

August 14, 2013

Final Independent External Peer Review Report Hunting Bayou Flood Risk Management Study



Prepared by
Battelle Memorial Institute

Prepared for
Harris County Flood Control District
Harris County, TX

Subcontract Agreement Dated May 13, 2013
AECOM Purchase Order Number: 46572ACM



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505 King Avenue
Columbus, OH 43201

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Hunting Bayou Flood Risk Management Study

EXECUTIVE SUMMARY

Project Background and Purpose

The Independent External Peer Review (IEPR) was performed for the studies that comprise the integrated draft General Reevaluation Report (GRR) and draft Supplemental Environmental Impact Statement (SEIS) for the Hunting Bayou Flood Risk Management Study. The Project Delivery Team (PDT) consists of the Harris County Flood Control District (HCFCD), which is directing this study in coordination with the U.S. Army Corps of Engineers (USACE) Galveston District. AECOM Technical Services, Inc. (AECOM) is the prime contractor working for HCFCD. Battelle is the contractor providing the IEPR services.

Hunting Bayou is a major tributary of Buffalo Bayou. The area encompassed by the Hunting Bayou watershed is located within the Houston metropolitan area including the cities of Houston, Galena Park, and Jacinto City. The Hunting Bayou watershed is approximately 30 square miles in size and is located approximately five miles northeast of downtown Houston in Harris County, Texas. The main stem of Hunting Bayou, consisting of an earthen channel section, extends approximately 15 miles from its headwaters west of US 59 to its confluence with the Houston Ship Channel.

The purpose of the proposed action is to evaluate a flood risk management plan consistent with the authorized plan recommended in the May 1988 Feasibility Report and authorized in the Water Resources Development Act (WRDA) of 1990, in light of current conditions that have changed and occurred since the original authorization. The need for the proposed action is to reduce flooding of structures (residential, commercial, public, etc.) along Hunting Bayou in a manner that is less disruptive to the existing environment versus the authorized plan and is effective and affordable. The study is being conducted under WRDA of 1996, Section 211(f) authority at the full expense of HCFCD and fully complies to date and will comply with the Corps planning requirements specified in Engineer Regulation (ER) 1105-2-100, Appendix H, Section H-8 (USACE, 2000).

This GRR/SEIS update was conducted following the published procedure, methodology, and guidance of USACE. The USACE HEC-HMS, HEC-RAS, and HEC-FDA computer models were used to determine the flood damages for the without-project and the with-project conditions. It is estimated that over \$26 million in average annual equivalent damages occur within the study area at the 2009 price level in the without-project condition. Flooding affects an estimated 6,500 structures within the 0.2% floodplain and over 4,800 structures within the 1% floodplain of Hunting Bayou. Over 90% of the structures in either floodplain are residential. The Tentatively Selected Plan (TSP) for Hunting Bayou would reduce average annual damages

by 75% and would remove 91% of all structures from the 1% floodplain. The benefit-to-cost ratio (BCR) for the TSP is 2.5:1.

Independent External Peer Review Process

The HCFCD is conducting an IEPR of the studies that comprise the integrated draft GRR and draft SEIS for the Hunting Bayou Flood Risk Management Study (hereinafter Hunting Bayou IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COI), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012a). Battelle has experience in establishing and administering peer review panels for USACE and was engaged by HCFCD to coordinate the IEPR of the Hunting Bayou draft GRR/SEIS. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the HCFCD and was conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012a) and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Based on the technical content of the Hunting Bayou IEPR review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: Civil Works planning; National Environmental Policy Act (NEPA) and biology; hydrologic and hydraulic engineering; and economics. Four panel members were selected for the IEPR. The HCFCD PDT was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received an electronic version of the 1042-page Hunting Bayou IEPR document, along with a charge that solicited comments on specific sections of the documents to be reviewed. The HCFCD PDT prepared the charge questions following guidance provided in USACE (2012a) and OMB (2004), which were included in the draft and final Work Plans.

The HCFCD PDT briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of the HCFCD PDT and clarify uncertainties. Other than this teleconference, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced individual comments in response to the charge questions.

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

Results of the Independent External Peer Review

The panel members agreed among themselves on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (USACE, 2012a; p. D-4) in the Hunting Bayou IEPR review documents. Table ES-1 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel’s findings.

Hydrologic and Hydraulic Engineering – The development of Hydrologic Engineering Centers Hydrologic Monitoring System (HEC-HMS) and Hydrologic Engineering Centers River Analysis System (HEC-RAS) models for the Hunting Bayou watershed is well documented and presented. The reduction in flooding extents resulting from implementing various flood mediation scenarios (including the TSP) is also clearly demonstrated. All assumptions included in each model are well defined, and model inputs are within acceptable engineering parameters for this type of project.

The single most important aspect of the hydrologic and hydraulic engineering studies that requires special attention is the improvement of the calibration and validation of the HEC-HMS and HEC-RAS models using all available high flow data. These improvements will also subsequently affect the Hydrologic Engineering Centers Flood Damage Reduction Analysis (HEC-FDA) output. As presented, the comparison between observed and modeled streamflow hydrographs suggests that the model overpredicts peak flows and may not include sufficient in-basin temporary water storage. Demonstrating agreement between modeled and observed peak flows and flooding extents resulting from the passage of Hurricane Ike in 2008 would greatly increase confidence in the model’s suitability for assessing flood damage. In addition, the 1% floodplain resulting from more fully validated HEC-HMS and HEC-RAS models would provide greater assurance regarding the need for property buyouts and flood insurance requirements.

Economics – The Panel determined that the appropriate methods and economic models were used to evaluate alternatives to the original 1990 authorized plan. However, sufficient documentation is not provided in the draft GRR/SEIS to explain the revisions in expected National Economic Development (NED) benefits and the BCR for the authorized plan. In addition, new alternatives to the authorized plan included in the draft GRR/SEIS are not fully compared to assess differences in the risk and uncertainty associated with expected damage reductions and NED benefits for each alternative. The Panel has strong concerns that the alternative identified as the NED plan in the draft GRR/SEIS (B60-A75) does not maximize NED benefits, has a lower BCR, and incurs project costs significantly higher than the other alternatives. The rationale provided in the draft GRR/SEIS for selecting this alternative as the NED plan is based on constraints defined by the local sponsor. These concerns could be addressed by providing a thorough risk analysis of the original 1990 authorized plan and all new alternatives presented in the draft GRR/SEIS, and by comparing the economic performance of the alternatives. If alternative B60-A75 cannot be shown to maximize NED benefits, it could be described as a Locally Preferred Plan.

Environmental – The draft GRR/SEIS addresses changes to the proposed project from previous environmental compliance efforts performed in the 1990s, and serves as a re-evaluation of the potential project impacts identified during that time. The draft GRR/SEIS highlighted the environmental concerns associated with the proposed action and clearly identified the significant of impacts from the project as a whole. However, due to an absence of documentation, the Panel was unable to determine if the project was in compliance with Executive Order 13166 (Limited English Proficiency). The Panel also noted that the discussion of some existing conditions (i.e., seismic activity/faults, sensitive noise receptors, and the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act) was not thorough and does not allow for a complete understanding of the potential effects of the proposed action on these specific resources. The Panel believes these concerns can be easily remedied through the future preparation of the mitigated Environmental Assessment/Finding of No Significant Impact (EA/FONSI).

Civil Works Planning – The plan formulation process follows the USACE six-step planning process and is generally consistent with guidance contained in ER 1105-2-100 (USACE, 2000). As a re-evaluation, the plan formulation process properly relies heavily on the previous planning effort and documentation. While the planning updates are appropriate, they are not always as extensive as would be found in a de novo planning effort. As a result, some aspects of the planning process are obscure, such as the degree of overlap between extent and depth of flooding predicted by the model and the extent of the flooding actually experienced under actual rainfall events. In addition, it is the opinion of the Panel that the link between mitigation and impact is not well supported and could be improved by expanding on the discussion presented.

Table ES-1. Overview of Ten Final Panel Comments Identified by the Hunting Bayou IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The HEC-HMS and HEC-RAS models appear to overpredict observed peak flows, and both under- and overpredict flooding extents, potentially leading to overestimates of likely flood damages and the need for flood mitigation.
2	The selection of the NED plan was not based on standard USACE planning criteria and is not supported by the economic analysis or data presented.
Significance – Medium	
3	The economic performance of the originally authorized plan is not well documented, and the rationale for the significant decrease in the BCR specified in the reevaluation is not explained.
4	The economic analysis does not provide a thorough risk analysis of the alternatives that is consistent with ER 1105-2-101.
5	Documentation reflecting compliance with Executive Order 13166, which requires an evaluation and program development for Limited English Proficiency communities, does not appear to have been provided.
6	The existing conditions for seismic activity/faults, sensitive noise receptors, and the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act are not thoroughly documented.
Significance – Low	
7	Peak streamflows in Hunting Bayou are increasing, thus increasing the uncertainty in quantifying future 1% and 0.5% floods using the log-Pearson Type III distribution.
8	The mitigation credits calculated do not appear to be consistent with the Greens Bayou Wetland Mitigation Bank/Mitigation Banking Instrument or other related guidance, and documentation of the habitat assessment procedures was not provided.
9	The rationale for excluding habitat suitability models for fish species such as the channel catfish and common carp, as well as the identification and mitigation of impacts on water quality and fringe wetlands resulting from the deepening of Hunting Bayou, were not discussed.
10	It cannot be determined from the description provided if the cumulative effects analysis includes areas that may extend beyond the Hunting Bayou Basin.

