change the hydraulics/hydrology portion main document to show the same project life as the other portions of the main text.
Significance – Low:
Including the explanation for shifting the project life from 2010-2060 to 2020-2070 will improve the reader’s understanding of the project.
Recommendations for Resolution:
To resolve these concerns, the report would need to be expanded to include add a few sentences to the main report where the life of the project is presented as 2010 to 2060 in the main report to explain the shift or change the time frame in the main report to 2020 to 2070.

Comment 20:
A comparison between new models and old models should be included, as well as a discussion of why the modeling was updated.
Basis for Comment:
The GRR states that new models were developed for this study. The reason for the development of the new models should be explained in the report. This could be a sentence or two that deal with why the new models were developed. This could discuss changes in the watershed, obtaining new topographic data that were more accurate, and/or other reasons for the new models. If the new models were compared with the old models, it would be of interest to see how the results from the two efforts compared.
Significance – Low:
Explanation of the modeling history will improve a reader’s understanding of the information.
Recommendations for Resolution:
To resolve these concerns, the report would need to be expanded to include add a sentence or two explaining the reason for the new model development and how the new model results compared with older model results.

Comment 21:

The GRR should clearly identify that the channel and detention basin slopes will be globally stable but may be subject to shallow slides periodically that will require long term maintenance.

Basis for Comment:

The following text is in Section 4 (Geotechnical) of Engineering Appendix to the GRR: “After long periods of rainfall events, absorption of moisture and consequential heaving of slope surface materials such as high plasticity clays may lead to some reduction in surface shear strength and some cases of “shallow” surface sloughing. Isolated shallow surface sloughing events are not anticipated to affect the immediate stability of the channel slopes, however, if not properly maintained over life of project (backfilled, graded, and reestablished with adequate vegetation where necessary as part of O&M), sloughed areas could become progressively larger in time and may eventually represent a threat to embankment safety.”

The panel agrees with this assessment and believes that it should be stated in the main text of the GRR. Additionally, maintenance costs associated with slope repairs should be included in the cost estimates.

Significance – Low:

The report should accurately describe how the project will perform and what will be required in terms of maintenance.

Recommendations for Resolution:

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

- A statement in the main text of the GRR that the channel and detention basin slopes may experience surface sloughing periodically and will require long-term maintenance
- The cost of this maintenance in the cost estimate.

Comment 22:

The erosion threshold of 6 fps needs to be documented.

Basis for Comment:

The geotechnical report does not identify areas where flow velocities will exceed 6 feet per second (fps). Additionally, the basis for establishing the critical erosive velocity as 6 fps is not documented. The report simply states that erosion protection will be required where flow velocities will exceed 6 fps. Several options for protection are mentioned but applicability of these options and general costs are not discussed.

Due to the fine-grained nature of the soils, unprotected embankments and soil around in-creek improvements like bridge piers, abutments, and culverts may be susceptible to erosion at velocities less than 6 fps. This threshold may be standard practice in the area, and if so should be stated as such — otherwise some basis for the use of the number should be provided.

Significance – Low:

Inclusion of documentation and references will clarify the use of the threshold of 6 fps and confirm the appropriateness of the proposed mitigation methods to reduce creek bank erosion.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded as follows:

- The GRR should first document that the critical flow velocity for the soils along the creek banks is 6 fps. Once the critical velocity is established, the GRR should identify areas where flow velocities greater than 6 fps are anticipated and then provide preliminary recommendations for mitigation that are appropriate for these sections.
- The GRR should provide at least a minimal discussion of scour and applicable mitigation at in-creek improvements.

Comment 23:

The implementation of “Setback Zones” for structural improvement near the tops of slopes and areas that receive sediment and soil from detention excavations should be considered.

Basis for Comment:

Channel slopes and detention basins will be created by excavating soil. Slope failure or near-surface shallow slumping may impact improvements such as roadways, buried utilities, and structures constructed near the tops of slopes. The stability analysis of the slopes may not include surcharge loading; that is, surface loading from improvements that are constructed immediately adjacent to the tops of slopes. Accordingly, a sufficient distance (i.e., a setback zone) between the top of slope and possible improvements should be provided to limit the potential for damage to improvements from landslides and shallow slumping.

Areas have been designated to receive sediment and excavated soils from construction of the in-creek detention areas and detention basins. Areas that receive sediment and excavated soil will settle as a result of the weight of this material. Structures and improvements constructed within the area of influence of this fill may experience detrimental settlement. Therefore, a sufficient distance from the fill to improvements should be provided to limit the impact of settlement on the adjacent improvements.

Significance – Low:

While establishment of setback zones does not affect the justification of the project, inclusion of setback zones will reduce the potential for impacts to improvements from landslides, shallow slumping, and settlement. It will also provide land planning guidance.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to include recommendations for the implementation of “Setback Zones” for improvements constructed near the tops of slopes and areas that receive sediment and soil from detention excavations. These recommendations should include guidelines for keying and benching of any fills, fill slope inclinations and corresponding heights, and an appropriate distance from the tops of slopes for temporary and permanent structures including but not limited to roadways, underground utilities, structures, and construction equipment.

