Final Independent External Peer Review Report
Upper Barataria, Louisiana,
Integrated Feasibility Study

Prepared by
Battelle Memorial Institute

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

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Executive Summary

Project Background and Purpose

The study area for the Upper Barataria, Louisiana, Integrated Feasibility Study (Upper Barataria FS) includes communities in the following seven southeast Louisiana parishes: Ascension, Assumption, Jefferson, Lafourche, St. Charles, St. James, and St. John the Baptist Parishes. The study area is bounded on the north and east by the Mississippi River and Tributaries Project, Mississippi River Levee; on the west by Bayou Lafourche; and on the south by a boundary extending slightly past U.S. Highway 90. The study area is part of the larger Barataria Basin watershed covering approximately 760 square miles and characterized by low, flat terrain with numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually into the Gulf of Mexico. Areas of development located within the study area are mostly unleveed or have inadequate levee systems, are dependent on gravity drainage, and are subject to the effects of interior rainfall flooding and riverine flooding. The southern half of the study area is also subject to tidal flooding due to hurricanes and other storms. The study area is mostly wetland and agricultural lands with numerous communities located adjacent to major highways, the Mississippi River, and Bayou Lafourche. Before construction of the Mississippi River levees, the area was subjected to rainfall, fluvial, tidal, and hurricane flooding from the Mississippi River, resulting in structural, agricultural, and environmental damages. Flood damages are aggravated by the long duration of the high stages due to conveyance constrictions. The Barataria Basin is a diverse ecosystem inhabited by a variety of species of birds, mammals, reptiles, amphibians, as well as fresh, brackish, and saltwater fish.

The Upper Barataria FS investigated alternatives that include structural and nonstructural measures to address flood risk from tidal surges, coastal storm surges, and heavy rainfall in the area between Bayou Lafourche and the Mississippi River System, from Donaldsonville to just past U.S. Highway 90 in the basin. Structural measures to regulate Upper Barataria Basin stages and storage to help reduce structure damage consist of a combination of levees and floodwalls, conveyance channels, flood gates, tidal exchange structures, T-walls, and pumping stations. Nonstructural measures to address flood damages include structure elevations, buy-outs and relocations, dry/wet flood-proofing, or localized levees/floodwalls.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Upper Barataria, Louisiana, Integrated Feasibility Study (hereinafter: Upper Barataria FS IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2018). Battelle has experience in establishing

and administering peer review panels for USACE and was engaged to coordinate this IEPR. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2018) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the decision documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: plan formulation/ economics, environmental law compliance, hydrology and hydraulic (H&H) engineering, and civil/geotechnical engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of all the final candidates to independently confirm that they had no COIs, and Battelle made the final selection of the four-person Panel from this list.

The Panel received electronic versions of the decision documents (360 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed. Following guidance provided in USACE (2018) and OMB (2004), USACE prepared the charge questions, which were included in the draft and final Work Plans.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference at the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. Other than Battelle-facilitated teleconferences, there was no direct communication between the Panel and USACE during the peer review process.

IEPR panel members reviewed the decision documents individually and produced individual comments in response to the charge questions. The panel members then met via teleconference with Battelle to review key technical comments and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium/high, medium, medium/low, or low); and (4) recommendations on how to resolve the comment. Overall, seven Final Panel Comments were identified and documented. Of these, two were identified as having medium/high significance, two had medium significance, and three had medium/low significance.

Battelle received public comments from USACE on the Upper Barataria Draft Feasibility Study with Integrated Environmental Impact Statement (FS/IEIS) (35 pages of comments) and provided them to the IEPR panel members. The panel members were charged with determining if any information or concerns presented in the public comments raised any additional discipline-specific technical concerns with regard to the Draft FS/IEIS. After completing its review, the Panel confirmed that no new issues or concerns were identified other than those already covered in the Final Panel Comments.

Results of the Independent External Peer Review

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2018) in the Draft FS/IEIS. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the report is well-written and concise, and the document presented the material in a comprehensive and logical approach. However, the Panel identified several elements of the project where additional analysis is needed and where project findings and objectives need to be documented or clarified.

Engineering: From a geotechnical and civil engineering perspective, the data provided and the methods of analyses presented were considered adequate and acceptable for this level of study. While the H&H modeling tools and input data were found to be generally adequate and acceptable, the panel members noted concerns regarding the residual risk and potential effects of compound flooding that were not assessed, particularly as it relates to storm surge, sea-level rise (SLR), inland rainfall, and system-level interactions. They believe the risks and effects have been underestimated because the models used are not integrated to address the combined effects of storm surge and inland rainfall/flooding. The Panel also noted other H&H modeling methods and assumptions that they believe need additional documentation.

The Panel also found that the assumption that levees would be "completely resilient" to overtopping due to armoring is not well-supported and requires further evaluation and sensitivity analysis. The panel members believe that uncertainty in the validity of this assumption has a strong probability of influencing the ability to implement the Tentatively Selected Plan (TSP) and maintain the levees in a manner that will be "completely resilient" to the significant overtopping that is anticipated with a 2% annual exceedance probability (50-year) levee height.

Environmental: To achieve the stated purpose of this project—to reduce the risk of flood damage—concerted efforts must be made during project implementation to avoid or mitigate adverse impacts to the environment. The Panel is concerned that the placement of a levee across a wetland will alter hydrology, and subsequently the environment, on both sides of the levee. The effects of the project on the hydroperiod and persistence of ecosystems waterward and landward of the proposed levee have not been evaluated and documented. Statements within the review documents imply that the proposed TSP would impact the Upper Barataria Basin hydrology and environment, but the documents do not provide a solution to avoid, account for, or mitigate the impacts.

Economics/Plan Formulation: Although the Planning Objectives specifically call out "Reduce the risk to human life, health, and safety by reducing flood impacts to structures, evacuation routes, and critical infrastructure" (Draft FS/IEIS, p. 15), the Panel noted that the review documents do not include any evaluation of the differential effects on life safety or critical infrastructure for project alternatives in either the initial screening or the final selection of alternatives.

The Panel also found that the limited documentation provided on the initial screening process does not support the assessment that all reasonable alternatives were considered. In addition, with no quantitative estimates of local socioeconomic impacts, the assumption that socioeconomic impacts would be negligible, minor, and temporary, or generally attributed to SLR or overall growth and development, is not supported.

Table ES-1. Overview of Seven Final Panel Comments Identified by the Upper Barataria FS IEPR Panel

No.	Final Panel Comment
Significance – Medium/High	
1	The residual risk and potential effects due to compound flooding appear to be underestimated.
2	The assumption that levees will be "completely resilient" to overtopping due to armoring is not well-supported and requires further evaluation and sensitivity analysis.
Significance – Medium	
3	The effects of the project on the hydroperiod and persistence of ecosystems waterward and landward of the proposed levee have not been evaluated and documented.
4	The Draft FS/IEIS documents do not evaluate the differential effects on life safety or critical infrastructure for project alternatives in either the initial screening or the final selection of alternatives.
Significance – Medium/Low	
5	The initial screening process does not clearly indicate that all reasonable alternatives were considered.
6	There are no quantitative estimates of local socioeconomic impacts under the TSP or the alternatives.
7	The H&H modeling methods and assumptions are not clearly documented.

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LIST OF ACRONYMS

ABCEP	Academy of Board-Certified Environmental Professionals
ADCIRC	ADvanced CIRCulation (Model)
ADM	Agency Decision Milestone
APUS	American Public University System
BCR	Benefit-Cost Ratio
CEP	Certified Environmental Professional
COI	Conflict of Interest
CPRA	Coastal Protection and Restoration Area
CSRM	Coastal Storm Risk Management
CSU	Colorado State University
CUWCC	California Urban Water Conservation Council
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EC	Engineer Circular
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
E.O.	Executive Order
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FS	Feasibility Study
H&H	Hydrology and Hydraulics
HEC-FDA	Hydrologic Engineering Center-Flood Damage Reduction Analysis
HEC-FIA	Hydrologic Engineering Center-Flood Impact Analysis
HEC-GeoHMS	Hydrologic Engineering Center-Geospatial Hydrologic Modeling System
HEC-GeoRAS	Hydrologic Engineering Center-Geospatial River Analysis System
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center-River Analysis System
IEIS	Integrated Environmental Impact Statement
IEPR	Independent External Peer Review

IWR	Institute for Water Resources
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NHPA	National Historic Preservation Act
O&M	Operations and Maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
OPSEC	Operations Security
PCX	Planning Center of Expertise
PDT	Project Delivery Team
PED	Pre-construction Engineering and Design
SLISA	Smith Lake Improvement and Stakeholder Association
SLR	Sea-Level Rise
TSP	Tentatively Selected Plan
UBB	Upper Barataria Basin
USACE	United States Army Corps of Engineers
UWIN	Urban Water Innovation Network
WVA	Wetland Value Assessment

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1. INTRODUCTION

The study area for the Upper Barataria, Louisiana, Integrated Feasibility Study (Upper Barataria FS) includes communities in the following seven southeast Louisiana parishes: Ascension, Assumption, Jefferson, Lafourche, St. Charles, St. James, and St. John the Baptist Parishes. The study area is bounded on the north and east by the Mississippi River and Tributaries Project, Mississippi River Levee; on the west by Bayou Lafourche; and on the south by a boundary extending slightly past U.S. Highway 90. The study area is part of the larger Barataria Basin watershed covering approximately 760 square miles and characterized by low, flat terrain with numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually into the Gulf of Mexico. Areas of development located within the study area are mostly unleveed or have inadequate levee systems, are dependent on gravity drainage, and are subject to the effects of interior rainfall flooding and riverine flooding. The southern half of the study area is also subject to tidal flooding due to hurricanes and other storms. The study area is mostly wetland and agricultural lands with numerous communities located adjacent to major highways, the Mississippi River, and Bayou Lafourche. Before construction of the Mississippi River levees, the area was subjected to rainfall, fluvial, tidal, and hurricane flooding from the Mississippi River, resulting in structural, agricultural, and environmental damages. Flood damages are aggravated by the long duration of the high stages due to conveyance constrictions. The Barataria Basin is a diverse ecosystem inhabited by a variety of species of birds, mammals, reptiles, amphibians, as well as fresh, brackish, and saltwater fish.