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LIST OF ACRONYMS

AECOM	AECOM Technical Services, Inc.
ATR	Agency Technical Review
BCR	Benefit-to-cost ratio
CFR	Code of Federal Regulations
COI	Conflict of Interest
DOT	Department of Transportation
DrChecks	Design Review and Checking System
EC	Engineer Circular
EA	Environmental Assessment
EO	Executive Order
ER	Engineer Regulation
ERM	Environmental Resources Management
FONSI	Finding of No Significant Impact
GBWMB	Greens Bayou Wetlands Mitigation Bank
GRR	General Reevaluation Report
HCFCDD	Harris County Flood Control District
HEC-FDA	Hydrologic Engineering Centers Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HEC-HMS	Hydrologic Engineering Centers Hydrologic Monitoring System
HEP	Habitat Evaluation Procedures
HSI	Habitat Suitability Index
IEPR	Independent External Peer Review
LEP	Limited English Proficiency
MBI	Mitigation Banking Instrument
NED	National Economic Development
NEPA	National Environmental Policy Act
NTP	Notice to Proceed
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
SEIS	Supplemental Environmental Impact Statement

TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WET	Wetland Evaluation Technique
WRDA	Water Resources Development Act

1. INTRODUCTION

The Independent External Peer Review (IEPR) was performed for the studies that comprise the integrated draft General Reevaluation Report (GRR) and draft Supplemental Environmental Impact Statement (SEIS) for the Hunting Bayou Flood Risk Management Study. The Project Delivery Team (PDT) consists of the Harris County Flood Control District (HCFCD), which is directing this study in coordination with the U.S. Army Corps of Engineers (USACE) Galveston District. AECOM Technical Services, Inc. (AECOM) is the prime contractor working for the HCFCD. Battelle is the contractor providing the IEPR services.

Hunting Bayou is a major tributary of Buffalo Bayou. The area encompassed by the Hunting Bayou watershed is located within the Houston metropolitan area including the cities of Houston, Galena Park and Jacinto City. The Hunting Bayou watershed is approximately 30 square miles in size and is located approximately five miles northeast of downtown Houston in Harris County, Texas. The main stem of Hunting Bayou, consisting of an earthen channel section, extends approximately 15 miles from its headwaters west of US 59 to its confluence with the Houston Ship Channel.

The purpose of the proposed action is to evaluate a flood risk management plan consistent with the authorized plan recommended in the May 1988 Feasibility Report and authorized in the Water Resources Development Act (WRDA) of 1990, in light of current conditions that have changed and occurred since the original authorization. The need for the proposed action is to reduce flooding of structures (residential, commercial, public etc.) along Hunting Bayou in a manner that is less disruptive to the existing environment versus the authorized plan and is effective and affordable. The study is being conducted under WRDA of 1996, Section 211(f) authority at the full expense of the HCFCD and fully complies to date and will comply with the Corps planning requirements specified in Engineer Regulation (ER) 1105-2-100, Appendix H, Section H-8 (USACE, 2000).

This GRR/SEIS update was conducted following the published procedure, methodology, and guidance of USACE. The USACE HEC-HMS, HEC-RAS, and HEC-FDA computer models were used to determine the flood damages for the without-project condition and with-project conditions. It is estimated that over \$26 million in average annual equivalent damages occur within the study area at the 2009 price level in the without project condition. Flooding affects an estimated 6,500 structures within the 0.2% floodplain and over 4,800 structures within the 1% floodplain of Hunting Bayou. Over 90% of the structures in either floodplain are residential. The Tentatively Selected Plan (TSP) for Hunting Bayou would reduce average annual damages by 75% and would remove 91% of all structures from the 1% floodplain. The benefit-to-cost ratio (BCR) for the TSP is 2.5:1.

The objective of the work described here was to conduct an IEPR of the studies that comprise the integrated draft GRR and draft SEIS for the Hunting Bayou Flood Risk Management Study (hereinafter Hunting Bayou IEPR) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE) Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012a) and Office of Management and Budget (OMB) bulletin *Final*

Information Quality Bulletin for Peer Review (OMB, 2004). Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the Hunting Bayou draft GRR/SEIS. The full text of the Final Panel Comments is presented in Appendix A.

2. PURPOSE OF THE IEPR

To ensure that decision documents for USACE projects are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2012a).

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

In this case, the IEPR of the Hunting Bayou draft GRR/SEIS was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214; USACE, 2012a) under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (2012a) and in accordance with OMB (2004) guidance. Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

3.1 Planning and Schedule

At the beginning of the Period of Performance, Battelle held a kick-off meeting with the HCFCD PDT to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 103 charge questions were provided by the HCFCD PDT and included in the draft and final Work Plans. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of May 13, 2013. The review documents were

provided by the HCFCD PDT on June 10, 2013. Note that the work items listed in Task 7 occur after the submission of this report. Battelle will enter the ten Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that the HCFCD PDT can review and respond to them. The HCFCD PDT will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All HCFCD PDT and Panel responses will be documented by Battelle. Battelle will provide the HCFCD PDT and the Panel a pdf printout of all DrChecks entries, through comment closure, as a final deliverable and record of the IEPR results.

Table 1. Hunting Bayou IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	5/13/2013
	Review documents available	6/10/2013
	Battelle submits draft Work Plan^a	5/21/2013
	HCFCD PDT provides comments on draft Work Plan and draft Charge Questions	5/29/2013
	Battelle submits final Work Plan and final Charge Questions^a	6/3/2013
2	Battelle requests input from HCFCD PDT on the conflict of interest (COI) questionnaire	5/14/2013
	HCFCD PDT provides comments on COI questionnaire	5/16/2013
	Battelle submits list of selected panel members^a	5/22/2013
	HCFCD PDT confirms the panel members have no COI	5/28/2013
	Battelle completes subcontracts for panel members	6/10/2013
3	Battelle includes Charge Questions provided by HCFCD PDT in draft Work Plan	5/21/2013
4	Battelle convenes kick-off meeting with HCFCD PDT	5/16/2013
	Battelle sends review documents to panel members	6/12/2013
	Battelle convenes kick-off meeting with panel members	6/12/2013
	Battelle convenes kick-off meeting with HCFCD PDT and panel members	6/12/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of HCFCD PDT	6/26/2013
5	Panel members complete their individual reviews	7/11/2013
	Battelle provides panel members with talking points for Panel Review Teleconference	7/17/2013
	Battelle convenes Panel Review Teleconference	7/18/2013

Table 2. Hunting Bayou IEPR Schedule (continued)

Task	Action	Due Date
	Battelle provides Final Panel Comment templates and instructions to panel members	7/19/2013
	Panel members provide draft Final Panel Comments to Battelle	7/26/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	7/27-8/5/2013
	Battelle finalizes Final Panel Comments	8/6/2013
6	Battelle provides Final IEPR Report to panel members for review	8/8/2013
	Panel members provide comments on Final IEPR Report	8/12/2013
	Battelle submits Final IEPR Report to HCFCD PDT^a	8/14/2013
7 ^b	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to HCFCD PDT	8/19/2013
	Battelle convenes teleconference with HCFCD PDT to review the Post-Final Panel Comment Response Process	8/19/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	8/19/2013
	HCFCD project team provides draft HCFCD PDT Evaluator Responses to Battelle	8/29/2013
	Battelle provides the panel members the draft HCFCD PDT Evaluator Responses	9/3/2013
	Panel members provide Battelle with draft BackCheck Responses	9/6/2013
	Battelle convenes teleconference with panel members to discuss draft Back-Check Responses	9/9/2013
	Battelle convenes Comment-Response Teleconference with panel members and HCFCD PDT	9/10/2013
	HCFCD PDT inputs final Evaluator Responses to DrChecks	9/24/2013
	Battelle provides HCFCD PDT final Evaluator Responses to panel members	9/27/2013
	Panel members provide Battelle with final BackCheck Responses	10/2/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	10/8/2013
	Battelle submits pdf printout of DrChecks project file^a	10/9/2013
	Contract End/Delivery Date	12/16/2013

^a Deliverable.

^b Task 7 occurs after the submission of this report.

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: Civil Works planning; National Environmental Policy Act (NEPA) and biology;

hydrologic and hydraulic engineering; and economics. These areas correspond to the technical content of the Hunting Bayou IEPR and overall scope of the Hunting Bayou draft GRR/SEIS.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential COIs. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected four experts for the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

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

- Previous and/or current involvement by you or your firm in the Modeling Hurricane Isaac Pre- and Post- 100-year Hurricane and Storm Damage Risk Reduction System (HSDRRS) Draft Technical Assessment Report and/or technical appendices.
- Previous and/or current involvement by you or your firm² in the Hunting Bayou Flood Risk Management Study.
- Previous and/or current involvement by you or your firm² in flood control in Harris County, Texas.
- Previous and/or current involvement by you or your firm² in the Hunting Bayou Flood Risk Management Study or related projects.
- Previous and/or current involvement by you or your firm² in the conceptual or actual design, construction, or operation and maintenance of any projects in the Hunting Bayou Flood Risk Management Study or related projects.
- Current employment by AECOM or HCFCD.
- Previous and/or current involvement with paid or unpaid expert testimony related to the Hunting Bayou Flood Risk Management Study.

¹ Battelle evaluated whether scientists in universities and consulting firms that are receiving HCFCD or USACE -funding have sufficient independence from HCFCD or USACE to be appropriate peer reviewers. See OMB (2004, p. 18), "...when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

² Includes any joint ventures in which a panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors: HCFCD, USACE Galveston District (for pay or pro bono).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to Hunting Bayou, Texas.
- Current personal involvement in other HCFCD projects, including whether involvement was to author any manuals or guidance documents for HCFCD or USACE. If yes, provide titles of documents or description of project, dates, and location and position/role. Please highlight and discuss in greater detail any projects that are specifically with the USACE Galveston District.
- Previous or current involvement in the development or testing of models that will be used for or in support of the Hunting Bayou Flood Risk Management Study.
- Current firm² involvement with other HCFCD or USACE projects, specifically those projects/contracts that are with the USACE Galveston District. If yes, provide title/description, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please also clearly delineate the percentage of work you personally are currently conducting for the Galveston District. Please explain.
- Any previous employment by the HCFCD or USACE as a direct employee, notably if employment was with the Galveston District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by the HCFCD or USACE as a contractor (either as an individual or through your firm²) within the last ten years, notably if those projects/contracts are with the Galveston District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning flood risk management), and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in the Hunting Bayou Flood Risk Management Study related contracts/awards from HCFCD or USACE.
- A significant portion (i.e., greater than 50%) of personal or firm² revenues within the last three years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm² revenues within the last three years from contracts with the non-federal sponsor (HCFCD).
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Hunting Bayou Flood Risk Management Study.
- Participation in other Federal studies relevant to this project and/or the Hunting Bayou Flood Risk Management Study.
- Previous and/or current participation in other non-Federal studies relevant to this project and/or the Hunting Bayou Flood Risk Management Study.
- Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project?