Comment 24:
The discussion of contributions to the Clear Creek watershed would benefit from a figure that demonstrates the difference in the extent of the 100-year or other floodplain areas.
Basis for Comment:
The extent of the floodplains is shown in Figure 2 for the 100-year flood (we assume this is existing conditions) but no figure in the PDEIS shows the expected change in floodplain area for the 100-year and possibly for other reoccurrence intervals. A figure showing the expected impacts of the project on the floodplains would be useful in understanding and illustrating how the project impacts flood potential along Clear Creek.
Significance – Low:
Inclusion of the figure will improve the technical quality and understanding of the document.
Recommendations for Resolution:
To resolve these concerns, the report would need to be expanded to: <ul style="list-style-type: none"> ▪ Include in the EIS either Figure 2-3 from pages 66-67 of the Engineering Appendix or another similar figure from the GRR that shows the change in floodplain extent due to the project. This will aid in presenting the case for the project. ▪ Display the 100-yr overflow for the With-Project condition.

Comment 25:

The Purpose and Need should include the physical characteristics of the watershed that contribute to flooding problems as well as quantification of the costs of flood damage.

Basis for Comment:

The Purpose and Need is the foundation of an EIS. It introduces the proposed project and describes why the project is proposed and important. The Purpose and Need defines the problem for which the Proposed Action and the alternatives are solutions and provides the basis for measure of the potential effectiveness of project alternatives.

The Purpose and Need states that flooding is a problem in the Clear Creek Watershed but doesn't describe any of the physical attributes that contribute to the flooding problem. The Purpose and Need could be strengthened by an explanation of the physical characteristics that contribute to the flooding — flat coastal plain with areas of dense forest that reduces conveyance and causes significant backwater flooding, etc.

Significance – Low:

Proper definition of the Purpose and Need will demonstrate the sufficiency of the alternatives analysis and make for a more legally defensible document.

Recommendations for Resolution:

To resolve these concerns, the report would need to be expanded to add a paragraph to the Purpose and Need section of the PDEIS describing the watershed in more detail.

Comment 26:
Best Management Practices that would be employed to mitigate construction impacts to water quality, sediment quality, air quality, and noise impacts should be addressed.
Basis for Comment:
Section 1502.14 subpart (f) of 40 CFR (the NEPA) requires inclusion of appropriate mitigation measures not already included in the proposed action or alternatives. The typical best management practices (BMPs) anticipated to be employed to mitigate construction impacts to water quality, sediment quality, air quality, and noise should be described in each applicable section to identify that measures will be taken to avoid and minimize impacts during and after construction.
Significance – Low:
Inclusion of examples of best management practices and other mitigation measures confirms future consideration of those measures as permitting and project design progress.
Recommendations for Resolution:
To resolve these concerns, the report would need to be expanded to define in each applicable section the typical best management practices to be employed to mitigate construction impacts to water quality, sediment quality, air quality, and noise.

Comment 27:

The interest cost and benefits from the completed features should be calculated for each year during the construction period.

Basis for Comment:

This large project includes several separable features. Many will be completed during the period of construction, before the base year. In fact, some are already completed.

Interest During Construction (IDC) is not straightforward in this situation. There is no way for the panel to determine the adequacy and consistency of assumptions, or the accuracy of calculations based on the information provided.

ER 1105-2-100 D-4c specifically states that benefits accruing during construction must be separately calculated. It seems that they were assumed to offset IDC, which is contrary to the guidance in paragraph D-4c(2).

As the period of construction is relatively long and includes several separable features, attention should also be given to the Project Implementation Timing guidance in ER 1105-2-100 2-4o. This requires the best schedule for implementing project features, or that the most cost effective features be constructed first unless there are overriding concerns, such as induced damages from upstream channel improvements. This may only be a concern during the fourth step required by Section 575, unless it would otherwise affect project justification.

Significance – Low

The calculation of interest and benefits during construction does not appear to conform with technical guidance; however, this is not expected to affect the final recommendation.

Recommendations for Resolution:

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

- Display details of IDC calculations in the Economic Appendix
- Display details of benefits accruing during construction in the Economic Appendix
- Demonstrate proper project implementation timing.

APPENDIX B

Charge to the Independent External Peer Review Panel

on the

**Final Independent External Peer Review Report
for Clear Creek, Texas Flood Risk Management General Reevaluation Report
and
Preliminary Draft Environmental Impact Statement**

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Final Charge to the Peer Reviewers

for

CLEAR CREEK GENERAL REEVALUATION REPORT AND PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT INDEPENDENT EXTERNAL PEER REVIEW

BACKGROUND

The U.S. Army Corps of Engineers (USACE) has been directed by Congress to develop the Clear Creek General Re-Evaluation Report (GRR). Clear Creek drains an area south of and partially within the City of Houston, Texas. The Clear Creek watershed is located in four counties, includes 16 cities, and covers approximately 260 square miles of land. The watershed is composed of relatively flat coastal plain with elevations varying from near sea level at Clear Lake on the eastern edge of the watershed to about 75 feet above mean sea level (MSL) on the western watershed boundary. Clear Creek receives flow from 17 principal tributaries. The Clear Creek watershed 1 percent (100-year) annual exceedance probability (AEP) floodplain contains an area of approximately 19,000 acres. Many communities and subdivisions along the creek are subject to flooding and recent floods (1973, 1976, twice in 1979, 1989, October 1994, and June 2001) have caused extensive property damage.

The Flood Control Act of 1962 authorized the initial investigation of flood problems on Clear Creek. In 1968 Congress authorized the Clear Creek Flood Control project consisting of an improved grass-lined channel 31 miles long which would replace about 41 miles of existing winding channel. This channel was designed to contain flood flows up to and including the 1% (100-year) AEP flood event. Subsequent Congressional actions, administrative changes to water resources planning policies, changes in the project area, and changes in the attitude of the affected public, required a comprehensive restudy of the Clear Creek project.