The Upper Barataria FS investigated alternatives that include structural and nonstructural measures to address flood risk from tidal surges, coastal storm surges, and heavy rainfall in the area between Bayou Lafourche and the Mississippi River System, from Donaldsonville to just past U.S. Highway 90 in the basin. Structural measures to regulate Upper Barataria Basin stages and storage to help reduce structure damage consist of a combination of levees and floodwalls, conveyance channels, flood gates, tidal exchange structures, T-walls, and pumping stations. Nonstructural measures to address flood damages include structure elevations, buy-outs and relocations, dry/wet flood-proofing, or localized levees/floodwalls.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Upper Barataria, Louisiana, Integrated Feasibility Study (hereinafter: Upper Barataria FS IEPR) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE), Engineer Circular (EC) *Review Policy for Civil Works* (EC 1165-2-217) (USACE, 2018) and the Office of Management and Budget (OMB), *Final Information Quality Bulletin for Peer Review* (OMB, 2004). 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).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Upper Barataria FS/IEIS review documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted, including the schedule followed in executing the IEPR. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE in the final Work Plan according to the schedule listed in Table A-1.

Appendix D presents the organizational COI form that Battelle completed and submitted to the Institute for Water Resources (IWR) prior to the award of the Upper Barataria FS IEPR.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review, as described in USACE (2018).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the engineering, economic, environmental, and plan formulation analyses of the project study. In particular, the IEPR addresses the technical soundness of a 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 Upper Barataria FS was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-217). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. The IEPR was completed in accordance with established due dates for milestones and deliverables as part of the final Work Plan; the due dates are based on the award/effective date and the receipt of review documents.

Battelle identified, screened, and selected four panel members to participate in the IEPR based on their expertise in the following disciplines: plan formulation/economics, environmental law compliance, hydrology and hydraulic (H&H) engineering, and civil/geotechnical engineering. The Panel reviewed the Upper Barataria FS documents and produced seven Final Panel Comments in response to 16 charge questions provided by USACE for the review. This charge also included two overview questions and one public comment question added by Battelle, for a total of 19 questions. Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)
3. Significance (high, medium/high, medium, medium/low, or low; in accordance with specific criteria for determining level of significance)
4. Recommendation(s) for Resolution (at least one implementable action that could be taken to address the Final Panel Comment).

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-217), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

This section presents the results of the IEPR. A summary of the Panel's findings and the full text of the Final Panel Comments are provided.

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2018) in the Upper Barataria Draft Feasibility Study/Integrated Environmental Impact Statement (FS/IEIS). The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the report is well-written and concise, and the document presented the material in a comprehensive and logical approach. However, the Panel identified several elements of the project where additional analysis is needed and where project findings and objectives need to be documented or clarified.

Engineering: From a geotechnical and civil engineering perspective, the data provided and the methods of analyses presented were considered adequate and acceptable for this level of study. While the H&H modeling tools and input data were found to be generally adequate and acceptable, the panel members noted concerns regarding the residual risk and potential effects of compound flooding that were not assessed, particularly as it relates to storm surge, sea-level rise (SLR), inland rainfall, and system-level interactions. They believe the risks and effects have been underestimated because the models used are not integrated to address the combined effects of storm surge and inland rainfall/flooding. The Panel also noted other H&H modeling methods and assumptions that they believe need additional documentation.

The Panel also found that the assumption that levees would be "completely resilient" to overtopping due to armoring is not well-supported and requires further evaluation and sensitivity analysis. The panel members believe that uncertainty in the validity of this assumption has a strong probability of influencing the ability to implement the Tentatively Selected Plan (TSP) and maintain the levees in a manner that will be "completely resilient" to the significant overtopping that is anticipated with a 2% annual exceedance probability (50-year) levee height.

Environmental: To achieve the stated purpose of this project—to reduce the risk of flood damage—concerted efforts must be made during project implementation to avoid or mitigate adverse impacts to the environment. The Panel is concerned that the placement of a levee across a wetland will alter hydrology, and subsequently the environment, on both sides of the levee. The effects of the project on the hydroperiod and persistence of ecosystems waterward and landward of the proposed levee have not been evaluated and documented. Statements within the review documents imply that the proposed TSP would impact the Upper Barataria Basin hydrology and environment, but the documents do not provide a solution to avoid, account for, or mitigate the impacts.

Economics/Plan Formulation: Although the Planning Objectives specifically call out "Reduce the risk to human life, health, and safety by reducing flood impacts to structures, evacuation routes, and critical infrastructure" (Draft FS/IEIS, p. 15), the Panel noted that the review documents do not include any evaluation of the differential effects on life safety or critical infrastructure for project alternatives in either the initial screening or the final selection of alternatives.

The Panel also found that the limited documentation provided on the initial screening process does not support the assessment that all reasonable alternatives were considered. In addition, with no quantitative estimates of local socioeconomic impacts, the assumption that socioeconomic impacts would be negligible, minor, and temporary, or generally attributed to SLR or overall growth and development, is not supported.

4.2 Final Panel Comments

This section presents the full text of the Final Panel Comments prepared by the IEPR panel members.

Final Panel Comment 1

The residual risk and potential effects due to compound flooding appear to be underestimated.

Basis for Comment

Flooding in the Upper Barataria Basin may be generated by rainfall, coastal storm surge / tides, riverine inputs, or some interacting combination of these mechanisms. H&H modeling of rainfall-generated flooding was performed using the Hydrologic Engineering Center-River Analysis System (HEC-RAS) program, and coastal storm surge / tidal flooding was performed using the ADvanced CIRCulation Model (ADCIRC). There is a joint probability that heavy inland rainfall, storm surge / tidal flooding, and riverine flooding may occur simultaneously and compound the severity of flooding impacts. Although these are generally the appropriate models for these analyses, the two models are not integrated in a way that accounts for the combined effects of storm surge and inland rainfall/flooding. Instead, USACE used the higher of the two estimates of flood elevations. This approach considers both types of flooding events, but it does not account for potential compound flooding impacts, especially given the degree of storm surge overtopping experienced by levees under the TSP during extreme events.

Engineer Regulation (ER) 1100-2-8162 (USACE, 2013) states that studies should examine the sensitivity of alternative plans to rates of future SLR, evaluate how this sensitivity affects calculated risk, and determine what design or operations and maintenance (O&M) measures should be implemented to adapt to SLR. Although the H&H analysis used ADCIRC modeling with intermediate SLR to set HEC-RAS boundary conditions, the study does not appear to satisfy ER 1100-2-8162 in terms of conducting a meaningful sensitivity analysis. The study assumes that changes in SLR will affect the alternatives equally, despite the fact that design levels differ among alternatives (e.g., levees designed for 50-year versus 75-year versus 100-year storm surge levels). This assumption does not appear consistent with USACE ER 1100-2-8162, which calls for alternative plans to be formulated and evaluated for three futures of possible sea level change.

The study area as currently delineated could mask potential system-level interactions among flooding mechanisms. Riverine flooding in the study area is acknowledged in the Draft FS/IEIS (p. 19), but potential riverine inputs of floodwaters were not modeled. Similarly, nature-based solutions seaward of the study area, especially those that could help sustain coastal wetlands under SLR, have the potential to reduce coastal flooding threats but were deemed outside the study area and were not considered.

Significance – Medium/High

If the potential combined effects of storm surge, SLR, inland rainfall, and system-level interactions among flood processes are not fully accounted for, storm damage risk could be underestimated, resulting in a strong probability of affecting the technical basis for plan selection.

Recommendations for Resolution

1. Acknowledge in the project documents that compound flooding may occur and that compound flooding is not accounted for in the Draft FS/IEIS.
2. Document and explain in the Draft FS/IEIS the topics and assumptions listed in the Basis for Comment, including SLR influence on ADCIRC boundary conditions, invariant effects of SLR on all plans, an approach to modeling that does not include riverine inputs, and the decision

Final Panel Comment 1

not to integrate inland rainfall with storm surge / tidal flooding analyses in a manner that accounts for the potential interaction and combined effects of these flooding processes.

3. Per ER 1100-2-8162, examine the sensitivity of alternative plans (for example, 50-year versus 100-year levee heights) to rates of future SLR, evaluate how this sensitivity affects calculated risk, and determine what design or O&M measures should be implemented to adapt to SLR in the present study, or commit to performing these steps in the Pre-construction Engineering and Design (PED) phase.
4. Provide a more complete description of the system-level context of the study area with respect to potential riverine inputs during combined river flood / storm surge events, and the effects of wetlands in the basin below the study area on storm surge at the boundary of the study area.

Literature Cited

USACE (2013). Incorporating Sea Level Change in Civil Works Programs. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Regulation (ER) No. 1100-2-8162. December 31.

Final Panel Comment 2

The assumption that levees will be "completely resilient" to overtopping due to armoring is not well-supported and requires further evaluation and sensitivity analysis.

Basis for Comment

The levee plans evaluated in this study are predicted to experience substantial overtopping by the 1% to 0.2% annual exceedance storm surge events (100- to 500-year recurrence intervals) under intermediate SLR. A previous study of flooding in the Upper Barataria Basin, the Donaldsonville to the Gulf of Mexico Feasibility Study (USACE, 2012), served as an advance starting point for alternatives evaluation in the current Draft FS/IEIS; in the Donaldsonville study, none of the levee plans evaluated were found to have net positive benefits (Draft FS/IEIS, p. 48). This result was, in part, due to a key assumption in the Donaldsonville study that unarmored levees would stop providing benefits once they were overtopped. In the current Draft FS/IEIS, armoring has been added to the landward side of the levee plans, and it is assumed that no breaching of levees would occur despite overtopping stillwater depths up to 4.4 feet for the 1% to 0.2% annual exceedance storm surges under intermediate SLR (Appendix G, pp. 33-37). Complete resilience under overtopping this severe is unlikely and requires further substantiation. Estimates of benefits derived from the armored levee plans, including the TSP, are probably very sensitive to the assumption that the levees would be completely resilient through the 100- to 500-year events, despite severe overtopping.

Significance – Medium/High

Achieving net positive benefits under the TSP and other levee plans appears to depend on the questionable assumption of complete levee resilience over the entire length of the project under severe overtopping during extreme events. Uncertainty in the validity of this assumption has a strong probability of influencing the ability to implement the TSP.