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Three final reviewers are affiliated with consulting companies and one final reviewer is affiliated with an academic institution. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. The HCFCDD PDT was given the list of candidate panel members, but Battelle made the final selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of the IEPR

Prior to beginning their review and within two days of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which the HCFCDD PDT presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the Hunting Bayou IEPR review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Hunting Bayou draft GRR/SEIS and appendices (1042 pages)**
- USACE guidance Civil Works Review (EC 1165-2-214; 15 December 2012).
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

In addition, the HCFCDD PDT provided supplemental habitat suitability index (HSI) model documents to Battelle, which were sent to the Panel as additional information only and were not part of the official review. A list of these supplemental documents is provided below.

- Habitat Suitability Index Model: Snapping Turtle (26 pages)
- Habitat Suitability Index Model: Swamp Rabbit (33 pages)
- Habitat Suitability Index Model: Barred Owl (32 pages)
- Habitat Suitability Index Model: Mink (31 pages)

About half way through the review of the Hunting Bayou IEPR review documents, a teleconference was held with the HCFCDD PDT, the Panel, and Battelle so that the HCFCDD PDT could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted four panel member questions to the HCFCDD PDT. The HCFCDD PDT was able to provide responses to all of the questions during the teleconference.

3.4 Review of Individual Comments

The Panel was instructed to address the charge questions within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions. Battelle reviewed the comments to identify overall recurring

themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the individual comments in a preliminary list of 19 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

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

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

3.6 Preparation of Final Panel Comments

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

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

- **Criteria for Significance:** The following were used as criteria for assigning a significance level to each Final Panel Comment:
 1. **High:** Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a “showstopper” issue.
 2. **Medium:** Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
 3. **Low:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.
- **Guidance for Developing Recommendations:** The recommendation section should include specific actions that the HCFCD PDT should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

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

4. PANEL DESCRIPTION

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

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

Table 2. Hunting Bayou IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Furnans	Cuba	Young	Milon
Hydrologic and Hydraulic Engineering	X			
Minimum 10 years of experience in hydrologic and hydraulic engineering	X			
Familiarity with large, complex Civil Works projects with high public and interagency interests	X			
Experience with engineering analyses related to flood risk management in urbanized areas along the Gulf Coast	X			
Experience with urban channels (non-storm sewer design), preferably experience with unsteady flow analysis with HEC-RAS	X			
Familiarity with standard USACE hydrologic and hydraulic computer models including:				
HEC-1	X			
HEC-HMS	X			
HEC-RAS	X			
Licensed Professional Engineer	X			
Minimum B.S. degree in civil engineering or hydrology and hydraulics	X			
Civil Works Planning				
Minimum 10 years of experience in Civil Works planning		X		
Familiarity with large, complex Civil Works projects with high public and interagency interests		X		
Experience with the plan formulation process		X		
Familiarity with the evaluation of alternative plans for flood risk management projects		X		
Familiarity with USACE standards and procedures		X		
Degree in planning or related field		X		
NEPA and Biology				
Minimum 10 years of experience in NEPA and biology			X	
Familiarity with large, complex Civil Works projects with high public and interagency interests			X	
Knowledge of and experience in the preparation of Environmental Assessments and Environmental Impact Statements			X	
Familiarity with all NEPA requirements			X	
Experience in wetlands and wetlands mitigation in urbanized areas along the Gulf Coast			X	

Table 2. Hunting Bayou IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Furnans	Cuba	Young	Milon
Experience with isolated urban wetlands			X	
Experience with ecosystem/HSI modeling			X	
M.S. degree in ecology or biology, or bachelor’s degree with 20+ years of experience this field			X ^a	
Economics				
Minimum 10 years of experience in economics				X
Familiarity with large, complex Civil Works projects with high public and interagency interests				X
Familiarity with the USACE tool for CE/ICA called IWR Planning Suite				X
Experience with National Economic Development (NED) analysis procedures, particularly as they relate to flood risk management projects				X
Familiarity with HEC-FDA for calculating benefits due to flood risk management projects				X
Degree in economics or a related field				X

^a A waiver statement was presented as part of the Task 2 deliverable and approved by HCFCDD.

Jordan Furnans, P.E., P.G., Ph.D.

Role: Hydrologic and hydraulic engineering experience and expertise.

Affiliation: INTERA, Inc.

Dr. Furnans is a senior water resources engineer at INTERA, Inc. He earned his Ph.D. in civil engineering from the University of Texas at Austin. He is a registered professional engineer in Texas, Florida, New Mexico, Colorado, Washington, and Oklahoma and licensed professional geoscientist in Texas. He is also a certified hydrographer with the American Congress on Surveying and Mapping. He has more than 14 years of experience in hydrologic and hydraulic engineering, including field hydrologic data collection and numerical model development and application. He specializes in the areas of watershed hydrology planning and management; hydrographic and sedimentation survey methods; coupled field and model hydrodynamic investigations of estuaries, lakes, and rivers; modeling linking water quality and hydrodynamics in natural systems; and freshwater inflow and instream flow requirements for ecosystem health and restoration.

Dr. Furnans is familiar with large Civil Works projects, with experience including the development of the Texas Instream Flow Program. This project involved high public and interagency interests and included collaboration with the Texas Parks and Wildlife Department and the Texas Commission on Environmental Quality. He is familiar with standard USACE hydrologic and hydraulic computer models including HEC-1, HEC-HMS and HEC-RAS, as well

as the theory, data input, limitations, and applications of such programs. His expertise includes model validation and verification, and hydrologic data collection. He has developed numerous HEC-HMS, HEC-RAS, RMA-2, and River2D models of Texas watersheds and streams/ivers.

Dr. Furnans is experienced with engineering analyses related to flood risk management in urbanized areas along the Gulf Coast. Relevant studies include the development of the stormwater management model for the City of Bonita Springs, Florida, where he assessed areas that would be flooded under extreme rainfall conditions and developed infrastructure to mitigate such flooding with emphasis on protecting the urban center of the city. He is also experienced with urban channels (non-storm sewer design), and is familiar with unsteady flow analysis. He has used River2D and RMA-2 to model flooding extent in river courses, selected two-dimensional models to improve scour modeling around riverbends, and has developed training material on the use of HEC-RAS.

Dr. Furnans is a current board member and past president of the Texas Rivers and Reservoirs Management Society.

Thomas Cuba, Ph.D.

Role: Civil Works planning experience and expertise.

Affiliation: Delta Seven, Inc.

Dr. Cuba is the President and Chief Scientist at Delta Seven, Inc., a research scientist at Stillwater Research Group, and served as research adjunct professor at the University of South Florida and St. Leo University, where he taught courses on environmental policy. He earned his Ph.D. in marine ecology from the University of South Florida and received his Lake Manager certification in 1996. Dr. Cuba has 30 years of ecological and planning experience working on large, complex Civil Works projects with high public and interagency interest, which includes developing management plans for a variety of watersheds, aquatic preserves, waterfront infrastructure feasibility plans and urban areas as well as designing wetland restoration plans.

As the Environmental Resources Management (ERM) Division Administrator for Pinellas County, Florida, Dr. Cuba led the development of four major watershed plans and participated as the County lead in the development of the Tampa Bay National Estuary Program Comprehensive Conservation & Management Plan, and the Florida Aquatic Preserves Management Plan. During his 12 year tenure with Pinellas County ERM, where he served as the team lead for the intergovernmental development of watershed management plans, he was responsible for coordinating with local municipalities, county, state, and Federal agencies, and consulted to the county engineering department on the formulation and analysis of alternatives, project identification, and life cycle funding. His familiarity with the evaluation of alternative plans for flood risk management projects includes assessing capital improvement projects in terms of risk and alternatives to ensure each alternative was in compliance with regulatory fail-safe requirements should none or all of the other projects be constructed.

Dr. Cuba is familiar with USACE plan formulation standards and procedures, and has served on multiple USACE IEPR panels in the recent past as plan formulator (e.g., Western C-111

Spreader Canal Project Implementation Report; Tamiami Trail Limited Re-Evaluation Report; and the Integrated Feasibility Study and Environmental Impact Statement for the Louisiana Coastal Area – Small Diversion at Convent/Blind River).

Dr. Cuba is the Founding President of the Tampa Bay Chapter of the National Association of Environmental Professionals, and has given workshop presentations on watershed management planning to the American Society of Civil Engineers and the Florida Department of Environmental Protection.

David Young

Role: NEPA and biology experience and expertise.

Affiliation: DESCO Environmental Consultants, LP.

Mr. Young is an environmental consultant with DESCO Environmental Consultants in Magnolia Texas. He earned his B.S. in marine biology from Texas A&M University at Galveston in 1993. He has more than 19 years of experience in wetland delineation, environmental assessments, water quality, and NEPA compliance. Mr. Young has advanced USACE Wetland Delineation/Management training and has attended training courses on various aspects of NEPA, including Section 106 coordination, and state Department of Transportation (DOT) processes related to NEPA compliance (Texas, Florida, and Arizona).

Mr. Young has experience with large, complex Civil Works projects with high public and interagency interests including flood control, dam safety, navigation channel improvement, and transportation projects. Some of these USACE project examples include managing and providing technical support for the Houston Ship Channel - Placement Area (HSC-PA) 14 and 15 navigational dredging project Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) (USACE Galveston District); preparing and managing the Section 227 Demonstration Project (EA/FONSI) (USACE Galveston District); and providing public involvement support for the Addicks and Barker Dam Safety Program (USACE Galveston District).

Mr. Young has demonstrated experience in evaluating and preparing EAs and Environmental Impact Statements (EISs) in a wide variety of ecosystems and regions along the East Coast, Gulf of Mexico, and the Intermountain West. He recently completed several EAs and FONSI for a proposed 3D seismic survey project at the Big Thicket National Preserve and with the U.S. Fish and Wildlife Service for several of their National Wildlife Refuges (e.g., San Bernard, Brazoria, Anahuac, Moody, and McFaddin). Mr. Young also has extensive experience with urbanized areas of the Houston metropolitan area with wetlands, water quality, and other NEPA-related disciplines through his transportation work for TxDOT and other public and private clients.