A restudy was initiated in the early 1970s. In 1982 a modified project was recommended that changed the previous 1% (100-year) AEP flood event level of protection in the 1968 authorization to a 10% (10-year) AEP flood event level. The new plan required less channel modification and included nonstructural measures. Construction began in the mid-1990s. Subsequently public concerns about potential environmental and hydraulic impacts led the project sponsors to request that construction be suspended. The Harris County Flood Control District developed a Sponsor Proposed Alternative (SPA) that is substantially different from the authorized project. Therefore, Galveston District initiated a general reevaluation study in 1999 to determine a technically effective and publicly acceptable solution to reducing flood risk in the watershed.

The GRR provides the details of the planning, engineering, and environmental objectives and assessment methods for evaluating the flood risk management projects proposed for the Clear Creek watershed. The Clear Creek GRR scope was to prepare a decision document that identifies and evaluates several plans for reducing flood risk; enhancing fish and wildlife

resources; improving water quality; preserving, protecting and restoring natural and cultural resources; and attaining the ecosystem benefits that Congress intended in a cost effective manner. The Clear Creek GRR culminates in a recommended plan.

An environmental impact statement (EIS) is being conducted in compliance with the National Environmental Policy Act (NEPA) (40 CFR § 1500-1508) to evaluate the potential environmental impacts of the proposed actions and reasonable alternatives to those actions. A Preliminary Draft EIS (PDEIS) has already been completed.

In compliance with WRDA 2034 (Public Law 110-114), Section 2034, and because of the importance of this project, an independent external peer review (IEPR) of the Clear Creek GRR and PDEIS will be conducted. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. 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 PDEIS. The independent review will be limited to technical review and will not involve policy review. The peer review will be conducted by subject matter experts with extensive experience in engineering, economic, and environmental issues associated with flood risk management. The subject matter experts 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. This work will be conducted in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE) Engineer Circular (EC) EC No. 1105-2-410, *Review of Decision Documents*, dated 22 August 2008, CECW-CP Memorandum dated March 30, 2007, and the Office of Management and Budget *Final Information Quality Bulletin for Peer Review* released 16 December 2004.

DOCUMENTS PROVIDED

The following documents will be provided to the peer reviewers:

- Clear Creek, Texas Flood Risk Management General Reevaluation Report and appendices
- Clear Creek, Texas Flood Risk Management Environmental Impact Statement and appendices
- EC 1105-2-410, *Peer Review of Decision Documents*
- CECW-CP Memorandum dated March 30, 2007
- *Final Information Quality Bulletin for Peer Review* released 16 December 2004.

SCHEDULE

1. Battelle confirms final selection of candidates	March 5, 2009
2. All peer reviewer contracts finalized	March 17, 2009
3. Clear Creek review documents distributed to IEPR Panel with charge	March 26, 2009
4. IEPR panel submits technical review comments to Battelle	April 21, 2009
5. Battelle identifies key issues/themes in comments and distributes to IEPR panel	April 23, 2009
6. Facilitated teleconference on confirm key issues	April 24, 2009
7. IEPR panel prepares final panel comments focused on key issues using formatted structure and submits to Battelle	May 4, 2009
10. Battelle provides the IEPR report ^a to IEPR panel for comment prior to submitted to USACE	May 8, 2009
11. IEPR Panel submits any comments to Battelle	May 11, 2009
12. USACE provides clarifying questions or input draft "Evaluator" response into DrChecks [*]	May 26, 2009 ^b
13. Teleconference with USACE to discuss final panel comments [*]	May 28 2009
14. IEPR Panel provides responses to USACE Evaluator comments [*]	June 18, 2009 ^b

* reflects a change in the process

CHARGE FOR PEER REVIEW

Members of this peer review panel are asked to determine whether the technical approach and scientific rationale presented in the Clear Creek GRR and PDEIS are credible and whether the conclusions are valid. The reviewers are asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The panel is being asked to assess *the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used*. The peer reviewers are not being asked whether they would have conducted the work in a similar manner. It should be noted that this IEPR is taking place before the Clear Creek GRR and PDEIS have been finalized.

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

^a Battelle's Final IEPR Report will include a summary of panelists and their qualifications, final formatted comments, and a brief discussion based on the key issues/consensus document prepared as a result of the panel review teleconference meeting. No Draft IEPR report will be prepared and submitted to the USACE.

^b Anticipated date of activity.

General Charge Guidance

1. Please answer the scientific and technical questions listed below and conduct a broad overview of the Clear Creek General Reevaluation Report and Preliminary Draft Environmental Impact Statement. Please focus on your areas of expertise and technical knowledge.
2. Identify, explain, and comment on assumptions that underlie economic, engineering, ecological, geotechnical, hydrological or environmental analyses.
3. Evaluate the soundness of models and planning methods as applicable and relevant to your area of expertise. Comment on whether models explain past events, how models will be validated, and whether the models are suitable for meeting project objectives.
4. Evaluate whether the interpretations of analysis and conclusions are reasonable.
5. 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.
6. Offer opinions as to whether there are sufficient analyses upon which to base a recommendation for construction, authorization, or funding.
7. 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.
8. Please **do not** comment on or make recommendations on policy issues and decision making.
9. Please **do not** evaluate the technical quality and usability of the models, as this has been done or is being done under a separate task.
10. IEPR panel members may contact each other. However, IEPR 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.
11. Please contact the Battelle project manager (Amanda Maxemchuk, MaxemchukA@Battelle.org) for requests or additional information.
12. In case of media contact, notify the Battelle project manager immediately.
13. Your name will appear as one of the panelists in the peer review. Your comments will be included in the Final IEPR Report, but will remain unattributed.