Recommendations for Resolution

1. Provide in the study documents a physically based rationale and further substantiation of the assumption that levees will be completely resilient to the degree of overtopping expected for the future 100- to 500-year storm surge under SLR.
2. Examine and document the sensitivity of the benefit-cost ratio (BCR) under the TSP to the complete resilience assumption.
3. Explain in the documentation how levee maintenance programs will ensure that the complete resilience assumption is valid over the life of the project.

Literature Cited

USACE (2012). Donaldsonville, Louisiana, to the Gulf of Mexico, Flood Control — Mississippi River and Tributaries Project Feasibility Scoping Report and Supporting Documentation. U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District. June 2012.

Final Panel Comment 3

The effects of the project on the hydroperiod and persistence of ecosystems waterward and landward of the proposed levee have not been evaluated and documented.

Basis for Comment

To achieve the stated purpose of this project—to reduce the risk of flood damage—concerted efforts must be made during project implementation to avoid or mitigate adverse impacts to the environment. The levee proposed under the TSP would act as a partial barrier to the flow of water in the project area. It can be assumed that a levee constructed across the wetland area will increase water retention landward of the levee during periods of rain, thus altering the hydrology and ecosystems. This may be the case even when openings in the levees are sized to mimic existing drainage conveyances, because the levee would prevent sheet flow and overbank flow across the wetland, especially in wetland areas that are relatively far from the conveyance structures. Similarly, wetlands waterward of the levee may be deprived of water that accumulated landward of the levee, thus impacting the hydrology and ecosystems.

Section 3.1, Historic and Existing Conditions (Affected Environment), describes the affected environment of the study area. The information in Section 3.1, supplemented with information in Appendix C (Environmental Information) and Appendix F (Agency Coordination), lacks baseline data regarding the hydrology and functioning of ecosystems in their current state. Baseline conditions should be defined so that USACE can assess whether (and how) the wetlands, wildlife, aquatic life, and essential fish habitat (EFH) landward and waterward of the levee would be affected by implementing the project alternatives. The Panel understands that some of the data and studies needed have not yet been completed.

The Draft FS/IEIS implies that the levee proposed under the TSP may adversely impact habitats within the study area:

- While floodgates are proposed for the levee, USACE recognizes that issues with hydroperiod may arise if the levee were constructed. Appendix C, Section 2.2 (p. 2-14) recognizes that changes to the vegetation may occur as a result of constructing the levee and floodgates. Further, extended periods of inundation can suppress seedling recruitment and transition vegetated areas to open-water areas from tree loss, which could ultimately affect wildlife, including migratory birds.
- The Draft FS/IEIS (p. 79) states, “Rainfall events and high tides could still cause significant flooding of the swamps within the levee-enclosed area.”
- Appendix C (p. 2-12) describes “…the potential to reduce water exchange and increase the hydroperiod of the Upper Barataria Basin.” As a result, “…growth rates of trees in those areas could be further reduced and tree mortality increased…”
- Appendix C (p. 2-14) states, “The construction of levees and borrow canals can result in temporary and/or permanent impacts to migratory birds and the habitats upon which they depend for various life requisites.”

The eastern black rail is one example of how wildlife can be adversely affected by flooding marshes. As described in Appendix F, p. 1-3, the habitat for this bird is high brackish marsh. If this type of marsh

Final Panel Comment 3

were inundated as a result of increased water levels, habitat for this at-risk species could be lost. Without baseline data and a monitoring program, detecting this impact would not be possible.

Vegetation and wildlife are impacted by changes in hydroperiod. Gergel (2002) examined the cumulative impacts of levees and dams on temporary ponds and wetlands that form throughout floodplains after flood events. Gergel found that, depending on flood magnitude, "…the combined effects of levees and dams were either additive, synergistic, or antagonistic" (p. 1750). Because we do not know how the levee would impact hydroperiod, we do not know how it may or may not impact vegetation and wildlife.

Lantz et al. (2010) examined the effects of water depth and submerged aquatic vegetation on the selection of foraging habitat and foraging success of wading birds, observing that changes to the hydroperiod would be expected to impact the ecosystems both landward and waterward of the levee.

With no clear picture of whether the hydrology and ecosystems would be impacted by the levee, the current mitigation plan, Appendix E, may need to be modified. An adaptive management approach would allow for data collected from a monitoring plan to be used to determine if additional compensatory mitigation may be necessary if the net loss of wetland functions has been underestimated by assuming, without modeling or other empirical evidence, that the levee would not negatively affect the hydrologic regime.

The lack of baseline data results in the inability to conduct hydrologic and ecological modeling. To confirm the USACE's assertion that the levee would not impact the hydroperiod landward or waterward of the levee, modeling is necessary. Without baseline data and modeling, the Panel cannot determine whether the levee would have adverse environmental impacts. This uncertainty could also affect the cost of the project.

A January 13, 2020, comment letter from the National Marine Fisheries Service reflects these issues.

Significance – Medium

The Upper Barataria Draft FS/IEIS documents imply that the proposed TSP would impact the Upper Baratraria Basin hydrology, and subsequently the ecosystems, but do not provide a solution to avoid, account for, or mitigate the impacts.

Recommendations for Resolution

1. Use the existing hydrologic data to model hydroperiod changes resulting from construction of the levee.
2. Create a pre-construction baseline of the current vegetation, water quality, EFH, wildlife, etc., to be able to measure impacts to the ecosystems landward and waterward of the levee.
3. Develop a monitoring plan to assess changes to marsh and/or upland habitat that would result from an altered hydroperiod.
4. Develop an adaptive management plan that provides opportunity to respond to real-time habitat change caused by the flood management structures.

Final Panel Comment 3

5. Modify the mitigation plan to include the impacts landward and waterward of the levee.

Literature Cited

Gergel, S.E. (2002). Assessing cumulative impacts of levee and dams on floodplains ponds: A neutral-terrain model approach. Ecological Applications 12(6). 1740-1754.

Lantz, S.M., D.E. Gawlik, & M.I. Cook (2010). The Effects of Water Depth and Submerged Aquatic Vegetation on the Selection of Foraging Habitat and Foraging Success of Wading Birds. The Condor 112(3). 460-469.

Final Panel Comment 4

The Draft FS/IEIS documents do not evaluate the differential effects on life safety or critical infrastructure for project alternatives in either the initial screening or the final selection of alternatives.

Basis for Comment

Section 2.3, Planning Objectives, states that one of the primary planning objectives is to "Reduce the risk to human life, health, and safety by reducing flood impacts to structures, evacuation routes, and critical infrastructure" (Draft FS/IEIS, p. 15). However, the Draft FS/IEIS does not provide any quantitative evaluation of the life safety risks associated with either the initial screening alternatives or the final alternatives. Also omitted from the Draft FS/IEIS is a discussion of the effects of the alternatives on evacuation routes or critical infrastructure.

Section 4 of the Draft FS/IEIS, Formulate Alternative Plans**,** includes the statement: "A quantitative assessment of life safety will be conducted using accepted USACE methods and tools" (p. 48). This quantitative assessment is not presented in the Draft FS/IEIS.

The Draft FS/IEIS also states that "The B/C ratio for the elevations of 7.5 thru 12 ft, shows that flexibility exist with the final design, to consider structural superiority resiliency and life safety concerns" (Section 4.7, p. 64). It is not clear whether this statement implies that life safety concerns will be addressed at a later project development stage.

If USACE implicitly assumes that reducing damage to structures will minimize life safety risks, this should be explicitly stated. Additionally, the differential impacts of the planning alternatives on critical infrastructure is omitted. Impacts to Highway 90 are of particular concern in terms of critical infrastructure.

Significance – Medium

Uncertainties surrounding the discussion of impacts to life safety and critical infrastructure under the alternatives evaluated raise doubt about the process for selecting and implementing the TSP.

Recommendations for Resolution

1. Develop and present in the Draft FS/IEIS additional information about life safety and critical infrastructure impacts under each project alternative. Contrast life safety and critical infrastructure impacts among alternatives.
2. Discuss critical infrastructure in the project area and compare differences in critical infrastructure among all alternatives.
3. If more detailed information on life safety risk is not available at the feasibility level of analysis, explain why the TSP would prevail over other alternatives at the design level, when more detailed information will be available.
4. Clarify the meaning of the statement on life safety concerns on p. 64 (quoted above) with regard to flexibility of the final design.

Final Panel Comment 5

The initial screening process does not clearly indicate that all reasonable alternatives were considered.

Basis for Comment

Both the cost and the benefit estimates in the initial screening of alternatives vary markedly from the final values. This is understandable, as further refinements of the estimates were developed for Alternatives 1 and 2 in the analysis of the final alternatives. However, it may be the case that alternatives which were eliminated after the initial screening stage might in fact have improved upon similar refinement of the estimates. In particular, Alternative 5, which was part of the initial screening, was dropped because it had an initial BCR of 0.99. Given the high uncertainty of cost and benefit estimates during the initial screening phase, the BCR for this alternative could have, upon further evaluation, risen above 1.0.

In addition, the discussion of the screening process (Section 4.1 of the Draft FS/IEIS) states that the initial screening alternatives were repackaged from the 2012 Donaldsonville to the Gulf of Mexico Feasibility Study and that no new individual measures and screening processes were undertaken by the USACE. It is not clear that this approach exhausts all reasonable alternatives.

Finally, the Draft FS/IEIS contains the following statement: “It was determined by the USACE that no natural or nature-based solutions be developed because the area is already populated by natural based features to prevent storm damages” (p. 48). The basis for USACE’s conclusion—that the existing natural-based features exhaust all reasonable nature-based features—is not clear, especially considering that future SLR and expected increases in storm frequency and storm surges might make nature-based features more resilient and more cost-effective than the structural measures considered in the Draft FS/IEIS.

Significance –Medium/Low

The limited explanation of the selection of the range of screening alternatives affects the clarity and completeness of the study documents. It is not clear whether the absence of explicit rationale for determining the range of screening alternative could have affected the selection of the TSP.

Recommendations for Resolution

1. Provide further justification for eliminating Screening Alternative 5, despite the fact that its BCR is only slightly below the cutoff value.
2. Provide further justification for relying on the 2012 Donaldsonville to the Gulf of Mexico Feasibility Study to provide an exhaustive array of alternatives for the initial screening process.
3. Re-evaluate whether additional natural-based features might augment or supplant the structural alternatives evaluated in the Draft FS/IEIS.

Final Panel Comment 6

There are no quantitative estimates of local socioeconomic impacts under the TSP or the alternatives.