Mr. Young is experienced in ecosystem/HSI modeling (including for the HSC-PA 14 and 15 projects) and he is well-versed and knowledgeable on function and value assessment methodologies and modeling. Mr. Young has been a NEPA/biology expert on several USACE IEPRs for complex Civil Work projects, which includes the Chatfield Reservoir Storage Reallocation Study and Environmental Impact Statement (USACE Omaha District), and the

Lake Isabella Dam Safety Modification Report (Engineering, Economic, and Environmental Evaluation) (USACE Sacramento District; an EIS) IEPRs.

Walter Milon, Ph.D.

Role: Economics experience and expertise.

Affiliation: University of Central Florida

Dr. Milon is the Provost’s Distinguished Research Professor in the Department of Economics at the University of Central Florida’s (UCF) College of Business Administration. At UCF, he teaches graduate-level courses in benefit cost and social impact analyses, economic theory, and natural resource and environmental economics. He earned a Ph.D. in economics from Florida State University and has 35 years of experience in economics and water resource economic evaluation. Dr. Milon is familiar with large, complex Civil Works projects with high public and interagency interests, and with relevant projects such as the USACE Florida Everglades Restudy (1995-1999), where he participated in both planning and served as a technical advisor.

Dr. Milon’s expertise with National Economic Development (NED) analysis, CE/ICA, and the USACE Institute for Water Resources (IWR) Planning Suite stems from 35 years of research and teaching experience in natural resource and environmental economics, marine resources, applied microeconomics, and includes studies on the theory and application of benefit-cost and social impact analysis. His experience with HEC-FDA to calculate benefits of flood risk management projects is a result of his years of teaching graduate-level courses on flood risk damage assessment; his participation as lead economist in the IEPR for White Oak Bayou Federal Flood Damage Reduction Plan; his involvement with the National Research Council Committee on USACE Water Resources Science, Engineering, and Planning; and his role as principal investigator for such research studies as “Economic Valuation of Water Storage in South Florida” for Florida Department of Environmental Protection and the South Florida Water Management District.

Dr. Milon has served as the lead economist on multiple USACE IEPRs including C-111 Spreader Canal Project Implementation Report and the Louisiana Coastal Area Restoration Project (2009-2011). He is a member of the American Economics Association, the Association of Environmental and Resource Economists, and Southern Economics Association.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among themselves other on their “assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (USACE, 2012a; p. D-4) in the Hunting Bayou IEPR document. Table 3 lists the Final Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel’s findings.

Hydrologic and Hydraulic Engineering – The development of Hydrologic Engineering Centers Hydrologic Monitoring System (HEC-HMS) and Hydrologic Engineering Centers River Analysis System (HEC-RAS) models for the Hunting Bayou watershed is well documented and pre-

sented. The reduction in flooding extents resulting from implementing various flood mediation scenarios (including the TSP) is also clearly demonstrated. All assumptions included in each model are well defined, and model inputs are within acceptable engineering parameters for this type of project.

The single most important aspect of the hydrologic and hydraulic engineering studies that requires special attention is the improvement of the calibration and validation of the HEC-HMS and HEC-RAS models using all available high flow data. These improvements will also subsequently affect the Hydrologic Engineering Centers Flood Damage Reduction Analysis (HEC-FDA) output. As presented, the comparison between observed and modeled streamflow hydrographs suggests that the model overpredicts peak flows and may not include sufficient in-basin temporary water storage. Demonstrating agreement between modeled and observed peak flows and flooding extents resulting from the passage of Hurricane Ike in 2008 would greatly increase confidence in the model's suitability for assessing flood damage. In addition, the 1% floodplain resulting from more fully validated HEC-HMS and HEC-RAS models would provide greater assurance regarding the need for property buyouts and flood insurance requirements.

Economics – The Panel determined that the appropriate methods and economic models were used to evaluate alternatives to the original 1990 authorized plan. However, sufficient documentation is not provided in the draft GRR/SEIS to explain the revisions in expected National Economic Development (NED) benefits and the BCR for the authorized plan. In addition, new alternatives to the authorized plan included in the draft GRR/SEIS are not fully compared to assess differences in the risk and uncertainty associated with expected damage reductions and NED benefits for each alternative. The Panel has strong concerns that the alternative identified as the NED plan in the draft GRR/SEIS (B60-A75) does not maximize NED benefits, has a lower BCR, and incurs project costs significantly higher than the other alternatives. The rationale provided in the draft GRR/SEIS for selecting this alternative as the NED plan is based on constraints defined by the local sponsor. These concerns could be addressed by providing a thorough risk analysis of the original 1990 authorized plan and all new alternatives presented in the draft GRR/SEIS, and by comparing the economic performance of the alternatives. If alternative B60-A75 cannot be shown to maximize NED benefits, it could be described as a Locally Preferred Plan.

Environmental – The draft GRR/SEIS addresses changes to the proposed project from previous environmental compliance efforts performed in the 1990s, and serves as a re-evaluation of the potential project impacts identified during that time. The draft GRR/SEIS highlighted the environmental concerns associated with the proposed action and clearly identified the significant of impacts from the project as a whole. However, due to an absence of documentation, the Panel was unable to determine if the project was in compliance with Executive Order 13166 (Limited English Proficiency). The Panel also noted that the discussion of some existing conditions (i.e., seismic activity/faults, sensitive noise receptors, and the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act) was not thorough and does not allow for a complete understanding of the potential effects of the proposed action on these specific resources. The Panel believes these concerns can be easily remedied through the future preparation of the mitigated Environmental Assessment/Finding of No Significant Impact (EA/FONSI).

Civil Works Planning – The plan formulation process follows the USACE six-step planning process and is generally consistent with guidance contained in ER 1105-2-100 (USACE, 2000). As a re-evaluation, the plan formulation process properly relies heavily on the previous planning effort and documentation. While the planning updates are appropriate, they are not always as extensive as would be found in a de novo planning effort. As a result, some aspects of the planning process are obscure, such as the degree of overlap between extent and depth of flooding predicted by the model and the extent of the flooding actually experienced under actual rainfall events. In addition, it is the opinion of the Panel that the link between mitigation and impact is not well supported and could be improved by expanding on the discussion presented.

Table 3. Overview of 10 Final Panel Comments Identified by the Hunting Bayou IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The HEC-HMS and HEC-RAS models appear to overpredict observed peak flows, and both under- and overpredict flooding extents, potentially leading to overestimates of likely flood damages and the need for flood mitigation.
2	The selection of the NED plan was not based on standard USACE planning criteria and is not supported by the economic analysis or data presented.
Significance – Medium	
3	The economic performance of the originally authorized plan is not well documented, and the rationale for the significant decrease in the BCR specified in the reevaluation is not explained.
4	The economic analysis does not provide a thorough risk analysis of the alternatives that is consistent with ER 1105-2-101.
5	Documentation reflecting compliance with Executive Order 13166, which requires an evaluation and program development for Limited English Proficiency communities, does not appear to have been provided.
6	The existing conditions for seismic activity/faults, sensitive noise receptors, and the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act are not thoroughly documented.

Table 3. Overview of 10 Final Panel Comments Identified by the Hunting Bayou IEPR Panel, continued

No.	Final Panel Comment
	Significance – Low
7	Peak streamflows in Hunting Bayou are increasing, thus increasing the uncertainty in quantifying future 1% and 0.5% floods using the log-Pearson Type III distribution.
8	The mitigation credits calculated do not appear to be consistent with the Greens Bayou Wetland Mitigation Bank/Mitigation Banking Instrument or other related guidance, and documentation of the habitat assessment procedures was not provided.
9	The rationale for excluding habitat suitability models for fish species such as the channel catfish and common carp, as well as the identification and mitigation of impacts on water quality and fringe wetlands resulting from the deepening of Hunting Bayou, were not discussed.
10	It cannot be determined from the description provided if the cumulative effects analysis includes areas that may extend beyond the Hunting Bayou Basin.

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APPENDIX A

Final Panel Comments

on the

Hunting Bayou IEPR

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Final Panel Comment 1

The HEC-HMS and HEC-RAS models appear to overpredict observed peak flows, and both under- and overpredict flooding extents, potentially leading to overestimates of likely flood damages and the need for flood mitigation.

Basis for Comment

Flooding extents, and the resulting expected flood damages, have been determined using HEC-HMS (to compute flow) and HEC-RAS (to compute area of inundation). In Appendix 2, Hydrology and Hydraulics, the comparison of HEC-HMS model results against observed streamflow measurements for five storm events demonstrates that the model consistently overpredicts peak flow values. These overpredicted peak flow values should, in turn, lead to consistent overpredictions of inundated areas that result from each storm. However, high-water levels computed by the HEC-RAS model are both above and below the high-water levels for the single storm event for which high-water levels were recorded. The variation between observed and predicted high-water levels is also within the relatively large error-bounds of the observed data, making it difficult to assess whether the combined HEC-HMS and HEC-RAS models can effectively predict accurate flooding extents in the Hunting Bayou watershed. The modeled flooding extents directly affect the levels of damage to be expected by design storms occurring in the Hunting Bayou watershed, and any inaccuracy in the modeling results leads directly to model uncertainty in predicting flooding, potential damages (i.e. HEC-FDA), and the resulting mitigation efforts (including property buyout) considered as part of the process for selecting the Tentatively Selected (TSP) selection process.

Computed peak streamflows exceed observed peak streamflows by 6% to 25% (Table A2-23) for the five storms used to verify the HEC-HMS model, with generally greater error obtained when modeling higher-volume (lower frequency) storm events. The largest storms used in model verification have an approximate 15% exceedance probability (Table A2-9), and have peak flows that are more than 50% lower than the 1%, 0.5%, or 0.2% storm events used to evaluate the various proposed options for mitigating Hunting Bayou flooding. The model inaccuracy in predicting peak flows under the 15% flow events is therefore likely to be increased when the model is used to compute peak flows resulting from more severe (lower frequency) storms. It is also troublesome that the Hunting Bayou watershed has not experienced a 1% storm event, with the highest recorded flows (resulting from Hurricane Ike in 2008) amounting to approximately a 5% storm event.