Please submit your comments in electronic form to Amanda Maxemchuk, MaxemchukA@Battelle.org, no later than April 10, 2009, 10 pm EDT.

**Clear Creek, Texas
Flood Risk Management
Clear Creek General Reevaluation Report (GRR)**

Final Charge Questions

General Questions

1. Are the assumptions that underlie the economic, engineering and environmental analyses sound?
2. Comment on the adequacy and acceptability of the economic, engineering, and environmental methods, models and analyses used.
3. In general terms, are the models and planning methods sound?
4. Are the interpretations of analysis and conclusions based on the analysis reasonable?
5. Comment on the adequacy and acceptability of the economic, engineering and environmental methods, models and analyses used.

Section 1 – Introduction

6. Comment on the completeness and clarity of the introduction.
7. Has the need for the project, goals and objectives of the project, constraints and actual project plan for the Clear Creek Flood Risk Management been adequately addressed?
8. Was the information provided in the introduction consistent with that presented in later sections?
9. Describe the extent to which the legislative restriction on the evaluation of economic benefits and costs is clearly explained.

Section 2 – Problem and Opportunities

10. Does the problem statement adequately describe the problem and the solution presented in the document?

Section 3 – Formulation Objectives, Constraints and Criteria

11. Discuss the extent to which the role of the various economic analyses (NED, NER, and RED) is clarified.

12. Discuss the relevance of the environmental criteria considered as they relate to the objectives and authority of the projects.
13. Are there any other objectives or constraints that should have been considered as part of the GRR study that will be important to reaching the final goal?
14. Do you agree that the recommended plan placed the correct weight on historical data, specific recent information, and project flooding rate in the hydrologic and hydraulic modeling analysis?

Section 4 – Plan Formulation

15. Discuss whether the “No Action Alternative” is clearly explained, is consistent with the Economic Analysis, and whether the baseline appears consistent with generally accepted economic principles.
16. Are the basic assumptions used to define the without-project conditions flooding and damages valid?
17. Does the recommended alternative detail a plan to dispose of dredge materials?
18. Are utility and structural modification addressed in the formulation of the recommended plan?
19. Is it important to address the effects of transportation within the project area under the recommended plan?
 - a. Why or why not?

Section 5 – Plan Assessment and Screening of Alternatives

20. Discuss the extent to which the incremental net benefits are consistent with and justified by the economic analysis in Chapter 6 of the GRR and the Economic Appendix to the GRR.
21. Explain whether you agree with how the alternatives were formulated and developed and the rationale that was used.
 - a. Were differences between the new alternative and those introduced in the 1982 and 1997 reports explained adequately?
22. Does the plan clearly represent the selection of alternative measures for each economic reach?

23. Is the method used to refine recommended conveyance measures from the First Added Measures to the Second Added Measures (Table 10) clear?
 - a. What, if any, recommendations should be considered?
24. Do the results of the engineering and design evaluations adequately support the component of the recommended plan?
25. Since timing of detention is a key objective of the recommended plan, do you feel that the conveyances described will meet this objective on a long-term basis?
 - a. Do you feel the plan is representative of the stakeholder's ability to maintain flood control measures?
26. Do the alternative cross sections for each reach meet the engineering, economic and ecological objectives?

Section 6 – Economic Evaluation

27. Discuss whether the incremental approach to optimize measures to include is appropriate and justified.
28. Discuss the extent to which the economic assumptions are clear, justified, appropriate, and protect against double-counting of benefits.
29. Discuss the appropriateness of the discount rate and valuation approach used.
30. Discuss any deficiencies or inconsistencies in the economic evaluation.
31. Does the hydrologic analysis support the economic analysis of equivalent flood damages?

Section 7 – Risk and Uncertainty Analysis

32. Discuss the extent to which the uncertainty in the economic analysis is sufficient, justified, and appropriate and whether uncertainty in the probability distribution of flood events is adequately addressed.

Section 8 – Description of Recommended Plan

33. Identify and comment on the validity of any major assumptions used in the formulation and evaluation of the alternatives.
34. Does the recommended plan address the purpose and authority of the project as well as the problems, objectives, constraints, and criteria outlined for the project?

35. Does the report adequately describe how information gained from past studies was used and updated to support the recommended plan?
36. Does the report adequately describe the decision-making process for the selection of cross sections for each reach of Clear Creek?

Section 9 – Plan Implementation

37. Based on your expertise, will the plan be able to meet the project objectives of flood risk management?

Section 10 – Summary of Coordination, Public Views and Comments

No questions.

Section 11 – Recommendations

38. Discuss the extent to which the recommendations are consistent with and justified by the economic analysis.

APPENDIX A - SECTION 575 (WRDA '96) IMPLEMENTATION GUIDANCE

No questions.

APPENDIX B – ECONOMIC APPENDIX

39. Provide overall comments on the extent to which the economic analysis follows generally accepted economic practices and is appropriate and adequate to enable cost-benefit analysis of the NED of alternative projects.
40. Comment on any significant deficiencies or errors that you note in the economic analysis.
41. Comment on the extent to which significant non-market opportunity costs and benefits have been addressed.

Section 1 – The Period of Analysis, Interest Rate, and Price Level

42. Discuss the appropriateness of the discount rate applied to flood damage estimated in constant (current) price levels, and the appropriateness of the period of analysis.