Basis for Comment

Appendix B (Economics) of the Draft FS/IEIS indicates a projected increase in households in the project area of 23% between 2017 and 2045 (see Table 3). Study area population is projected to grow 22% during the same period (ibid., Table 2). Yet the following statement appears in Appendix B in the context of the HEC Flood Damage Reduction Analysis (HEC-FDA): "The increase in damages from 2023 to 2073 are due to sea-level rise. No future development was included in this analysis" (p. 17). Given the projected growth in the project area, it is not clear why future development was not factored into the HEC-FDA analysis. Further, if projected growth were included in the HEC-FDA analysis, it is not clear how the BCR would be affected.

The Draft FS/IEIS (p. 72) states in connection with Alternatives 1 and 2 that "There will be negligible direct impacts to socio-economic resources. There will be minor temporary indirect impacts during construction." No data are provided in the project review documents to support this conclusion.

Appendix B of the Draft FS/IEIS states "…the overall growth rate is anticipated to be the same with or without the project in place. Thus, the project will not induce development, but would rather reduce the risk of the population being displaced after a major storm event" (p. 5). No supporting data or explanation is provided to support the conclusion that no growth-inducing impacts would occur due to project implementation.

Significance – Medium/Low

Without quantitative estimates, the conclusions that socioeconomic impacts under the TSP would be negligible, minor and temporary, or generally attributed to SLR or overall growth and development cannot be fully supported.

Recommendations for Resolution

1. Explain why projected project area growth was not included in the HEC-FDA analysis or, alternatively, revise the analysis to include growth.
2. Substantiate the Draft FS/IEIS assertion of negligible impacts to socioeconomic resources.
3. Support the assertion that there would be no growth-inducing impacts as a result of the project and given that the risk of displacement after a major storm event would be reduced.

Final Panel Comment 7

The H&H modeling methods and assumptions are not clearly documented.

Basis for Comment

Several aspects of the H&H modeling methods and assumptions are not sufficiently documented at a minimum level of detail that is appropriate for SMART Planning. Therefore, the appropriateness of the H&H models cannot be determined from the information provided. Specifically, the Draft FS/IEIS (main report) and Appendices A and G do not sufficiently document and explain ADCIRC and HEC-RAS modeling assumptions, including:

1. Levees included in the various plans (including the TSP) appear to essentially function as weirs in the HEC-RAS model when overtopped by storm surge.
2. Floodwaters from storm surge that overtop the levees are spread out across the upper basin at depths shallower than flow depths over the levees as determined by topography.
3. Certain antecedent rainfall conditions affecting available storage and flooding depths are assumed.

The results produced by these models for a particular plan and design storm can be quite variable and sensitive to these assumptions.

Significance – Medium/Low

The Panel does not currently have sufficient information to assess the soundness of the H&H methods and assumptions and determine whether the H&H analyses provide reasonably accurate estimates of future without-project versus future with-project conditions and risks. Without this information, the technical basis for selection of the TSP cannot be determined.

Recommendations for Resolution

1. Document and succinctly explain in the Draft FS/IEIS each of the topics and assumptions listed above, including the rationale for not accounting for the potential interaction and combined effects of different flooding mechanisms.
2. Provide a more complete discussion of the potential implications of these critical assumptions with respect to residual risk and life safety in Section 6.2.7, Risk & Uncertainty Analysis.

5. REFERENCES

Gergel, S.E. (2002). Assessing cumulative impacts of levee and dams on floodplains ponds: A neutral-terrain model approach. Ecological Applications 12(6). 1740-1754.

Lantz, S.M., Gawlik, D.E., & Cook, M.I. (2010). The Effects of Water Depth and Submerged Aquatic Vegetation on the Selection of Foraging Habitat and Foraging Success of Wading Birds. The Condor 112(3). 460-469.

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The National Academies (2003). Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports. The National Academies (National Academy of Science, National Academy of Engineering, Institute of Medicine, National Research Council). May 12.

USACE (2018). Water Resources Policies and Authorities: Review Policy for Civil Works. Engineer Circular (EC) 1165-2-217. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. February 20.

USACE (2013). Incorporating Sea Level Change in Civil Works Programs. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Regulation (ER) No. 1100-2-8162. December 31.

USACE (2012). Donaldsonville, Louisiana, to the Gulf of Mexico, Flood Control — Mississippi River and Tributaries Project Feasibility Scoping Report and Supporting Documentation. U.S. Army Corps of Engineers, Mississippi Valley Division, New Orleans District. June 2012.

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APPENDIX A

IEPR Process for the Upper Barataria FS Project

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A.1 Planning and Conduct of the Independent External Peer Review (IEPR)

Table A-1 presents the major milestones and deliverables of the Upper Barataria, Louisiana, Integrated Feasibility Study (hereinafter: Upper Barataria FS IEPR). Due dates for milestones and deliverables are based on the award/effective date listed in Table A-1. The review documents were provided by U.S. Army Corps of Engineers (USACE) on December 3, 2019. Note that the actions listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on April 20, 2020. The actual date for contract end will depend on the date that all activities for this IEPR are conducted and subsequently completed.

Table A-1. Major Milestones and Deliverables of the Upper Barataria FS IEPR

Task	Action	Due Date
1	Award/Effective Date	9/13/2019
	Review documents available	12/3/2019
	Public comments available	1/21/2020
	Battelle submits draft Work Plan[a]	9/18/2019
	USACE provides comments on draft Work Plan	10/1/2019
	Battelle submits final Work Plan[a]	10/2/2019
2	Battelle submits list of selected panel members[a]	10/2/2019
	USACE confirms the panel members have no COI	10/15/2019
3	Battelle convenes kick-off meeting with USACE	10/8/2019
	Battelle convenes kick-off meeting with panel members	12/3/2019
	Battelle convenes kick-off meeting with USACE and panel members	12/4/2019
4	Panel members complete their individual reviews	1/3/2020
	Panel members provide draft Final Panel Comments to Battelle	1/6/2020
	Battelle sends public comments to panel members for review	1/21/2020
	Panel confirms no additional Final Panel Comment is necessary with regard to the public comments	1/27/2020
	Panel finalizes Final Panel Comments	1/24/2020
5	Battelle submits Final IEPR Report to USACE[a]	2/14/2020
6[b]	Battelle convenes Comment Response Teleconference with panel members and USACE	4/3/2020
	Battelle submits pdf printout of DrChecks project file[a]	4/20/2020
	Agency Decision Milestone (ADM) meeting[c]	3/5/2020
	Contract End/Delivery Date	9/30/2020

[a] *Deliverable.*
[b] *Task 6 occurs after the submission of this report.*
[c] *The ADM meeting was listed in the Performance Work Statement under Task 3 but was relocated in this schedule to reflect the chronological order of activities.*

At the beginning of the Period of Performance for the Upper Barataria FS IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., terminology to use, access to DrChecks, etc.). Any revisions to the schedule were submitted as part of the final Work Plan. The final charge consisted of 16 charge questions provided by USACE, two overview questions and one public comment question added by Battelle (all questions were included in the draft and final Work Plans), and general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and after their subcontracts were finalized, all the 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 USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge, as well as the review documents and reference/supplemental materials listed in Table A-2.

Table A-2. Documents to Be Reviewed and Provided as Reference/Supplemental Information

Review Documents	No. of Review Pages
Draft Feasibility Study with Integrated Environmental Impact Statement	106
Appendix A Engineering	104
Appendix B Economics	33
Appendix C Environ Setting	25
Appendix D Real Estate	16
Appendix E General Mitigation Plan	31
Appendix F Agency Coord	5
Appendix G Hydrology	40
Total Number of Review Pages	**360**
Public Comments	35

In addition to the materials provided in Table A-2, the panel members were provided the following USACE guidance documents.

- Review Policy for Civil Works (EC 1165-2-217, February 20, 2018)
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review (December 16, 2004)
- Foundations of SMART Planning
- Feasibility Study Milestones (PB 2018-01, September 30, 2018 and PB 2018-01(S), June 20, 2019)
- SMART – Planning Overview

- Planning Modernization Fact Sheet
- USACE Climate Change Adaptation Plan (2015)
- Procedures to Evaluate SLR Change Impacts Responses Adaptation (ETL 1100-2-1 – June 30, 2014)
- Incorporating SLR Change in CW Programs (ER 1100-2-8162 – December 31, 2013).

About halfway through the review, a teleconference was held with USACE, Battelle, and the Panel so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 29 panel member questions to USACE. USACE was able to provide responses to all the questions during the teleconference or was able to provide written responses to all the questions prior to the end of the review.

In addition, throughout the review period, USACE provided documents at the request of panel members. These documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review. A list of these additional documents requested by the Panel is provided below.

- Annex 1_Upper Baratraria Basin-REVISED Final Screening Phase Quantities for Engineering Appendix.pdf
- Annex 2_Upper Baratraria Basin-REVISED Geotechnical Drawings for Engineering Appendix.pdf
- Annex 3_Upper Baratraria Basin -Relocations Maps for Existing Utilities for Engineering Appendix.pdf
- Annex 4_Upper Baratraria Basin–CRPA Coastal Master Plan Attachment C3-251-Storm Surge-Final.pdf
- Annex 5_Upper Baratraria Basin-CRPA-Appendix D-24 CRPA STORM SURGE-WAVE MODEL (ADCIRC) TECHREPORT.pdf
- Annex 7_Upper Baratraria Basin-Levee Design Elevation Output Plots of Exterior Overtopping Analysis.pdf
- Annex 8_Upper Baratraria Basin-Relative Sea Level and Climate Change.pdf.

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response form provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. At the end of the review, Battelle summarized the individual comments into a preliminary list of overall comments and discussion points. Each panel member's individual comments were shared with the full Panel.

A.3 IEPR Panel Teleconference

Battelle facilitated a 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 should 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 significant importance to the findings, and merged any related individual comments. At the conclusion of the teleconference, Battelle reviewed each Final Panel Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

A.4 Preparation of Final Panel Comments

Following the teleconference, Battelle distributed 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 Upper Barataria FS 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 a summary email 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 members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final 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/high, medium, medium/low, and 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:** There is a fundamental issue within study documents or data that will influence the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.
    2. **Medium/High:** There is a fundamental issue within study documents or data that has a strong probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.

3. **Medium:** There is a fundamental issue within study documents or data that has a low probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.