The modeled hydrographs for the larger design storms (June 1989, Exhibit A2-12; October 1994, Exhibit A2-18; September 1998, Exhibit A2-20) also overestimate the rate at which floodwaters recede, suggesting that the Hunting Bayou watershed has some temporary water storage areas (e.g., depressions, stormwater conveyance features, etc.) that have not been accounted for in the HEC-HMS models.

Considering the lack of agreement between observed and modeled peak flows, the lack of low-frequency (high flow) storm events used in model verification, and with only a single storm event used to assess the ability of HEC-RAS to accurately calculate flooding, insufficient evidence is presented to suggest that the combined HEC-HMS and HEC-RAS models accurately reproduce flooding conditions in the Hunting Bayou watershed. The Panel acknowledges that overpredicting flooding extents is acceptable to demonstrate the reduction in flooding resulting from various alternative mitigation efforts. The Panel does not, however, endorse using unsatisfactorily verified models to determine property buyouts and floodplain extents until further model verification has been conducted.

Significance – High

The uncertainty in the ability of the HEC-HMS and HEC-RAS models to reproduce flood extents directly affects the accuracy of determining the extent of property buyouts and floodplain extent, potentially leading to unnecessary displacement of residents and overdesign of proposed flooding mitigation alternatives.

Recommendations for Resolution

1. If data on the flooding extents resulting from Hurricane Ike in 2008 are available, revise the HEC-HMS and HEC-RAS models to calculate flooding extents observed and recorded after Hurricane Ike in 2008.
2. Demonstrate how the HEC-RAS model-calculated flooding extents agree with observed flooding due to Hurricane Ike.
3. Re-verify the HEC-HMS and HEC-RAS model results for the 5 and 1 verification events (respectively), currently included in the draft GRR/SEIS Main Report.
4. Revise text and figures in Appendix, 2 Hydrology and Hydraulics, and throughout the GRR/SEIS Main Report to reflect the improved model verification. If data from Hurricane Ike are unavailable or unsuitable for model verification purposes, revise the HEC-HMS models to obtain better agreement with the higher-flow (lower frequency) storm events currently used in the model verification process.
5. Revise text and figures in Appendix 2, Hydrology and Hydraulics, and throughout the GRR/SEIS Main Report to reflect the improved model verification.
6. As needed, revise HEC-FDA models and results presented throughout the draft GRR/SEIS Main Report and appendices to reflect usage of updated HEC-HMS and HEC-RAS models.

Final Panel Comment 2

The selection of the NED plan was not based on standard USACE planning criteria and is not supported by the economic analysis or data presented.

Basis for Comment

Alternatives B60-A75 and B90-A50 are identified as possible National Economic Development (NED) plans (draft GRR/SEIS Main Report, Section 4.7.4). Table 4-4 indicates B90-A50 provides greater net annual excess benefits than B60-A75 (\$11,640,990 vs. \$11,096,810, respectively) and would be the preferred Federal alternative under USACE guidance to maximize NED benefits. Total costs for B90-A50 are also lower than for B60-A75 (\$150,966,190 vs. \$158,295,160, respectively).

Section 4.7.4 of the draft GRR/SEIS Main Report states B60-A75 was selected as the NED plan because it "...reduced to the maximum extent practical the need for population displacements" (pp. 4.54). Section 4.7.4 (p. 4-54) and Table A5-33 indicate that displacements under the two plans differ by three structures: 70 structures for B60-A75 and 73 structures for B90-A50. These three structures are residential (p. 4-59). Avoiding these three displacements reduces net excess benefits by \$181,393 annually and results in additional project costs of \$7,328,970. The additional project costs of \$2,442,990 per displacement avoided are significantly greater than the average costs that have been incurred for prior residential land acquisitions listed in Appendix 6, Real Estate Plan (Table A6-1). Appendix 5, Economics Analysis, Section 15, also states that a relatively large number of buyouts have already occurred within the study area at significantly lower costs than these avoided displacements.

As such, the stated justification for selecting alternative B60-A75 over B90-A50, as well as other alternatives, is not supported by information provided in the project documents. For example, Table 4-3 shows that several alternatives with smaller project scale such as B60-A50, B50-A50, B50-A25, and B40-A50 all provide greater NED benefits and have lower project costs than B60-A75. Specifically, alternative B40-A50 is reported as having annual NED benefits of \$11,328,350 compared to \$11,096,810 for B60-A75, and the project costs of B40-A50 are \$132,723,900 or \$25,571,260 lower than B60-A75. Also, the benefit-cost ratio (BCR) for B40-A50 is 2.68 compared to 2.38 for B60-A75.

The local sponsor's objective to limit displacements addresses local priorities for the project rather than NED benefits and results in higher project costs. These local priorities indicate alternative B60-A75 is the Locally Preferred Plan rather than the NED plan (USACE 2000); however, this distinction is not reflected in the project documents.

Significance – High

The alternative selected as the NED plan is not consistent with USACE planning guidance because it does not maximize NED benefits and is more costly than the other

alternatives.

Recommendations for Resolution

1. Provide further information and discussion to support the selection of B60-A75 over alternatives that provide greater NED benefits and lower project costs.
2. Provide additional information on displacements avoided or other information to document the incremental benefits of B60-A75.
3. Identify alternative B60-A75 as the Locally Preferred Plan in the project documents if it cannot be shown to maximize NED benefits and provide lower project costs.

Literature Cited:

USACE (2000). Planning Guidance Notebook. Engineer Regulation (ER) 1105-2-100. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 22 April.

Final Panel Comment 3

The economic performance of the originally authorized plan is not well documented, and the rationale for the significant decrease in the BCR specified in the reevaluation is not explained.

Basis for Comment

Data regarding the economic performance of the original 1990 authorized plan is provided in Table 4-1, and discussed in Section 4.1 of the draft GRR/SEIS Main Report. This information is provided in 2001 price levels and a 5.625 discount rate. The Panel understands from this discussion that four alternatives were evaluated, but the alternative that represents the original 1990 authorized plan is not identified. These results are updated and presented in Table 4-5 with 2013 price levels and a 3.75 discount rate, but this table only refers to an 'authorized plan' and not one of the specific alternatives presented in Table 4-1.

The economic performance information from Table 4-5 is also presented in Table ES-1 (and in Appendix 5, Economics Analysis, Table A5-54) in order to compare these reevaluation results to the performance of the originally authorized plan in 1990. The information in Table ES-1 indicates dramatic decreases in the authorized plan's estimated annual National Economic Development (NED) benefits (from \$59.9 million to \$19.7 million) and the benefit-cost ratio (BCR) (from 10.2 to 1.18). However, no data or discussion are presented in the draft GRR/SEIS Main Report or Appendix 5, Economics Analysis, to describe the reasons for these changes in the expected economic performance of the original 1990 authorized plan.

Significance – Medium

A complete description of the performance of the original flood risk reduction plan authorized in 1990 and of the process used to reevaluate the authorized plan alternatives is necessary to understand the history of the project and for a thorough analysis of the alternatives.

Recommendations for Resolution

1. Provide a thorough description of the four authorized plan alternatives described in Section 4.1 of the draft GRR/SEIS Main Report, and define one of these alternatives as the actual authorized plan.
2. Provide a detailed comparison of the economic performance of the authorized plan alternatives with the original 1990 authorized plan as presented in Table ES-1.
3. Describe the reasons and provide justification for any changes in the NED benefits and the BCR for the original 1990 authorized plan as a result of the reevaluation.

Final Panel Comment 4

The economic analysis does not provide a thorough risk analysis of the alternatives that is consistent with ER 1105-2-101.

Basis for Comment

One rationale for the selection of alternative B60-A75 as the National Economic Development (NED) plan is presented in Section 4.7.4 and Table 4-4 of the draft GRR/SEIS Main Report as a difference in populations at risk in different flood events. Specifically, alternative B60-A75 is preferred to B90-A50 due to a reduction in the number of structures removed from the floodplain and the single occurrence damages.

This comparison is incomplete, however, because it does not provide full information about the risk and uncertainty associated with the economic performance of the alternatives. Risk and uncertainty information is presented for B60-A75 in Appendix 5, Economics Analysis, Table A5-53, but no comparable information is provided for B90-A50. Table A5-53 shows that B60-A75 has a large standard deviation for the estimated NED benefits (i.e., the coefficient of variation is 3.42) and a probability of 0.62 that net benefits are greater than 0. Comparable information for B90-A50 and for other alternatives with greater NED benefits than B60-A75 would allow for a full evaluation of the risk tradeoffs for these alternatives. ER 1105-2-101 (USACE 2006) recommends that comparable risk and uncertainty information for all alternatives should be considered in the planning analysis.

Significance – Medium

Risk and uncertainty analysis is an integral part of comparing alternatives for flood damage reduction and a requirement under USACE planning guidelines.

Recommendations for Resolution

1. Provide information about uncertainty in the economic performance of the alternatives comparable to Appendix 5, Economics Analysis, Table A5-53, for the B90-A50 alternative and the original 1990 authorized plan; alternatives with greater NED benefits than B60-A75 could also be addressed.
2. Describe the differences in uncertainty for the performance of each alternative in terms of single occurrence events, as well as the probability of realizing positive NED benefits for each alternative.

Literature Cited:

USACE (2006). Risk Analysis for Flood Damage Reduction Studies. Engineer Regulation ER 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C.

Final Panel Comment 5

Documentation reflecting compliance with Executive Order 13166, which requires an evaluation and program development for Limited English Proficiency communities, does not appear to have been provided.

Basis for Comment

The absence of documentation showing compliance with Executive Order 13166 (EO 13166) in the GRR/SEIS Main Report seems to be inconsistent with other NEPA documents prepared by USACE and/or HCFCD involving Federal funding (e.g., HCFCD/USACE 2010, USACE 2012b).