Section 2 – Data Collection and Analysis Procedures

43. Discuss the appropriateness and adequacy of the method used to gather the data and the extent to which all significant project benefits are likely to be documented through the methods used.

Section 3 – Analytical Tools and Risk and Uncertainty

44. Discuss the appropriateness and adequacy of the method used to gather the data and to evaluate uncertainty, and the extent to which all significant risk and uncertainty in project benefits are likely to be documented through the methods used.

Section 4 – Damage Categories

45. Discuss the completeness of damage categories included in the analysis and the appropriateness and adequacy of the methods used to estimate costs and benefits in the various damage categories.

Section 5 – Without-Project Condition

46. Discuss the completeness and reasonableness of the assumptions included in the without project condition
47. Discuss the extent to which the without condition is clearly presented, adequately justified, and consistent with the economic methods described in this Economic Appendix.

Section 6 – With-Project Condition

48. Discuss the completeness and reasonableness of the assumptions included in the with-project condition.
 - a. Discuss the extent to which the with-project condition is clearly presented, adequately justified, and consistent with the economic methods described in this Economic Appendix.

Section 7 – Comparison of Alternatives

49. Discuss the extent to which the economic comparisons are consistent with the methods and analysis described in this Economic Appendix.
 - a. Comment on the results presented.

Section 8 – Refinement of the NED Plan

50. Comment on the quality of results presented.

Section 9 – Effect of the Second Outlet Channel and Gate Structure; Section 575 Analysis

51. Comment on how these sections provide support for understanding the economic implications of the required assumptions related to the second outlet channel and the Section 575.

Section 10 – Recommended Plan

No questions.

Section 11 – Economic Benefit Update Plan

52. Discuss the appropriateness and adequacy of the method used to update the economic benefits.

Section 12 – First and Second-Added Analysis Process

53. Comment on the data used (e.g., varying base-years), results, and conclusions reached in the “First and Second-Added Analysis Process.”

APPENDIX C – Clear Creek General Reevaluation Report – Hydrologic Analysis – Without-Project Conditions

Section 1 – Introduction and Scope

54. How has the “newly acquired data” changed the “Without Project Conditions” results from the rainfall runoff model (HEC-1) and the hydraulic model (HEC-RAS)?
55. Were the flood results from the October 1994 flood and Tropical Storm Allison (June 2001) similar to past “catastrophic” flooding events?
56. Are all of the major tributaries of the study area represented?
57. Given the lengthy north-south reach of the preferred alternative and the relatively shallow conveyance design, should wave action be a design consideration?

Section 2 – Special Modeling Assumptions and Overview

58. Is the basis for the development trends used to code the HEC-1 models justified?
59. Are the underlying assumptions used to develop the models for the two proposed types of detention basin analysis based on engineering judgment sound?
60. Does including community ordinances’ regarding new development and detention basins represent a realistic worst-case condition (no project improvements)?
61. Are the steps to calibrate the hydrologic model outlined in Table II.1 inclusive?
 - A. What, if any, additional data should be considered?

Section 3 – HEC- Watershed Modeling

62. Are the assumptions used in the Clark unit hydrograph method (Clear Creek HEC-1) and the Harris County Flood Control District equations for estimating required subbasin runoff coefficients clearly identified?
63. Comment on the suitability of the Modified Puls method for computing hydrograph routing for this project.
64. How does “borrowing” storage outflow data from previous flood insurance models affect the results?
65. Have the most recent SCS soil data available been used in analyzing the hydrologic soil groups?
 - a. If not, comment on how using less recent data may affect the analysis.

- b. Is using the soil group “D” (worst case for runoff) a valid approach?
- 66. Comment on the validity of the HEC-1 model versions (development-dependent variables, etc) (Table III.2).
- 67. Is there sufficient information presented to project development-dependent subbasin parameters (DLU)?
 - a. Have the 2010 results been compared to the most recent aerial photographs?
 - b. What percentage change would be considered significant?
- 68. Comment on the use of year 2000 conditions to compute the percent channel improvement (DCI) for future improvements to Clear Creek, Armand Bayou, and their tributaries.
- 69. Is the method used for interpolating the ponding percentage (DPP) as a linear event between 2000 and 2060 justified?
 - a. Why or why not?
- 70. Comment on the calculation of the control factor based on the relative stringency of the in-place ordinances and the limitations set forth in Table III.4.
- 71. Comment on the completeness and amount of rainfall data used for comparing historic and computed results.
- 72. How appropriate are the methods used to calibrate the models?
- 73. Comment on the use of the 40-year old TP-40 values within the HEC-1 modeling.
- 74. Comment on the assumptions used in the HEC-1 flood verification.

Section 4 – HEC-RAS Modeling

- 75. Comment on the use of a starting water elevation of +1.45 feet at Galveston Bay to represent nominal coincident tide conditions in Clear Lake.
- 76. Is the decision to disregard continuing development fill up to one-foot in the one-percent exceedance flood elevation sound?
 - a. Why or why not?

APPENDIX D - Floodplain Forest and Wet Coastal Prairie Community Index Models for the Clear Creek Watershed, Texas Model Documentation Draft Report

77. Do the models support the primary objective of the flood risk management projects?
 - a. Why or why not?
78. Do the model results effectively facilitate the comparison of restoration and mitigation alternatives for flood risk management?