4. **Medium/Low:** There is missing, incomplete, or inconsistent technical or scientific information that affects the clarity, understanding, or completeness of the study documents, and there is uncertainty whether the missing information will affect the selection of, justification of, or ability to implement the recommended plan.

5. **Low:** There is a minor technical or scientific discrepancy or inconsistency that affects the clarity, understanding, or completeness of the study documents but does not influence the selection of, justification of, or ability to implement the recommended plan.

- Guidelines for Developing Recommendations: The recommendation section was to include specific actions that USACE should consider to resolve the Final Panel Comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

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, seven Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The full text of the Final Panel Comments is presented in Section 4.2 of the main report.

A.5 Conduct of the Public Comment Review

Following the schedule in Table A-1, Battelle received a PDF file containing 35 pages of public comments on the Draft FS/IEIS from USACE. Battelle then sent the public comments to the panel members in addition to the following charge question:

1. **Do the public comments raise any additional discipline-specific technical concerns with regard to the overall report?**

The Panel produced individual comments in response to the charge question. Each panel member's individual comments for the public comment review were shared with the full Panel. Battelle reviewed the comments to identify any new technical concerns that had not been previously identified during the initial IEPR. Upon review, Battelle determined and the Panel confirmed that no new issues or concerns were identified other than those already covered in the Final Panel Comments.

A.6 Final IEPR Report

After concluding the review and preparation of the Final Panel Comments, Battelle prepared a final IEPR report (this document) on the overall IEPR process and the IEPR panel members' findings. Each panel member and Battelle technical and editorial reviewers reviewed the IEPR report prior to submission to USACE for acceptance.

A.7 Comment Response Process

As part of Task 6, Battelle will enter the seven Final Panel Comments developed by the Panel into USACE's DrChecks, a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle. Battelle will provide USACE and the Panel a pdf printout of all DrChecks entries, through comment closeout, as a final deliverable and record of the IEPR results.

APPENDIX B

Identification and Selection of IEPR Panel Members for the Upper Barataria FS Project

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B.1 Panel Identification

The candidates for the Independent External Peer Review of the Upper Barataria, Louisiana, Integrated Feasibility Study (hereinafter: Upper Barataria FS IEPR) Panel were evaluated based on their technical expertise in the following key areas: planning formulation/economics, environmental law compliance, hydrology and hydraulic engineering, and civil/geotechnical engineering. These areas correspond to the technical content of the review documents and overall scope of the Upper Barataria FS project.

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 conflicts of interest (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.

Candidates were screened for the following potential exclusion criteria or COIs. These COI questions were intended to serve as a means of disclosure in order to better characterize a candidate's employment history and background. Battelle evaluated whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. Guidance in OMB (2004, p. 18) states,

> "…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."

The term "firm" in a screening question referred to any joint venture in which a firm was involved. It applied to any firm that serves in a joint venture, either as a prime or as a subcontractor to a prime. Candidates were asked to clarify the relationship in the screening questions.

Panel Conflict of Interest (COI) Screening Statements for the IEPR of the Upper Barataria, Louisiana, Integrated Feasibility Study
1. Previous and/or current involvement by you or your firm in the Upper Barataria, Louisiana, Integrated Feasibility Study) and related projects.
2. Previous and/or current involvement by you or your firm in flood risk in the Upper Barataria basin in southeastern Louisiana.
3. Previous and/or current involvement by you or your firm in the conceptual or actual design, construction, or operation and maintenance (O&M) of any projects in the Upper Barataria FS or related projects.

Panel Conflict of Interest (COI) Screening Statements for the IEPR of the Upper Barataria, Louisiana, Integrated Feasibility Study
4. Current employment by the U.S. Army Corps of Engineers (USACE).
5. Previous and/or current involvement with paid or unpaid expert testimony related to the Upper Barataria FS project
6. Previous and/or current employment or affiliation with the non-Federal sponsors or any of the following cooperating Federal, State, County, local and regional agencies, environmental organizations, and interested groups *(for pay or pro bono):* • Coastal Protection and Restoration Authority Board of Louisiana
7. Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Upper Barataria basin.
8. Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the New Orleans District.
9. Previous or current involvement with the development or testing of models that were used for, or in support of, the Upper Barataria FS project. Note that the following models have been used to develop information for this project: Hydrologic Engineering Center's (HEC) Flood Damage Reduction Analysis (FDA), HEC Flood Impact Analysis (FIA), Institute for Water Resources (IWR) Plan, Wetland Value Assessment (WVA), AdCIRC, HEC River Analysis System (RAS)
10. Current firm involvement with other USACE projects, specifically those projects/contracts that are with the New Orleans 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 New Orleans District. Please explain.
11. Any previous employment by USACE as a direct employee, notably if employment was with the New Orleans District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
12. Any previous employment by USACE as a contractor (either as an individual or through your firm) within the last 10 years, notably if those projects/contracts are with the New Orleans District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
13. 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).
14. Pending, current, or future financial interests in contracts/awards from USACE related to the Upper Barataria FS project.

Panel Conflict of Interest (COI) Screening Statements for the IEPR of the Upper Barataria, Louisiana, Integrated Feasibility Study
15. Significant portion of your personal or office's revenues within the last three years came from USACE contracts.
16. Significant portion of your personal or office's revenues within the last three years came from Coastal Protection and Restoration Authority Board of Louisiana contracts.
17. . Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Upper Barataria FS project.
18. Participation in relevant prior and/or current Federal studies related to the Upper Barataria FS project.
19. Previous and/or current participation in prior non-Federal studies related to the Upper Barataria FS project.
20. Has your research or analysis been evaluated as part of the Upper Barataria FS project?
21. Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

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.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Table B-1 provides information on each panel member's affiliation, location, education, and overall years of experience. 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. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

Table B-1. Upper Barataria FS IEPR Panel: Summary of Panel Members

Name	Affiliation	Location	Education	P.E.	Exp. (yrs)
Planning Formulator / Economist					
Marvin Feldman	Resource Decisions	San Francisco, CA	Ph.D., Natural Resource Economics	No	39
Environmental Law Compliance Specialist					
Kris Thoemke	Independent consultant	Naples, FL	Ph.D., Biology	No	40
H&H Engineer					
Brian Bledsoe	University of Georgia	Athens, GA	Ph.D., Civil Engineering – River Mechanics	Yes	30
Civil/Geotechnical Engineer					
Robert Fleming Jr.	Independent consultant	Vicksburg, MS	M.S., Geotechnical Engineering	Yes	53

Table B-2 presents an overview of the credentials of the final four members of the Panel and their qualifications in relation to the technical evaluation criteria. More detailed biographical information on the panel members and their areas of technical expertise is given in Section B.3.

Table B-2. Upper Barataria FS IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Feldman	Thoemke	Bledsoe	Fleming
Plan Formulator / Economist				
Minimum of 15 years of demonstrated experience in economics and planning from academia, a public agency, a non-governmental entity, or an architect-engineer or consulting firm	X			
Minimum Master's Degree or higher in economics	X			
Minimum of five years of experience directly dealing with the U.S. Army Corps of Engineers (USACE) six-step planning process governed by Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook	X			
Experience related to economic evaluation of traditional National Economic Development (NED) plans and trade-off analysis and with Civil Works coastal storm risk management projects	X			
Thorough understanding of the use of models similar to the Hydrologic Engineering Center Flood Damage Reduction Analysis (HEC-FDA)	X			

Table B-2. Upper Barataria FS IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Feldman	Thoemke	Bledsoe	Fleming
Environmental Law Compliance Specialist				
Scientist from academia, a public agency, a non-governmental entity, or an architectural-engineering or consulting firm		X		
Minimum of 15 years of experience directly related to water resources environmental evaluation or review and the National Environmental Policy Act (NEPA) process and analysis		X		
Biological or environmental background that is familiar with the project area and environmental impact analysis and mitigation		X		
Familiar with the National Historic Preservation Act (NHPA), applicable rules and regulations governing hazardous, toxic, and radioactive waste, and all other areas of environmental compliance required for this study		X		
Knowledge of fisheries biology, Coastal Storm Risk Management (CSRM) projects, and experience in wetland ecology of the Gulf Coast		X		
Hydrology and Hydraulic (H&H) Engineer				
Registered professional engineer from academia, a public agency (whose mission is flood risk management), or an architectural-engineering or consulting firm			X	
Minimum of 15 years of experience in H&H engineering with emphasis on large public works projects and CSRM features, designs, and structures			X	
Familiar with standard USACE H&H computer models and experience with both computer simulation and physical modeling of large river systems			X	
Civil/Geotechnical Engineer				
Senior-level geotechnical engineer with a minimum of 15 years of experience in the field				X
Experience in geotechnical design in coastal settings and existing soil conditions as they align with USACE standards				X
Experience performing cost engineering/construction management for all phases of CSRM or related projects and familiarity with construction industry and practices used in CSRM and standard hurricane structure design				X

B.3 Panel Member Qualifications

Detailed biographical information on each panel member's credentials and qualifications and areas of technical expertise are summarized in the following paragraphs.

Name	**Marvin Feldman, Ph.D.**
Role	**Planning Formulator/Economist**
Affiliation	**Resource Decisions**

Dr. Feldman, an independent consultant and principal economist at Resource Decisions, has more than 39 years of experience in water resource and environmental economics. He earned his M.S. in water resource management in 1969 and a Ph.D. in natural resource economics in 1979 from the University of Wisconsin.

Dr. Feldman is experienced in the evaluation and conduct of complex multi-objective public works projects with high public and interagency interests, including flood risk analysis. As a senior economist at Dames & Moore under contract to the U.S. Department of Energy, he worked on developing a multi-attributable site selection model for evaluating risks of alternative sites for the Preliminary Nevada High-level Nuclear Waste Siting Analysis. For the Smith Lake Improvement and Stakeholder Association (SLISA), Alabama, he provided economic evaluation of alternative costs and benefits of municipal and industrial, navigation, recreation, and hydroelectric water uses and non-power evaluations for recreation, property values flood control, navigation, and erosion control to support SLISA's negotiations with the Federal Energy Regulatory Commission and Alabama Power. For the Alaska Department of Natural Resources, he applied risk/cost/benefit analysis to environmental protection methods for petroleum exploration in the Beaufort Sea. As a member of IEPR teams (under contract to Battelle), he reviewed flood Civil Works planning and economic issues related to the Ala Wai Canal in Hawaii, Mamaroneck River in Connecticut, and Moose Creek in Alaska. Dr. Feldman is familiar with the USACE plan formulation process, procedures, and standards as they relate to flood risk management and has more than 10 years of demonstrable experience dealing directly with the USACE six-step planning process, governed by Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook. Most notably, he applied the six-step process to his work on the USACE/Bureau of Reclamation Central Arizona Water Control Study.