EO 13166 provides guidance for Federal agencies to improve access to, and activities for, persons who may have limited proficiency in speaking or reading English as a result of their national origin. EO 13166 mandates that each Federal agency examine the services it provides and implement a system by which Limited English Proficiency (LEP) persons can access these services and programs.

The GRR/SEIS Main Report does not provide information describing LEP communities present in the study area, whether the effect of the proposed project on these communities would be positive or negative, or whether any potential effects would be considered significant. The report assumes that notification would be made about flooding and its effects, but it is not clear how these notifications would be directed to potential LEP communities present in the study area.

Significant efforts at public involvement have been conducted over the years during planning of the project, which preceded EO 13166. The Panel assumes that both agency partners (i.e., HCFCD and USACE) in the project have implemented policies and guidance on public involvement of LEP communities (e.g., including providing translators and notifications in other languages for those citizens), but this is not documented in the GRR/SEIS Main Report.

Significance – Medium

The potential effects on LEP communities/citizens cannot be fully understood without documentation of compliance with EO 13166.

Recommendations for Resolution

1. Revise the draft GRR/SEIS Main Report and subsequent NEPA documents to reflect compliance with EO 13166.
2. Discuss and document communities with LEP within the study area in the applicable socio-economic sections of the draft GRR/SEIS Main Report.
3. Discuss any beneficial and adverse effects on these communities, if present.

Literature Cited:

EO 13166 (2000). Improving Access to Services for Persons with Limited English Proficiency. Executive Order 13166, The White House, Office of the Press Secretary, August 11.

<http://www.justice.gov/crt/about/cor/Pubs/eolep.php>

HCFCFCD/USACE (2010). Draft Environmental Assessment: 2008 Updated Right-of-Way on the Detention Element. Upper Watershed of Brays Bayou. HCFCFCD Project ID D100-00-00-Y005. Harris County Flood Control District and U.S. Army Corps of Engineers.

USACE (2012b). Final Environmental Impact Statement. Freeport Harbor Channel Improvement Project, Brazoria County, Texas. U.S. Army Corps of Engineers, Galveston District. 2 volumes.

<http://www.swg.usace.army.mil/BusinessWithUs/PlanningEnvironmentalBranch/DocumentsforPublicReview.aspx>

Final Panel Comment 6

The existing conditions for seismic activity/faults, sensitive noise receptors, and the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act are not thoroughly documented.

Basis for Comment

The GRR/SEIS Main Report presents existing conditions well; however, it does not describe several key components of resources and concerns:

- Section 2.4 describes the geology within the study area, but does not address seismic activity or faults that may be present. This section does explain that the “Houston area” has normal growth faults or surface expansion due to salt domes; however, it is not specific to the project area (see Section 2.4.1.1). 40 CFR Section 1502.15 requires that the affected environment “...succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration.” It is the Panel’s experience that the affected environment section of the draft GRR/SEIS Main Report should be specific to the Hunting Bayou basin. The term “Houston area” would describe basins and areas outside the draft GRR/SEIS Main Report’s defined study area. Section 5.1.2 describes the corresponding effects on geology, indicating that faults are present within the vicinity, but in the upper reach of Hunting Bayou these features are mapped as normal or growth faults. It is not clear whether seismic activity has occurred or is anticipated to occur from these faults.
- Section 2.5.1.1 describes noise-sensitive receptors/receivers within the project area, and indicates that “most” of the receptors include residential dwellings and associated neighborhood land uses. It does not state whether the following receptors/receivers are present in the study area: cemeteries, parks, hospitals, funeral homes, hotels, motels, churches, and religious institutions. These types of facilities are likely present within the study area and would warrant consideration as a noise-sensitive receptor.
- Section 2.7 does not identify the migratory birds anticipated to be within the project study area. Section 2.7.3.1 (Threatened and Endangered Species) states that the bald eagle was evaluated within the project study area; however, Section 2.7 does not indicate that this species is also protected under the Migratory Bird Treaty Act and/or Bald and Golden Eagle Protection Acts. Examples of migratory birds that are potentially present in the project area include, but are not limited to, the northern cardinal, brown-headed cowbird, American crow, mourning dove, white-winged dove, and the snowy egret (50 CFR 10.13, Houston Audubon Society 2013). It is the Panel’s experience that a description of migratory birds that use the study area should be provided in both the affected environment and environmental consequences sections of a formal NEPA compliance document.

Significance – Medium

The lack of documentation on existing conditions related to seismic activity/faults, sensitive noise receptors, and compliance with the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Act results in an incomplete understanding of environmental constraints present that may be affected by the project.

Recommendations for Resolution

1. Describe seismic activity and/or faults specific to the project study area. Include positive or negative statements about their presence, absence, or occurrence.
2. Provide additional documentation describing potential noise-sensitive receptors in the project area.
3. Provide a subsection in Section 2.7 of the draft GRR/SEIS Main Report that includes a description of migratory birds that may be present within the project study area that would be protected under the Migratory Bird Treaty Act/Bald and Golden Eagle Protection Acts.

Literature Cited:

50 CFR 10.13 (1985). List of Migratory Birds. Code of Federal Regulations.

Houston Audubon Society (2013). Common Birds of Houston, Texas.
<http://www.houstonaudubon.org/html/CommonBirdsofHouston.pdf>

Final Panel Comment 7

Peak streamflows in Hunting Bayou are increasing, thus increasing the uncertainty in quantifying future 1% and 0.5% floods using the log-Pearson Type III distribution.

Basis for Comment

Table A2-8 of Appendix 2, Hydrology and Hydraulics, lists the annual peak discharges as measured at the U.S. Geological Survey (USGS) gauge within the Hunting Bayou watershed. Exhibit A2-7 uses these data to plot annual peak flows versus time, as well as a five-year moving average. On page 4-11 of Appendix 2, Hydrology and Hydraulics, the statement is made that as the “5-year moving average has no general upward trends,” the entire 49-year record could be used to determine the 1%, 0.5%, and 0.2% flood flows for Hunting Bayou.

The Panel has determined that peak streamflows in Hunting Bayou do demonstrate an increasing trend. Upon applying a Mann-Kendall standard test to the annual peak data shown in Table A2-8, significant increasing streamflow trends were computed, even after excluding years 1964 and 1965, which have anomalously low peak flow values.

Since peak streamflow values are increasing in Hunting Bayou, the study’s definition of 1%, 0.5%, and 0.2% storm events (based on historical values) may actually underestimate the magnitude of such rare peak flow values. Therefore it becomes difficult to quantify the level of protection afforded to Hunting Bayou in either without project or Tentatively Selected Plan (TSP) conditions, as well as under other potential project alternatives. It also makes it difficult to define the 1% floodplain.

Significance – Low

Increasing streamflow trends suggest that larger future peak flows will occur more often than expected, therefore reducing the stated protection levels of the TSP and other flood mitigation scenarios.

Recommendations for Resolution

1. Revise Appendix 2, Hydrology and Hydraulics, to support the interpretation that Hunting Bayou peak flows are increasing, and include a discussion of the impact of such increases on the computed level of protection provided by the TSP and other mitigation alternatives.
2. Review US BoR (1982) and IACWD (1982), and modify Appendix 2, Hydrology and Hydraulics, as needed to indicate how an increasing trend in peak flows may be handled when computing Flood Flow Frequencies.

Literature Cited:

US BoR (1982). Guidelines for Determining Flood Flow Frequency, Bulletin #17B. August 7, 2013.

IACWD (1982). Guidelines for Determining Flood Flow Frequency. Bulletin #17B of the Hydrology Subcommittee. Interagency Advisory Committee on Water Data, U.S. Department of the Interior, Geological Survey, Office of Water Data Coordination, Reston, VA, 22092.

http://water.usgs.gov/osw/bulletin17b/dl_flow.pdf

Final Panel Comment 8

The mitigation credits calculated do not appear to be consistent with the Greens Bayou Wetland Mitigation Bank/Mitigation Banking Instrument or other related guidance, and documentation of the habitat assessment procedures was not provided.

Basis for Comment

The draft GRR/SEIS Main Report and Appendix 1, SEIS Attachments, describe the methodology and results of how mitigation credits were calculated to offset unavoidable impacts from the implementation of the Tentatively Selected Plan (TSP). The mitigation credits reported in the draft GRR/SEIS Main Report were calculated based on data provided in the Habitat Suitability Index/Habitat Evaluation Procedures (HSI/HEP) modeling. The use of HSI models may be inconsistent with the requirements set forth in the Greens Bayou Wetlands Mitigation Bank (GBWMB) Mitigation Banking Instrument (MBI) (HCFCD 1995) and other literature (HCFCD 2005). The MBI and other literature direct that the Wetland Evaluation Technique (WET) 2.0 analysis should be performed rather than HEP. However, the draft GRR/SEIS Main Report or Appendices do not indicate whether the HEP/HSI modeling was approved by the resource agency team partners during interagency coordination, which would negate the requirement to perform WET 2.0.

Attachment 1 of Appendix 1, SEIS Attachments, states that habitat assessments were conducted as components of the *Habitat Assessment of the Existing Conditions of Twenty-five Wetlands within the Hunting Bayou Channel Right-of-Way, Inline Detention Tract, Offline Detention Tract, and Soil Disposal Sites* report. However, this report was not included in Appendix 1, SEIS Attachments, for review. The Panel was therefore unable to determine how the HSI models were employed, the extent of interagency coordination activities regarding habitat model selection, or the decision to use the HEP rather than the WET 2.0 process.

In addition, impacts on palustrine scrub-shrub wetlands (PSS) are not calculated for the proposed project even though the HSI model for swamp rabbit, for instance, does indicate that this species uses scrub-shrub habitats for cover and food source (USFWS 1985). The Panel also noted that the HSI models used specifically exclude these habitat impacts from evaluation, but documentation supporting these exclusions is not provided.

Significance – Low

A discussion of the use of HSI/HEP modeling to calculate mitigation credits, along with documentation of interagency coordination in the draft GRR/SEIS Main Report and Appendix 1 SEIS Attachments, would improve the quality and readability of the report.