Section 1 – Introduction

80. Comment on the suitability of the approach for meeting the Clear Creek project objectives.

Section 2 – HEP Overview

81. Comment on the utility of the HEP methodology for evaluating ecosystem changes to support decisions to meet the project objectives.

Section 3 – Community Index Models

82. Were all significant ecosystem components considered in the development of the conceptual model?
 - a. If not, please describe what is missing.
83. Comment on whether the model reference domain (i.e., the 500-year floodplain) accurately reflects the ecosystem benefits within the area targeted for flood risk management (i.e., the 100-year floodplain).

Section 4 – Model Sampling and Calibration Protocols

No questions.

APPENDIX E – Initial Alternatives Screening Scoresheet

No questions.

APPENDIX F – Clear Creek General Reevaluation Report – Flood Damage Reduction – 1st Added Measures Results

84. Discuss the extent to which the assumptions used in the initial screening are clear and likely to ensure inclusion of alternatives with net NED benefits.

85. Comment on whether significant opportunity costs and benefits of ecosystem services and values are adequately addressed.
86. Comment on the appropriateness of including the structures removed from the floodplain as a result of Tropical Storm Allison in calculations.

APPENDIX G – Real Estate Plan

No questions.

GENERAL REEVALUATION REPORT CLEAR CREEK, TEXAS – ENGINEERING APPENDIX

Part 2 – H&H Appendix

2.1 Introduction and Background

1. At the time of the report, the basin is stated to be over 40% developed. Is this a significant difference from the conditions studied in 2003 *Clear Creek GRR, Hydrologic Analysis-Without Project Conditions* (2003 Hydrologic Analysis)?
2. How does the build-out date compare to 2060 projected conditions?
3. Compare and comment on the starting elevation at Galveston Bay for this study with the 2003 Hydrologic Analysis to represent nominal coincident tide conditions in Clear Lake.

2.2 Hydrologic Modeling

4. Comment on the approach taken and the results of the hydrologic modeling used.
5. Discuss whether the hydrological investigations and modeling adequately address the basin project area.
6. Were all relevant questions raised by Halff and Associates on the 2003 Hydrologic Analysis responded to accordingly?
7. Does the presented sensitivity analysis justify no change in the water surface elevation from the previous base conditions (2010) and future conditions (2060) to a base year of 2020 and a future year of 2070 used in this GRR Engineering Appendix?
8. Does the analysis outlined reasonably conclude that there will be no impact on the project due to a probable rise in sea level?

2.3 Without Project Modeling for Tributaries

9. Given the flat land characteristic of the project area, is it reasonable to average conveyance values?
10. How did the addition of the six tributaries affect the model results presented in the 2003 Without Conditions report?

2.4 Modeling Flood Damage Reduction Measures

11. Are the underlying assumptions used to develop the relative effectiveness ranking of the First Added Analysis and Second-Added Modeling components justified?
12. Is there sufficient information detailed in the report to support the conveyance methods outlined in Exhibit 2.4, Second Added Measures?
13. Does the information contained in Exhibit 2.5, Hydrologic Modeler's Notebook for NED Plan, support the recommended plan?

2.5 NED Plan Description, Modeling, and Performance

14. Is the method used to select the final NED Clear Creek Mainstream components justified?
15. Comment on the selection of the trapezoid templates as a channel template for the tributary conveyance measures.
16. Is the method used to select a concrete-lined channel for the upper reaches and use an earthen lined channel for the lower reaches of Mud Gully and Turkey Creek justified?
17. Discuss the final NED components reliance on storage and timing effects.

Part 3 – Geotechnical Appendix

4.1 General

18. Does this section of the appendix adequately outline:
 - a. information available from prior studies,
 - b. information collected to support the current project, and

- c. the intended use of the information relative to the current pre-design phase of the project?

4.2 Geology

19. In your opinion, are the potential geological hazards associated with the Beaumont Clay formation underlying this region (e.g. sinkholes, salt domes, active faults, subsidence, expansive clays, organic soils, etc.) clearly stated and discussed thoroughly in the report?
20. Does the report adequately address all potential natural hazards, such as the simultaneous or sequential occurrence of interactive climatic and geologic hazards that produce cumulative effects (for example, seismic movements during a period of heavy rainfall leading to landslides) that might impact the project?

4.3 Geotechnical Investigation

21. Comment on the quality, completeness and utility of the currently available data from previous geotechnical investigations.
22. Comment on whether sufficient information has been collected to identify and mitigate potential geotechnical hazards (e.g. slides, slumps, springs, faults, etc.) within the project footprint.

4.3.1 Clear Creek Channel

23. Are the data quality objectives for locating these borings in these areas clearly stated?

4.3.2 Clear Creek Detention Basin

24. Is there sufficient existing geotechnical information available on these areas prior to PED?

4.3.3 Supplemental Borings

25. Is the information on geotechnical assumptions reliable and sufficient as it relates to the borings and tests?
26. Is there additional geotechnical information that should be included?
 - a. If so, please describe.

4.4 Groundwater Table

27. Will the elevation of the water table have an impact on pre-design considerations (e.g. in the areas of detention basins)?
28. Has sufficient data been acquired in the area of critical project features?
29. Has the seasonal fluctuation in groundwater table elevation been sufficiently documented?

4.5 Foundation Conditions

30. Are there any key design mitigation measures that need to be taken into account given the presence of high plasticity shrinking/swelling clays in the Clear Creek region?

4.6 Laboratory Testing

31. Has sufficient lab testing been performed to characterize the physical and mechanical soil properties throughout the project area, and to sufficient depths?