Dr. Feldman has experience related to the economic evaluation of traditional National Economic Development (NED) plans, including his participation in a University of Wisconsin test team that helped develop the original U.S. Water Resources Council Principles and Guidelines. In conjunction with the USACE/Bureau of Reclamation Central Arizona Water Control Study, he designed a multi-attribute utility analysis framework for selecting preferred alternatives. This framework included flood risk management and National Ecosystem Restoration (NER) attributes and structured the tradeoffs among hundreds of alternative plans with regard to these and other attributes. The framework allowed the specification of minimum and maximum acceptable attribute values. Identification of attributes and the importance of weighting these attributes was a key aspect of the public involvement program. By focusing the public involvement on NER and flood control, as well as other key attributes, the plan selection process was more cooperative and less competitive. While working as a consultant to the USACE Sacramento District, he developed and applied a methodology for the cost-effectiveness and incremental analysis of

alternative mitigation measures to enhance the habitat of the endangered winter-run salmon on the Sacramento River.

Dr. Feldman has a strong working knowledge of USACE economic benefit calculations. Throughout his career, he has conducted studies requiring economic benefit analysis for flood risk management. For example, he evaluated the state-of-the-art municipal and industrial water conservation benefit evaluation techniques for the California Urban Water Conservation Council (CUWCC) and identified promising methods for application by CUWCC member water agencies in evaluating their conservation options. His advanced expertise and extensive experience in flood damage analysis and risk and decision analysis is reflected in his work on such studies as the Smith Lake-Black Warrior River (Alabama) benefit-cost analysis of lake levels, the calculation of cost-benefit tradeoffs for the North Fork of the Feather River (Pacific Gas and Electric, California), and an economic analysis of agricultural diversion alternatives for the Glenn-Colusa Irrigation District (California).

Dr. Feldman is also familiar with methodologies for estimating damages, including the Hydrologic Engineering Center Flood Damage Reduction Analysis (HEC-FDA) software. His familiarity with HEC-FDA includes his knowledge of inputs, assumptions, calculations, and results attributed to the program. He has applied his knowledge of USACE flood risk management and damage calculations/analysis in his work as economist/planner on the USACE/Bureau of Reclamation Central Arizona Water Control Study. This study was a flood control and dam safety study involving the consideration of feasibility alternatives and the selection of preferred alternatives. Other studies requiring the assessment of risk and damage included the aforementioned Preliminary Nevada High-level Nuclear Waste Siting Analysis and the SLISA studies.

Dr. Feldman has participated on a previous USACE IEPR panel as an economics expert for the Institute for Water Resources Planning Suite Model II certification review.

Name	**Kris Thoemke, Ph.D., CEP**
Role	**Environmental Law Compliance Specialist**
Affiliation	**Independent Consultant**

Dr. Thoemke is an independent consultant with 40 years of experience as a professional ecologist. He received his Ph.D. in biology from the University of South Florida in 1979 and is a Certified Environmental Professional (CEP). He has been a researcher and land manager for the State of Florida, a private environmental consultant, an environmental and outdoor communicator, and an Everglades project manager for a nonprofit organization. Since 2012, he has been a part-time faculty member teaching graduate and undergraduate classes for the American Public University System's (APUS) Environmental Policy and Management and the National Environmental Policy Act (NEPA) Graduate Certificate Programs. His experience with wetlands and estuarine ecosystems derives from his Ph.D. work on estuarine invertebrates; 11 years as manager of Rookery Bay National Estuarine Research Reserve in Naples, Florida; four years as a wetlands ecologist conducting Everglades restoration work; and 14 years as a wetlands and estuarine consultant.

Dr. Thoemke's consulting work focuses on managing the Federal and state environmental permitting process, conducting seagrass and listed species surveys along the Atlantic and Gulf coasts in Florida, and preparing NEPA documents. He is familiar with large, complex Civil Works projects with high public

and interagency interests. His direct experience includes his work as a wetland scientist on the Florida Everglades restoration program, ongoing involvement as the environmental scientist for the Charlotte County Florida Erosion Control Project for Stump Pass, and participation on a team working on large Civil Works restoration projects for the State of Louisiana in the Mississippi Delta region.

Dr. Thoemke has studied construction impacts on the marine and terrestrial ecology of coastal regions and characterization of benthic communities, including assessing construction impacts on seagrass, mangrove, shorebird, and dune plant communities at Stump Pass, New Pass, and Blind Pass, Florida, and gopher tortoise habitat at Clam Pass and Vanderbilt Beach Parks, Florida. He has been characterizing benthic communities for more than 30 years. His Ph.D. research focused on the life history and population dynamics of estuarine benthic invertebrates. He has extensive experience permitting and mitigating for construction impacts resulting from coastal and upland development, including assessing and monitoring impacts on beach and dune systems, nesting sea turtles, shorebirds, and upland listed species found in the coastal and beach/dune habitats. In addition, he has conducted post-storm analysis of beach and dune systems.

Dr. Thoemke was the project manager on the Port Everglades Ocean Dredged Material Disposal Site Environmental Assessment, which included assessments of Marine Mammals Protection Act listed species. In addition, he has completed Section 7 assessments for listed species under National Marine Fisheries Service jurisdiction for projects in several south Florida locations, and coordinated with the U.S. Fish and Wildlife Service to prepare an updated Biological Opinion for swimming sea turtles and shorebirds on Marco Island, Florida. He has provided essential fish habitat (EFH) consultation to several projects and continues to prepare EFH studies for marine and estuarine species as a part of his permitting work.

Dr. Thoemke obtained his expertise with the NEPA by preparing environmental impact statements (EISs) and environmental assessments (EAs) related to marine and estuarine environments. He was a member of an integrated team of scientists and engineers that prepared the EIS for the Terrebonne Basin Barrier Island Shoreline Restoration Project, Louisiana, providing expertise on Endangered Species Act (ESA), EFH, and NEPA requirements. He was also the primary author of the 2019 West Grand Terre Beach Nourishment and Shoreline Stabilization Restoration Project Environmental Assessment and has reviewed EISs and EAs for other coastal restoration projects in the Mississippi Delta.

Dr. Thoemke's expertise includes serving on multiple IEPR panels, including the Central Everglades Planning Project Draft Project Implementation Report and EIS, the Fire Island Inlet to Montauk Point, New York General Reformulation Report and the Integrated Feasibility Report and EIS for the Bogue Banks, Carteret County, North Carolina.

Through his consulting work, teaching classes in NEPA for APUS and participation on IEPR panels, Dr. Thoemke has first-hand knowledge of the need to meet the requirements of various legislation passed by Congress, including the National Historic Preservation Act, Fish and Wildlife Coordination Act, Clean Air Act, Clean Water Act, and Endangered Species Act, and has knowledge of topics that may be of concern to one or more Federal agencies, such as hazardous, toxic, and radioactive waste; Executive Order (E.O.) 11988, Floodplain Management; the Migratory Bird Treaty Act; E.O. 12898, Environmental Justice; and E.O. 13175, Consultation and Coordination with Indian Tribal Governments.
Dr. Thoemke is a member of the National Association of Environmental Professionals and a member and Trustee of the Academy of Board-Certified Environmental Professionals (ABCEP). He served as ABCEP's Chairman of the Certification Review Board from 2013 to 2019.

Name	Brian Bledsoe, Ph.D., P.E.
Role	Hydrology and Hydraulic Engineer
Affiliation	University of Georgia

Dr. Bledsoe is Georgia Athletic Association Distinguished Professor in the College of Engineering at the University of Georgia. He has over 30 years of experience as a civil engineer in the private and public sectors. He holds degrees from Georgia Tech, North Carolina State University, and Colorado State University (CSU). Dr. Bledsoe is a registered Professional Civil Engineer in Colorado and North Carolina. Before moving to the University of Georgia, he was a tenured full professor at CSU, where he conducted hydrology and hydraulics (H&H) research in the CSU Hydraulics Laboratory from 1997-2015.

Before entering the professoriate, Dr. Bledsoe worked as a consulting engineer and surveyor, and for the State of North Carolina Divisions of Coastal Management and Water Quality as a watershed restoration engineer and coastal hydrologist. Over the last two decades, his research has focused on environmental hydraulics, flood hazards, stormwater, infrastructure, water quality, and restoration of riverine, wetland, and coastal ecosystems. He is experienced in all aspects of H&H engineering and has authored more than 70 peer-reviewed publications related to H&H, geomorphology, ecosystem restoration, statistical hydrology, and flood hazards. He currently leads the urban flooding research group for the National Science Foundation's Urban Water Innovation Network (UWIN). The research he leads through UWIN is focused on compound flooding (pluvial, fluvial, and coastal) and probabilistic flood hazard mapping under changing land cover and climate.

Dr. Bledsoe is well-versed in the application of many USACE H&H models, including HEC-RAS (1-D, 2-D, and hydraulic design modules), HEC-GeoRAS, HEC-HMS, HEC-GeoHMS, HEC-FDA, and SAM. He is familiar with Coastal Storm Risk Management (CSRM), coastal flood modeling with ADCIRC, floodplain mapping and flood management projects, risk and uncertainty analysis, and safety assurance reviews.

Dr. Bledsoe has served as an expert peer reviewer for several flood mitigation and ecosystem restoration projects, including the Southwest Coastal Louisiana Feasibility Study; Orestimba Creek-West Stanislaus County, California, Feasibility Study; Louisiana Coastal Area Barataria Basin Barrier Shoreline Restoration Project; Biscayne Bay Coastal Wetlands Project; and Louisiana Coastal Area Amite River Diversion Canal Modification Project Feasibility Study and Supplemental Environmental Impact Statement.

Dr. Bledsoe received a National Science Foundation CAREER Award in 2006, served as a Fulbright Scholar in Chile with a focus on hydraulic engineering research in 2008, is past president of the American Ecological Engineering Society, and was elected a Fellow of the American Society of Civil Engineers in 2017.