Recommendations for Resolution

1. Provide supporting documentation showing the coordination that led to the use of the specific HSI models.

2. Provide supporting documentation and rationales for not including calculations of impacts on habitats for certain species, such as the swamp rabbit. Include the reasoning for not calculating mitigation credits for scrub-shrub wetlands present in the project area.

Literature Cited:

HCFCFCD (2005). Mitigating Wetland Impacts with the Harris County Flood Control District. Greens Bayou Wetlands Mitigation Bank. Harris County Flood Control District. http://www.hcfcfd.org/downloads/brochures/GBWMB_CreditSalesBRO_2005a.pdf

HCFCFCD (1995). Memorandum of Agreement for the Greens Bayou Wetland Mitigation Bank in Harris County. Harris County Flood Control District. http://www.eli.org/pdf/wmb/TX.WMB.Greens_Bayou_Wetland.pdf

USFWS (1985). Habitat Suitability Index Models: Swamp Rabbit. Biological Report 82 (10.107). U.S. Department of the Interior, Fish and Wildlife Service. <http://www.nwrc.usgs.gov/wdb/pub/hsi/hsi-107.pdf>

Final Panel Comment 9

The rationale for excluding habitat suitability models for fish species such as the channel catfish and common carp, as well as the identification and mitigation of impacts on water quality and fringe wetlands resulting from the deepening of Hunting Bayou, were not discussed.

Basis for Comment

The deepening and widening of Hunting Bayou may result in losses of habitat for various fish species. The reconfiguration of the channel may impair the reestablishment of some affected habitats and result in permanent habitat shifts for others. No Habitat Suitability Index/Habitat Evaluation Procedures (HSI/HEP) models are identified for these habitats and mitigation credits are not calculated. Suitable HSI models that may have been used include the channel catfish and common carp.

As indicated in the draft GRR/SEIS Main Report, dissolved oxygen levels within Hunting Bayou are currently not meeting water quality standards, and the deepening and widening of the Bayou would likely exacerbate poor water quality. The Panel cannot understand from the information provided how this potential impact would be mitigated, as new waters may not meet water quality standards.

Impacts on fringe wetlands from the deepening and widening of Hunting Bayou are also described. The deepening and widening of Hunting Bayou, along with routine maintenance activities in the 50-year analysis period (i.e., maintenance dredging) would likely preclude the reestablishment of fringe wetlands in the Bayou. In addition, in situations with high frequency, higher stream flows during flooding events would result in scouring of fringe habitats present and prevent recruitment of desired wetland vegetation.

Calculations for temporal impacts on the fringe wetland systems adjacent to the Bayou are not provided for review. As stipulated in the draft GRR/SEIS Main Report, it is anticipated that these wetlands would reestablish themselves; however, if these habitats do not reestablish with at least 70% cover after construction, 1.0 acre of mitigation would be provided. The mitigation calculations identified for fringe wetland impacts are not consistent with the HEP methodology used for other wetland impacts proposed within the study area. They are not consistent because the proposed mitigation to fringe wetlands is acre-based versus model-based. The draft GRR/SEIS Model Report and Appendix 1, SEIS Attachments, provide a model-based methodology for calculating mitigation required for wetlands.

Significance – Low

The quality and readability of the report would be improved by including more thorough assessments and calculations of the environmental impacts related to the deepening and widening of Hunting Bayou.

Recommendations for Resolution

1. Provide additional documentation to support the decision to not include fish species in the habitat evaluation and mitigation calculations.
2. Provide documentation and supporting calculations to address permanent and/or temporal impacts on fringe wetlands consistent with mitigation credits identified in the draft GRR/SEIS Main Report.
3. Provide additional documentation on mitigation for water quality either through text revision or as an Attachment to the SEIS in Appendix 1.

Final Panel Comment 10

It cannot be determined from the description provided if the cumulative effects analysis includes areas that may extend beyond the Hunting Bayou Basin.

Basis for Comment

Section 6 of the draft GRR/SEIS Main Report describes cumulative effects, but not the various cumulative analysis resource study areas that may extend beyond Hunting Bayou basin. For example, transportation projects and their effects may extend into watersheds surrounding or outside Hunting Bayou.

The cumulative effects analysis does not adequately describe the implementation of the Tentatively Selected Plan (TSP) in combination with past, present, and future actions. The Panel expects that the implementation of the TSP would have economic effects outside the watershed.

Significance – Low

The quality and readability of the report would be improved by including more thorough descriptions of the cumulative effects analysis area(s).

Recommendations for Resolution

1. Provide supporting documentation describing how the cumulative effects analysis area(s) were determined and whether these effects extend beyond the project study area.
2. Provide supporting documentation that the implementation of the TSP, in combination with past, present, and future actions, could affect areas outside the Hunting Bayou watershed.

APPENDIX B

**Final Charge to the Independent External Peer Review Panel
as Submitted to USACE on May 31, 2013**

on the

Hunting Bayou IEPR

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Charge Questions and Guidance to the Peer Reviewers for the Independent External Peer Review of the Hunting Bayou IEPR

BACKGROUND

The Independent External Peer Review (IEPR) is to be performed for the studies that comprise the integrated draft General Reevaluation Report (GRR) and draft Supplemental Environmental Impact Statement (SEIS) for the Hunting Bayou Flood Risk Management Study. The Project Delivery Team (PDT) consists of the Harris County Flood Control District (HCFCD), which is directing this study in coordination with the U.S. Army Corps of Engineer (USACE) Galveston District. AECOM Technical Services, Inc. (AECOM) is the prime contractor working for HCFCD. Battelle is the contractor providing the IEPR services.

Hunting Bayou is a major tributary of Buffalo Bayou. The area encompassed by the Hunting Bayou watershed is located within the Houston metropolitan area including the cities of Houston, Galena Park and Jacinto City. The Hunting Bayou watershed is approximately 30 square miles in size and is located approximately five miles northeast of downtown Houston in Harris County, Texas. The main stem of Hunting Bayou, consisting of an earthen channel section, extends approximately 15 miles from its headwaters west of US 59 to its confluence with the Houston Ship Channel.

The purpose of the proposed action is to evaluate a flood risk management plan consistent with the authorized plan recommended in the May 1988 Feasibility Report and authorized in the Water Resources Development Act (WRDA) of 1990, in light of current conditions that have changed and occurred since the original authorization. The need for the proposed action is to reduce flooding of structures (residential, commercial, public etc.) along Hunting Bayou in a manner that is less disruptive to the existing environment versus the authorized plan and is effective and affordable. The study is being conducted under the WRDA of 1996, Section 211(f) authority at the full expense of HCFCD and fully complies to date and will comply with the Corps planning requirements specified in Engineer Regulation (ER) 1105-2-100, Appendix H, Section H-8.

This GRR/SEIS update was conducted following the published procedure, methodology and guidance of USACE. The USACE HEC-HMS, HEC-RAS, and HEC-FDA computer models were used to determine the flood damages for the without-project condition and with-project conditions. It is estimated that over \$26 million in average annual equivalent damages occur within the study area at the 2009 price level in the without project condition. Flooding affects an estimated 6,500 structures within the 0.2% floodplain and over 4,800 structures within the 1% floodplain of Hunting Bayou. Over 90% of the structures in either floodplain are residential. The Tentatively Selected Plan (TSP) for Hunting Bayou would reduce average annual damages by 75% and would remove 91% of all structures from the 1% floodplain. The benefit-to-cost ratio (BCR) for the TSP is 2.5:1.

OBJECTIVES

The objective of this work is to conduct an IEPR of the GRR/SEIS for the Hunting Bayou Flood Risk Management Study (hereinafter: Hunting Bayou IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (EC 1165-2-214; December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

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

The purpose of the IEPR is to assess the “adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used” (EC 1165-2-214; p. D-4) for the Hunting Bayou IEPR documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in Civil Works planning, NEPA and biology, hydrologic and hydraulic engineering, and economic issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

The Panel will be “charged” with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents, supporting information, and reference materials that will be provided for the review.

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages	Required Disciplines
Hunting Bayou Main Report, SEIS, June 2013	237	All Disciplines
Appendix 1: SEIS Attachments, June 2013	194	All Disciplines
Appendix 2: Hydrology and Hydraulics, June 2013	183	Hydrology and Hydraulics
Appendix 3: Engineering Analysis, June 2013	61	Hydrology and Hydraulics
Appendix 4: Cost Estimates, June 2013	489*	Hydrology and Hydraulics, Economics
Appendix 5: Economic Analysis, June 2013	154	All Disciplines
Appendix 6: Real Estate Plan, June 2013	50	All Disciplines
Total Page Count	1368*	

* Pages count includes MCACES output which will not be reviewed

Supporting Material Provided by HCFCD Project Team

Title	Approx. No. of Pages
Habitat Suitability Index Model: Snapping Turtle	26
Habitat Suitability Index Model: Swamp Rabbit	33
Habitat Suitability Index Model: Barred Owl	32
Habitat Suitability Index Model: Mink	31
Total Page Count	122

Documents for Reference

- USACE guidance Civil Works Review, (EC 1165-2-214) dated 15 December 2012.
- Office of Management and Budget’s Final Information Quality Bulletin for Peer Review released December 16, 2004.