4.7 Shear Strength

32. Are there any the design implications due to the presence of fissured or slickensided clay deposits?

4.8 Stability Analysis of Channel Slopes

33. Should channel slopes other than 1:4 (v:h) be considered given the potential for sloughing and slope instability in the area of the study project?
34. Has slope stability been sufficiently evaluated for steady state, seismic, and rapid-drawdown conditions?
35. Have the short-term and long operations to maintain the channel side slopes been adequately detailed?

4.9 Slope Stability of Detention Basin

36. Given the available soils information, is the assumption about the embankment slope a reasonable one?
 - a. Should additional information be obtained in the pre-design phase?

37. Are the hydraulic structures associated with hydraulic structure settlement and soil bearing well defined?
38. Are the design limitations for the detention basins complete?
 - a. If not, what is missing?
39. Are there other critical design input parameters that should be known during the pre-design phase (e.g. water table elevation)?

4.10 Clear Creek Channel Design

40. Comment on the suitability and costs (including long-term maintenance) of the channel protection measures in areas where flow velocities will exceed 6 fps.
 - a. Is the noted 6 fps velocity a suitable metric to establish “erosive forces”?
41. Comment on the potential effect of the increased flow velocity on the six bridges located along Clear Creek.
 - a. Is sufficient information available to support the recommended design modifications to these structures?

4.11 Stone Protection

42. Comment on the range of stone gradation presented in the report for the recommended plan.

4.12 Geotextile

43. Comment on the geotextile design criteria presented for the recommended plan.
 - a. Are there other technologies available which have not been discussed?

4.13 Construction Procedures

44. Are all appropriate construction measures included?
45. Should contingency measures be considered and adopted the event of adverse weather during construction (e.g. effect of rain on soils being placed or excavated)?
46. Is any monitoring or instrumentation recommended?

4.13.1 Clearing and Stripping

47. Have the requirements for siltation fences been clearly stated?

4.13.2 Detention Basin and Channel Excavation

48. Are there any other geotechnical considerations regarding the designated placement areas (e.g. maximum slopes, vegetation, etc.)?

4.13.3 Backfills

49. Are there sufficient soils to be excavated from the project footprint that will be suitable for backfill?
50. Comment on the compaction criteria for backfill material placed within 3 feet of foundations, walls and tops of structures.

4.13.4 Channel Slopes

51. Are the methods outlined for channel slope protection sufficiently detailed for each type of conveyance?

4.13.5 Preparation of Slopes for Turfing & Erosion Protection

No questions.

4.13.6 Care and Diversion of Water

52. Are the methods outlined for temporary diversion of surface and ground water sufficiently detailed in critical construction areas?

Part 4: Civil Appendix

53. Comment on the use of topographic surveys and other survey data in preparing the plans for this report.
54. Comment on the technical considerations and evaluations presented in this supplement to the GRR.
55. Does the recommended design support the opportunities and recognize the constraints relating to stream (re)alignment, mitigation of relocated infrastructure and utilities, conveyance and detention, and placement plan for excavated material?

56. Do the plans presented in this section provide adequate basis for future planning and design regarding potential environmental and infrastructure impacts and the determination of real estate requirements?

Part 6: Cost Appendix

57. Comment on the rationale and completeness of information provided for both the structural and non-structural components of the cost estimates.

**Clear Creek, Texas
Flood Risk Management
Clear Creek Preliminary Draft Environmental Impact Statement (PDEIS)**

Final Charge Questions

General

1. Are the assumptions that underlie the economic, engineering and environmental analyses sound?
2. Are the interpretations of analysis and conclusions based on the analysis reasonable?
3. Does the report adequately support the recommended plan within this unique basin area?

Section 5 – Need for Proposed Action

4. Is the Purpose and Need clearly stated?
5. Does the recommended plan meet the purpose and need?
6. Will the objectives of both flood risk management and ecosystem restoration be achieved?

Section 6 – Alternatives

7. Comment on whether the future environmental conditions under the No-Action Alternative are accurately portrayed
8. Comment on the methods used to compare the alternatives.
 - a. What, if any, additional parameters should be considered?
9. Are the criteria used to evaluate and screen the alternatives clearly stated?
 - a. Are the criteria used to evaluate and screen the alternatives appropriate?
 - b. Why or why not?

10. Comment on the comparison of the nine alternatives with regards to biological resource impacts and the conclusion that the three GRP alternatives will result in the least impact and the most potential for benefits.
11. Comment on whether all the potentially impacted ecosystem habitats were considered for mitigation.
12. Comment on whether the planned maintenance and operation activities listed in this section are comprehensive, suitable, and/or ecologically sound and provide a measure of safety for the surrounding communities.
13. Does the report adequately address how information gained during the preliminary screening and detailed evaluation process supports the recommended structural and non-structural alternatives?
 - a. Comment on the validity of basic assumptions for the alternatives.
14. Are the description and graphic presentation of the recommended conveyance measures complete and sufficient for this project?
15. Have the constraints associated with the implementation of the conveyance measures within each reach been evaluated?
 - a. Discuss and comment on how the large scale safety and maintenance issues associated with the project been addressed.
16. Within your area of expertise, are there any additional constraints that should be considered when designing or constructing the recommended plan that have not been identified?

Section 7 – Affected Environment

17. Has the affected environment been adequately described?
18. Should any other factors be considered for the affected environment?
 - a. If so, which?
19. Comment on whether the “project area” and “study area, “as described in the introduction to Chapter 3 and depicted in Figures 3.0-1 and 3.0-2, have accurately established spatial boundaries.
20. Comment on the accuracy and comprehensiveness of the descriptions of the physiography, geology, and climate of the study area and region.