Name	**Robert Fleming Jr., P.E.**
Role	**Civil/Geotechnical Engineer**
Affiliation	**Independent Consultant**

Mr. Fleming is a geotechnical engineer specializing in project design and geotechnical and structural engineering for flood control projects. He earned his Master of Engineering (M.E.) in geotechnical engineering from Texas A&M University in 1971 and is a licensed professional engineer in Mississippi. He has more than 53 years of experience in geotechnical and structural engineering, including working for the USACE Vicksburg District for 35 years. In that capacity, he was actively involved in the design, construction, and evaluation of all types of hydraulic structures. At USACE, he served 10 years as the Chief of the Geotechnical Branch, 5 years as the Chief of the Design Branch, and 4 years as the Chief of Engineering. Mr. Fleming has had overall technical responsibility for all types of flood control, navigation, environmental restoration, and recreation projects, which have included locks and dams, pumping stations, levees, levee tie-ins to natural features, flood management channels, drainage structures, floodwalls, earth dams, channels, channel stabilizations, and earth slide remediation.

Major accomplishments while serving as USACE Chief of Engineering include responsibility for the overall design, plans and specifications, and construction consultation of the Mississippi River Enlargement Program in Mississippi, Louisiana, and Arkansas. Enlargements included more than 40 miles of levee raises of up to 8 feet on existing levees 25 to 35 feet in height. As the Dam Safety Officer for seven large high-hazard dams, he was responsible for ensuring the safe operation and maintenance of these structures, as well as the design and construction of numerous floodwater-retarding structures, riser pipes, low-drop grade control, and high-drop grade control structures as part of the Demonstration Erosion Control Program in North Mississippi. Mr. Fleming was involved in numerous designs and construction of both semi-pervious and pervious seepage berms, relief wells, and slurry trench cut-offs on various projects, including the mainline Mississippi River Levees and high-hazard dams located within the Vicksburg District, USACE. He was also involved in numerous slope stability analyses of dams, levees, and excavation slopes, as well as the remediation of existing slope failures. One example was a study completed to determine the cause of, and make recommendations for repair of, a continuous problem with shallow slough slides that occurred on the riverside slopes of the mainline Mississippi River Levees. The riverside slopes consisted of highly plastic CH clays.

Mr. Fleming has extensive expertise in the geotechnical evaluation of flood risk management structures, including static and dynamic slope stability evaluation. He has demonstrated experience related to USACE geotechnical practices associated with flood management channels, construction, and soil engineering, and he also has significant knowledge about dams and their stability. For example, from 1980 to 1993, he was involved in and responsible for the Sardis earthquake study and remediation of the large Sardis hydraulic fill dam in North Mississippi. Sardis Dam was founded on an alluvial foundation that contains recent-age liquefiable silt layers that were determined to be the primary risk for liquefaction in the dam foundation and cause for excessive deformation of the dam during the Design Earthquake.
Mr. Fleming was also responsible for numerous geotechnical designs of levees, floodwalls, and hydraulic structures, such as the Lake Chicot Pumping Plant, the first structure built in the Lower Mississippi River mainline levees, and locks and dams on the Red River. As Chief of the Design Branch, he was involved in the mechanical stabilization of the historically significant bluffs overlooking the Mississippi River in Natchez, Mississippi. He is experienced in the evaluation of seepage through earth foundations of large urban levees, as evident in his work on numerous seepage studies evaluating alternatives such as

seepage berms, relief wells, and slurry trench cutoffs to find the most cost-effective seepage control. Relevant studies involved the Ouachita River in Monroe, Louisiana, and the Red River in Alexandria, Louisiana.

As Chief of Engineering, Mr. Fleming signed the Construction Plans & Specifications that were advertised for bids. He also signed the Official Cost Estimates for evaluating bids submitted. As Chief of the Design Branch, he signed individual drawings in the bid package. Both at USACE and as a geotechnical consultant, Mr. Fleming has worked on projects that have involved bridge design and construction, namely as part the appurtenant structures associated with the design and construction of Locks and Dams 3, 4, and 5 on the Red River Waterway. He has experience with the design and construction of detention/retention basins, utility relocations, positive closure requirements, and interior drainage requirements on the various recreation sites on the Red River Waterway and the seven high-hazard dams located within Vicksburg District. His design and construction experience also includes the numerous floodwater-retarding and grade control structures that were part of the Demonstration Erosion Control Project located in the hills overlooking the Mississippi Delta in Mississippi. On several flood risk management projects in Vicksburg, he routinely applied and considered non-structural flood risk management measures as part of plan development.

Mr. Fleming has a working knowledge of the geomorphology of the primary rivers of the Vicksburg District. These alluvial rivers include the Mississippi River, the Red and Ouachita Rivers (in Louisiana), and the Yazoo and Tallahatchie Rivers (in Mississippi). A specific example of a levee project that incorporated tie-ins to natural features is the Big Sand Creek, a tributary of the Yazoo River located in the Mississippi Delta. It included tie-ins to the hills and appurtenant structures such as grade controls in the channel and drainage structures through the levee.

Mr. Fleming has experience designing and implementing site investigation and laboratory testing plans; executing and interpreting data and risk analyses, including seepage, stability, and seismically induced liquefaction; and performing most of the individual analyses in GeoStudio software. Mr. Fleming also has experience in geotechnical risk and fragility analysis, as demonstrated by his work on the Sardis earthquake analysis and remediation project described above.

Mr. Fleming is knowledgeable in all phases of alternatives development and evaluation and was involved in numerous USACE planning studies investigating flood control alternatives. In addition, he has served on six IEPR panels: (1) as geotechnical, structural, and cost engineering reviewer for the Jordan Creek-Springfield, Greene County, Missouri, Feasibility Study Report and Environmental Assessment (2013); (2) geotechnical reviewer for the Manhattan, Kansas, Section 216 Feasibility Study (2014); (3) geological/geotechnical reviewer for the Malibu Creek, California, Ecosystem Restoration Feasibility Study (2017); (4) geotechnical engineer reviewer for the Middle Rio Grande Flood Protection Project (2017); (5) structural/civil engineering reviewer for the Brazos River Floodgate and Colorado River Lock Feasibility Study (2018); and (6) geotechnical reviewer for the Port Fourchon Belle Pass Channel Deepening Project (2018). He can address the USACE Safety Assurance Review aspects of all projects due to his experience and background in the development and implementation of the Design Quality Management System and the Independent Technical Review Process for USACE, Vicksburg District. He also served as an independent consultant on the Interagency Performance and Evaluation Task Force for the Greater New Orleans Hurricane and Storm Damage Risk Reduction System.

Mr. Fleming actively participates in professional engineering and scientific societies. He is a fellow of the American Society of Civil Engineers and a member of the U.S. Society on Dams and the Society of American Military Engineers.

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APPENDIX C

Final Charge for the Upper Barataria FS IEPR

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Charge Questions and Guidance to the Panel Members for the Independent External Peer Review (IEPR) of the Upper Barataria, Louisiana, Integrated Feasibility Study

This is the final Charge to the Panel for the Upper Barataria FS IEPR. This final Charge was submitted to USACE as part of the final Work Plan, originally submitted on October 2, 2019. The dates and page counts in this document have not been updated to match actual changes made throughout the project.

BACKGROUND

The Study Area includes communities in the following seven southeast Louisiana parishes: Ascension, Assumption, Jefferson, Lafourche, St Charles, St. James, and St. John the Baptist Parishes. The Study Area is bounded on the north and east by the Mississippi River and Tributaries Project, Mississippi River Levee, on the west by Bayou Lafourche, and on the south Study Area extends slightly past U.S. Highway 90. See Figure 1. The Study Area is part of the larger Barataria Basin watershed covering approximately 760 square miles and characterized by low, flat terrain with numerous navigation channels, drainage canals, and natural bayous that drain into Lake Salvador and eventually the Gulf of Mexico. Areas of development located within the Study Area are mostly unleveed or have inadequate levee systems, are dependent on gravity drainage and are subject to the effects of interior rainfall flooding and riverine flooding. The southern half of the Study Area is also subject to tidal flooding due to hurricanes and other storms. The Study Area is mostly wetland and agricultural lands with numerous communities located adjacent to major highways and adjacent to the Mississippi River and Bayou Lafourche. Before construction of the Mississippi River levees, the area was subjected to rainfall, tidal, and hurricane flooding from the Mississippi River resulting in structural, agricultural, and environmental damages. Flood damages are aggravated by the long duration of the high stages due to conveyance constrictions. The Barataria Basin is a diverse ecosystem inhabited by a variety of species of birds, mammals, reptiles, amphibians, as well as fresh, brackish, and saltwater fish.

This Study will investigate alternatives that may include structural and non-structural measures to address flood risk from tidal surges, coastal storm surges, and heavy rainfall in the area between Bayou Lafourche and the Mississippi River System, from Donaldsonville to just past U.S. Highway 90 in the basin. Structural measures to regulate Upper Barataria Basin stages and storage to facilitate structure damage reduction may consist of a combination of levees and floodwalls, conveyance channels, flood gates, tidal exchange structures, t- walls, and pumping stations. Nonstructural measures to address flood damages could include structure elevations, buy-outs and relocations, dry/wet flood-proofing, or localized levees/floodwalls.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Upper Barataria, Louisiana, Integrated Feasibility Study (hereinafter: Upper Barataria FS IEPR) in accordance with the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' *Review Policy for Civil Works* (Engineer Circular [EC] 1165-2-217, dated February 20, 2018), and the Office of Management and Budget's (OMB'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 and environmental assumptions and projections, project evaluation data, economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, models used in evaluation of economic or environmental impacts, and any biological opinions" (EC 1165-2-217; p. 39) for the decision 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) who meet the technical criteria and areas of expertise required for and relevant to the project.

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 1165-2-217 (p. 41), 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

Review Documents	No. of Review Pages	Subject Matter Experts			
		Planning Formulator/ Economist	Environmental Law Compliance Specialist	Hydrology and Hydraulic Engineer	Civil/ Geotechnical Engineer
Upper Barataria FS	128	128	128	128	128
Engineering Appendix	300			300	300
Economics Appendix	60	60			
Real Estate Appendix	50	50	50	50	50
Environmental Appendix	300	300	300		
Decision Management Plans	10	10	10	10	10
Total Number of Review Pages	**848**	**548**	**488**	**488**	**488**
Public Review Comments[a]	100	100	100	100	100
Supplemental Information					
Risk Register	5	5	5	5	5
Total Number of Reference Pages	**5**	**5**	**5**	**5**	**5**

[a] USACE will submit public comments to Battelle, which will in turn submit to the IEPR Panel.