SCHEDULE

This final schedule is based on the June 10, 2013 receipt of the final review documents. The schedule will be revised upon receipt of final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	6/12/2013
	Battelle convenes kick-off meeting with panel members	6/12/2013
	Battelle convenes kick-off meeting with HCFCD PDT and panel members	6/12/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of HCFCD PDT	6/26/2013
	Panel members complete their individual reviews	7/11/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	7/17/2013
	Battelle convenes Panel Review Teleconference	7/18/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	7/19/2013
	Panel members provide draft Final Panel Comments to Battelle	7/26/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	7/27-8/5/2013
	Battelle finalizes Final Panel Comments	8/6/2013
	Battelle provides Final IEPR Report to panel members for review	8/8/2013
	Panel members provide comments on Final IEPR Report	8/12/2013
	*Battelle submits Final IEPR Report to HCFCD PDT	8/15/2013

Task	Action	Due Date
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to HCFCD PDT	8/19/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	8/19/2013
	HCFCD project team provides draft HCFCD PDT Evaluator Responses to Battelle	8/29/2013
	Battelle provides the panel members the draft HCFCD PDT Evaluator Responses	9/3/2013
	Panel members provide Battelle with draft BackCheck Responses	9/6/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	9/9/2013
	Battelle convenes Comment-Response Teleconference with panel members and HCFCD PDT	9/10/2013
	HCFCD project team inputs final Evaluator Responses to DrChecks	9/24/2013
	Battelle provides HCFCD PDT final Evaluator Responses to panel members	9/27/2013
	Panel members provide Battelle with final BackCheck Responses	10/2/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	10/8/2013
	*Battelle submits pdf printout of DrChecks project file	10/9/2013

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Hunting Bayou documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically credible conclusions. The Panel is being asked to provide feedback on the economic, engineering, environmental resources, and plan formulation. The panel members are not being asked whether they would have conducted the work in a similar manner.

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Hunting Bayou documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that

the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-214; Appendix D).

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

Please **do not** make recommendations on whether a particular alternative should be implemented, or whether you would have conducted the work in a similar manner. Also, please **do not** comment on or make recommendations on policy issues and decision-making. Comments should be provided based on your professional judgment, **not** the legality of the document.

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

Please submit your comments in electronic form to Julian DiGialleonardo, digialleonardoj@battelle.org, no later than July 11, 2013, 5 pm ET.

Independent External Peer Review of the Hunting Bayou Flood Risk Management Study

Charge Questions and Relevant Sections as Supplied by USACE

General Questions

1. Are the assumptions underlying the economic, engineering, and environmental analyses valid and reasonable?
2. Comment on the adequacy and acceptability of the economic, engineering, and environmental models.
3. Comment on how well the economic, engineering and environmental analyses conform to accepted standards and U.S. Army Corps of Engineers policy and guidance.
4. Comment on how well the report and SEIS satisfy the requirements of the National Environmental Policy Act (NEPA) and other regulations promulgated there under.
5. Are the conclusions reached in the economics, engineering, and environmental reports reasonable?
6. Has the overall history of the project, including prior studies and reports, been adequately described and documented?
7. Comment on the appropriateness and adequacy of the study area description.
8. Have the water resource problems and opportunities been clearly stated and adequately documented?
9. Are the planning objectives clearly described and to what extent are they attainable given the problems, opportunities, and constraints associated with the study?
10. Are the planning constraints clearly explained and described?
11. Does the project planning process adhere to the Water Resource Council Principles and Guidelines and Planning Guidance Notebook's Six Step Planning process?
12. Is the future without-project condition clearly described and well documented?
13. Was the plan formulation process sufficiently rigorous and adequately documented?
14. Are the iterative evaluations, integral to the alternatives screening process, reasonable and appropriate (Refer to the Plan Formulation chapter of the Main Report and Economics Appendix)
15. Provide your overall comments on the description of the TSP.
16. Does the TSP reasonably address the water resource problems and opportunities?
17. Does the TSP reasonably avoid the planning constraints?
18. Does the TSP meet the planning objectives of providing flood risk reduction benefits while satisfying the constraints of avoiding adverse impacts to downstream interests?
19. Does the TSP meet the planning objectives of providing flood risk reduction benefits while satisfying the constraints of avoiding adverse impacts to the Hunting Bayou environment?

ENGINEERING ANALYSIS

20. Comment on the completeness and adequacy of the scope of the engineering investigations described in the Engineering Appendix.
21. Are the engineering assumptions reasonable and adequate for a project of this magnitude and complexity?
22. Were there a sufficient number of alternatives analyzed in the engineering investigations?
23. Comment on the efficacy of the TSP to address the flooding problems in the watershed.
24. Do the exhibits adequately illustrate the TSP and are there any issues in them that affect your ability to understand the TSP?
25. In your opinion, is the TSP a constructible plan as proposed and described in the Engineering Appendix?
26. From an H&H perspective, in your opinion, is the TSP a reasonably operable and maintainable project?

ECONOMIC ANALYSIS

27. Comment on the adequacy of the documentation and your understanding of the economic analysis, especially with regards to the Six Step Planning Process.
28. Were the assumptions made in the economics analysis reasonable and appropriate?
29. Referring to all sections in Appendix 5, how well does the economic analysis present the history of the analyses performed, and how well does the economic analysis justify the TSP?
30. Is the future without-project condition reasonable and adequately described?
31. Comment on the integration of the hydrology & hydraulics analysis with the economic analysis. Do the two analyses produce a reasonable and appropriate evaluation of expected future flood damages, both with and without the project?
32. Comment on the reasonableness and acceptability of the economic models employed in the analysis.
33. Are the depth-damage functions used in the original analysis and iterative updates reasonable and applicable to the Hunting Bayou study area?
34. Are the analytical methods employed in the economic model reasonable and appropriate, and do they comply with applicable policy and guidance for this type of study?
35. Is there a sufficient level of detail in the description of the future without-project condition to understand flood risk in the absence of a federal project for Hunting Bayou?
36. Are land use and floodplain inventory data adequately described and documented?
37. 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.
38. Are the Critical Uncertainty Parameters adequately defined and described?
39. Are the economic reaches adequately delineated?
40. Comment on the appropriateness and adequacy of the damage categories.

41. Comment on the appropriateness and adequacy of all economic benefit categories. Are there any other benefit categories that could or should be considered?
42. Is the scope of with-project components sufficient? Is the range of components considered reasonable?
43. Discuss the reasonableness and adequacy of the recreation benefit analysis and the Unit Day Value approach.
44. Comment on the non-structural components analysis and discuss the reasonableness and adequacy of the documentation of the components considered.
45. Is the range of alternatives reasonable?
46. Discuss the appropriateness and effectiveness of the alternatives reevaluation.
47. Are the assumptions, methods, and analyses used in the land use, floodplain inventory, and price level updates reasonable and appropriate?
48. Is the sampling procedure in the iterative economic updates reasonable and adequately described?
49. Comment on the economic performance of the NED and TSP plans.
50. Discuss the evaluation of residual risk and population at risk in the residual floodplain. Is the residual risk appropriate and adequately documented?
51. Provide discussion of the Section 575 analysis and its impact on the future without and future with-project conditions.
52. Comment on the analysis of expected economic performance of the TSP.

HYDROLOGY AND HYDRAULICS

53. Are the assumptions used in the development of the without-project condition appropriate and adequately described?
54. Is the H&H modeling software appropriate and applicable to the Hunting Bayou watershed?
55. Is the watershed description adequately described and reasonable?
56. Discuss the descriptions of H&H topographic surveys and survey datum.
57. Discuss how land subsidence was incorporated into the analysis and adequately addressed.
58. Discuss how the H&H analysis addressed sea level rise (per EC 1165-2-212, Oct. 2011) and its application to the H&H, engineering, and economic analyses.
59. Comment on the effectiveness of the analytical procedure used in the H&H analysis.
60. Are the hypothetical rainfall events used to define the benchmark rainfall events appropriate?
61. Are the sub-watersheds in the Hunting Bayou basin adequately defined and modeled?
62. Are the models properly calibrated and representative of the Hunting Bayou watershed?
63. Comment on the models' capability to estimate historic events.
64. Comment on the appropriateness and applicability of the roughness coefficients used in the analysis.
65. Discuss the appropriateness of the HEC-RAS without-project condition results.
66. Comment on the risk and uncertainty parameters employed in the modeling process.
67. Comment on the adequacy of the documentation, reasonableness and effectiveness of the with-project conditions optimizations.

68. Are the H&H procedures used in the alternatives formulation reasonable and adequately documented?
69. Comment on the methods and assumptions used to convert the H&H models from legacy HEC software to the nextgen applications employed in 2009 and 2013.
70. Comment on the modeling effort undertaken to analyze the TSP.
71. Comment on the flood risk performance of the TSP.
72. Comment on the capacity exceedance performance of the TSP.
73. Comment on the analysis of residual risk and residual floodplains.

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

74. Does the SEIS satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?
75. Is the No Action Alternative clearly described and well documented?
76. Are there any documented aspects of the No Action alternative that would make it preferable to the TSP?
77. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?
78. Are there any unmitigated environmental impacts not identified and if so could they impact project feasibility and/or acceptability?
79. Are residual risks adequately described and is there a sufficient plan for communicating the residual risk to affected populations?
80. Is the description of wetland resources in the project area appropriate and adequately documented?
81. Is the description of aquatic resources in the project area appropriate and adequately documented?
82. Is the description of threatened and endangered species resources in the study area appropriate and adequately documented?
83. Is the description of the cultural resources in the study area appropriate and adequately documented?
84. Is the description of the historical and existing socioeconomic resources in the study area appropriate and adequately documented? Were specific socioeconomic issues not addressed?
85. Have impacts on significant resources been adequately and clearly described?
86. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?
87. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?
88. Are cumulative impacts adequately described and discussed?
89. Discuss the appropriateness and reasonableness of the description of the affected environment.
90. Are the environmental consequences of the recommended alternative appropriately and adequately described and addressed?
91. Provide your overall assessment of the coordination effort associated with this project.
92. Has agency coordination been reasonably appropriate?

93. Has public involvement been conducted in a reasonable and appropriate manner for a project of this magnitude?

COST ESTIMATING

94. Comment on the extent to which the methodology is clearly explained and appropriate.
95. Comment on the extent to which the assumptions have been adequately identified and justified.
96. Comment on whether the cost estimates are consistent with and appropriately reflect the application of the methodology described.
97. Comment on the extent to which uncertainty is adequately addressed.
98. Comment on the extent to which operation, maintenance, and repair costs are adequately identified and assumptions are documented and justified.

REAL ESTATE

99. Is the discussion of the project approach presented for the Real Estate Plan appropriate and reasonably documented?
100. Are the components listed comparable with the TSP components as listed in the GRR?
101. Comment on whether the NED real estate costs have been adequately determined and presented.

SUMMARY QUESTIONS

102. Please identify the most critical concerns (up to 5) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.
103. Please provide positive feedback on the project and/or review documents.