21. Comment on the accuracy of the discussion of historic and future subsidence and eustatic sea level rise.
22. Comment on the accuracy and comprehensiveness of the discussion of water quality in the study area.
23. Comment on the accuracy and comprehensiveness of the discussion of sediment quality in the study area.
24. Comment on the accuracy and comprehensiveness of the discussion of hydrology in the study area.
25. Comment on the accuracy and comprehensiveness of the discussion of air quality in the study area.
26. Comment on the accuracy and comprehensiveness of the discussion of noise in the study area.
27. Comment on the accuracy and comprehensiveness of the discussion of soils in the study area.
28. Comment on the accuracy and comprehensiveness of the discussion of hazardous, toxic, and radioactive waste in the study area.
29. Comment on the accuracy and comprehensiveness of the discussion of vegetation in the study area.
30. Comment on the accuracy and comprehensiveness of the discussion of fish and wildlife resources in the study area.
31. Comment on the accuracy and comprehensiveness of the discussion of threatened and endangered species in the study area.
32. Comment on whether sufficient data are presented for evaluating whether historic displacements or deformations associated with faults exist within the project footprint.
33. Comment on the effectiveness of using the conveyance measures within each reach to control flood activity and meet the goals and objectives of the project.
34. Are the contributions to the Clear Creek watershed comprehensively listed and defined?
35. Does the information in this section accurately describe normal flow within the basin area?

36. Is the discussion of Clear Lake and tides complete?
37. Is the groundwater hydrology adequately defined?
 - a. What, if any, additional information should be presented?
38. Has the potential for geotechnical hazards (subsidence, sink holes, salt domes) been adequately discussed?

Section 8 – Environmental Consequences

39. Have the environmental consequences of all alternatives been adequately discussed?
 - a. If not, please, discuss.
40. Should any additional environmental impacts of the project be considered?
41. Are there any additional environmental consequences that should be considered for the water detention areas?
 - a. Specifically, should impacts to groundwater hydrology be considered?
42. Comment on the accuracy and comprehensiveness of the discussion of physiographic and geologic environmental consequences for the project alternatives (including the no-action alternative).
43. Comment on the accuracy and comprehensiveness of the discussion of water quality-related environmental consequences for the project alternatives (including the no-action alternative).
44. Comment on the accuracy and comprehensiveness of the discussion of sediment quality-related environmental consequences for the project alternatives (including the no-action alternative).
45. Comment on the accuracy and comprehensiveness of the discussion of hydrologic environmental consequences for the project alternatives (including the no-action alternative).
46. Comment on the accuracy and comprehensiveness of the discussion of air quality-related environmental consequences for the project alternatives (including the no-action alternative).

47. Comment on the accuracy and comprehensiveness of the discussion of noise-related environmental consequences for the project alternatives (including the no-action alternative).
48. Comment on the accuracy and comprehensiveness of the discussion of soil and farmland-related environmental consequences for the project alternatives (including the no-action alternative).
49. Comment on the accuracy and comprehensiveness of the discussion of hazardous, toxic, and radioactive waste-related environmental consequences for the project alternatives (including the no-action alternative).
50. Are the impacts of water control during construction on local hydrology adequately characterized and discussed?

Section 9 – Mitigation

51. Comment on the appropriateness and completeness of the mitigation planning objectives for the Clear Creek project.
52. Does the expected mitigation result in the expected project meeting the threshold of negligible adverse impact on significant ecological resources?
53. Comment on whether the GRP alternative contains sufficient avoidance and minimization elements.
54. Comment on whether the HEP screening process successfully identified the most appropriate mitigation alternative measures and if they are accurately described.
55. Comment on whether the HEP-assisted identification of the “single most productive measure”.
56. Comment on the use and results of IWR-PLAN in the final screening of the mitigation measures.
57. Comment on whether the recommended mitigation plan was the most appropriate selection.
58. Comment on the completeness of the operations and maintenance information included for the recommended mitigation plan.

Section 10 – Cumulative Impacts Analysis

59. Comment on the cumulative impacts assessment, including whether all relevant factors were considered and whether the cumulative impacts were accurately assessed.
60. With regard to the cumulative impacts discussion, comment on the completeness of the descriptions of past and present actions.
61. Comment on the completeness of the descriptions of reasonably foreseeable future actions with regard to the cumulative impacts discussion.
62. Comment on how the cumulative effects analysis was conducted and whether the results are reliable and accurate for all aspects of the project.

Section 11 – Compliance With Texas Coastal Management Program

No questions.

Section 12 – Consistency With State and Federal Regulations

63. Comment on the regulation compliance assessments in this section.

Section 13 – Any Adverse Environmental Impacts That Cannot Be Avoided Should the Preferred Alternative Be Implemented

64. Comment on whether all adverse impacts have been addressed.

Section 14 – Any Irreversible or Irretrievable Commitments of Resources Involved in the Implementation of the Recommended Plan

65. Comment on the resource commitments presented in this section.

Section 15 – Relationship Between Local Short-Term Uses and Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

66. Comment on whether the discussion in this section is comprehensive.

Section 16 – Energy and Natural or Depletable Resource Requirements and Conservation Potential of Various Alternatives and Mitigation Measures

67. Comment on whether the discussion in this section is comprehensive.

Section 17 – Public Involvement, Review, and Consultation

68. Was adequate public involvement conducted?