Documents for Reference

- Review Policy for Civil Works (EC 1165-2-217, February 20, 2018)
- Office of Management and Budget's Final Information Quality Bulletin for Peer Review (December 16, 2004)
- Foundations of SMART Planning
- Feasibility Study Milestones (PB 2018-01, September 30, 2018; PB 2018-01(S), June 20, 2019)
- SMART – Planning Overview
- Planning Modernization Fact Sheet
- USACE Climate Change Adaptation Plan (2015)
- Engineer Technical Letter (ETL) 1100-2-1 – Procedures to Evaluate SLR Change Impacts Responses Adaptation
- Engineer Regulation (ER) 1100-2-8162 – Incorporating SLR Change in CW Programs.

SCHEDULE AND DELIVERABLES

This schedule is based on the receipt date of the final review documents and may be revised if review document availability changes. This schedule may also change due to circumstances out of Battelle's control such as changes to USACE's project schedule and unforeseen changes to panel member and USACE availability. As part of each task, the panel member will prepare deliverables by the dates indicated in the table (or as directed by Battelle). All deliverables will be submitted in an electronic format compatible with MS Word (Office 2003).

SCHEDULE

Task	Action	Due Date
Meetings	Subcontractors complete mandatory Operations Security (OPSEC) training	11/17/2019
	Battelle sends review documents to panel members	12/4/2019
	Battelle convenes kick-off meeting with panel members	12/5/2019
	Battelle convenes kick-off meeting with USACE and panel members	12/6/2019
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	12/18/2019
Review	Panel members complete their individual reviews	1/7/2020
	Battelle provides talking points for Panel Review Teleconference to panel members	1/9/2020
	Battelle convenes Panel Review Teleconference	1/10/2020
	Battelle provides Final Panel Comment templates and instructions to panel members	1/13/2020
	Panel members provide draft Final Panel Comments to Battelle	1/17/2020
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	1/18/2020 - 1/27/2020
	Panel finalizes Final Panel Comments	1/28/2020

Task	Action	Due Date
Public Comment Review**	Battelle receives public comments from USACE	1/24/2020
	Battelle sends public comments to Panel	1/27/2020
	Panel completes its review of public comments	1/30/2020
	Battelle and Panel review the Panel's responses to the charge question regarding the public comments	1/31/2020
	Panel drafts Final Panel Comment for public comments, if necessary	2/4/2020
	Panel finalizes Final Panel Comment regarding public comments, if necessary	2/6/2020
Final Report	Battelle provides Final IEPR Report to panel members for review	2/10/2020
	Panel members provide comments on Final IEPR Report	2/12/2020
	*Battelle submits Final IEPR Report to USACE	2/14/2020
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance	2/24/2020
Comment Response Process	Battelle inputs Final Panel Comments to Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	2/26/2020
	Battelle convenes teleconference with Panel to review the Comment Response process	2/26/2020
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE PCX for review	3/18/2020
	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	3/24/2020
	USACE PCX provides draft PDT Evaluator Responses to Battelle	3/25/2020
	Battelle provides draft PDT Evaluator Responses to panel members	3/27/2020
	Panel members provide draft BackCheck Responses to Battelle	4/1/2020
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	4/2/2020
	Battelle convenes Comment Response Teleconference with panel members and USACE	4/3/2020
	USACE inputs final PDT Evaluator Responses to DrChecks	4/10/2020
	Battelle provides final PDT Evaluator Responses to panel members	4/13/2020
	Panel members provide final BackCheck Responses to Battelle	4/16/2020
	Battelle inputs panel members' final BackCheck Responses to DrChecks	4/17/2020
	*Battelle submits pdf printout of DrChecks project file	4/20/2020
ADM	Agency Decision Milestone (ADM) Meeting	3/27/2020
	Contract End/Delivery Date	9/30/2020

* Deliverables

**Battelle will provide public comment to the panel members after they have completed their individual reviews of the project documents to ensure that the public comment review does not bias the Panel's review of the project.

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the decision documents are credible and whether the conclusions are valid. The Panel is asked to determine whether the technical work is adequate, competently performed, and 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 decision documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Some sections have no questions associated with them; however, you may still 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 that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-217).

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 Patti Connaughton-Burns (burnsp@battelle.org) or Program Manager Lynn McLeod (mcleod@battelle.org) for requests or additional information.

3. In case of media contact, notify the Battelle Program Manager, Lynn McLeod (mcleod@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 the Project Manager, no later than 10 pm ET by the date listed in the schedule above.

Independent External Peer Review of the Upper Barataria, Louisiana, Integrated Feasibility Study

Charge Questions and Relevant Sections as Supplied by USACE

The following Review Charge to Reviewers outlines the objectives of the Independent External Peer Review (IEPR) for the subject study and identifies specific items for consideration for the IEPR Panel.

The objective of the IEPR is to obtain an independent evaluation of whether the interpretations of analysis and conclusions based on analysis are reasonable for the subject study. The IEPR Panel is requested to offer a broad evaluation of the overall study decision document in addition to addressing the specific technical and scientific questions included in the Review Charge. The Panel has the flexibility to bring important issues to the attention of decision makers, including positive feedback or issues outside those specific areas outlined in the Review Charge. The Panel can use all available information to determine what scientific and technical issues related to the decision document may be important to raise to decision makers. This includes comments received from agencies and the public as part of the public review process.

The Panel review is to focus on scientific and technical matters, leaving policy determinations for USACE and the Army. The Panel should not make recommendations on whether a particular alternative should be implemented or present findings that become “directives” in that they call for modifications or additional studies or suggest new conclusions and recommendations. In such circumstances, the Panel would have assumed the role of advisors as well as reviewers, thus introducing bias and potential conflict in their ability to provide objective review.

Panel review comments are to be structured to fully communicate the Panel’s intent by including the comment, why it is important, any potential consequences of failure to address, and suggestions on how to address the comment.

The Panel is asked to consider the following items as part of its review of the decision document and supporting materials.

Broad Evaluation Charge Questions

1. Is the need for and intent of the decision document clearly stated?
2. Does the decision document adequately address the stated need and intent relative to scientific and technical information?
3. Given the need for and intent of the decision document, assess the adequacy and acceptability of the project evaluation data used in the study analyses.
4. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, social, and engineering assumptions that underlie the study analyses.

5. Given the need for and intent of the decision document, assess the adequacy and acceptability of the economic, environmental, social, and engineering methodologies, analyses, and projections.

6. Given the need for and intent of the decision document, assess the adequacy and acceptability of the models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives.

7. Given the need for and intent of the decision document, assess the adequacy and acceptability of the methods for integrating risk and uncertainty.

8. Given the need for and intent of the decision document, assess the adequacy and acceptability of the formulation of alternative plans and the range of alternative plans considered.

9. Given the need for and intent of the decision document, assess the adequacy and acceptability of the quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans.

10. Given the need for and intent of the decision document, assess the adequacy and acceptability of the overall assessment of significant environmental impacts, social justice, and any biological analyses.

11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.

12. Assess the considered and tentatively selected alternatives from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

13. For the tentatively selected plan, assess whether the models used to assess life safety hazards are appropriate.

14. For the tentatively selected plan, assess whether the assumptions made for the life safety hazards are appropriate.

15. For the tentatively selected plan, assess whether the quality and quantity of the surveys, investigations, and engineering are sufficient to support a concept design considering the life safety hazards and to support the models and assumptions made for determining the hazards.

16. For the tentatively selected plan, assess whether the analysis adequately addresses the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project.

Battelle Summary Charge Questions to the Panel Members[1]

Summary Questions

17. Please identify the most critical concerns (up to five) 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.

18. Please provide positive feedback on the project and/or review documents.

Public Comment Questions

19. Do the public comments raise any additional discipline-specific technical concerns with regard to the overall report?

[1] Questions 17 through 19 are Battelle-supplied questions and should not be construed or considered part of the list of USACE-supplied questions. These questions were delineated in a separate appendix in the final Work Plan submitted to USACE.

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APPENDIX D

Conflict of Interest Form

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David Kaplan
USACE, Institute for Water Resources
September 4, 2019
C-2

Conflicts of Interest Questionnaire

Independent External Peer Review

Upper Barataria, Louisiana, Integrated Feasibility Study and Environmental Impact Statement

The purpose of this document is to help the U.S. Army Corps of Engineers identify potential organizational conflicts of interest on a task order basis as early in the acquisition process as possible. Complete the questionnaire with background information and fully disclose relevant potential conflicts of interest. Substantial details are not necessary; USACE will examine additional information if appropriate. Affirmative answers will not disqualify your firm from this or future procurements.

NAME OF FIRM: **Battelle Memorial Institute Corporate Operations**
REPRESENTATIVE'S NAME: **Courtney Brooks**
TELEPHONE: **614-424-5623**
ADDRESS: **505 King Avenue, Columbus, Ohio 43201**
EMAIL ADDRESS: **brooksc1@battelle.org**

I. INDEPENDENCE FROM WORK PRODUCT. Has your firm been involved in any aspect of the preparation of the subject study report and associated analyses (field studies, report writing, supporting research etc.) **No** Yes (if yes, briefly describe):

II. INTEREST IN STUDY AREA OR OUTCOME. Does your firm have any interests or holdings in the study area, or any stake in the outcome or recommendations of the study, or any affiliation with the local sponsor? **No** Yes (if yes, briefly describe):

III. REVIEWERS. Do you anticipate that all expert reviewers on this task order will be selected from outside your firm? No **Yes** (if no, briefly describe the difficulty in identifying outside reviewers):

IV. AFFILIATION WITH PARTIES THAT MAY BE INVOLVED WITH PROJECT IMPLEMENTATION. Do you anticipate that your firm will have any association with parties that may be involved with or benefit from future activities associated with this study, such as project construction? **No** Yes (if yes, briefly describe):

V. ADDITIONAL INFORMATION. Report relevant aspects of your firm's background or present circumstances not addressed above that might reasonably be construed by others as affecting your firm's judgment. Please include any information that may reasonably: impair your firm's objectivity; skew the competition in favor of your firm; or allow your firm unequal access to nonpublic information.

No additional information to report.

Courtney M. Brooks
Courtney Brooks

September 4, 2019
Date

Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal

BATTELLE

It can be done