DEPARTMENT OF THE ARMY
CHIEF OF ENGINEERS
2600 ARMY PENTAGON
WASHINGTON, D.C. 20310-2600

AUG - 6 2013

DAEN-ZA

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Morganza to the Gulf of Mexico, Louisiana – Final USACE Response to Independent External Peer Review

1. Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resources Development Act of 2007, EC 1165-2-214, and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).

2. The Battelle Memorial Institute engaged the Louisiana Water Resource Council (LWRC) to conduct the IEPR of the Mississippi River and Tributaries, Morganza to the Gulf of Mexico Hurricane Protection Project, Louisiana – Post Authorization Change Report and Revised Programmatic Environmental Impact Statement. The LWRC is the exclusive peer review panel for activities conducted by the Corps of Engineers in the State of Louisiana that fall under the purview of section 7009 of the Water Resources Development Act of 2007. The IEPR panel consisted of seven members with technical expertise in civil works planning, economics, wetland ecology/biology, civil/construction engineering, coastal engineering, geotechnical/structural engineering, and fisheries biology.

3. I approve the final written responses to the IEPR contained in the enclosed document. The IEPR Report and USACE responses will be posted on the Internet, as required in EC 1165-2-214.

4. Please direct questions to Mr. Joseph Redican, Deputy Chief, Mississippi Valley Division Regional Integration Team, at 202-761-4523.

Encl

THOMAS P. BOSTICK
Lieutenant General, USA
Chief of Engineers

Morganza to the Gulf of Mexico, Louisiana
Post Authorization Change Report and
Revised Programmatic Environmental Impact Statement
USACE Response to Independent External Peer Review
Revised 17 June 2013

Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resources Development Act (WRDA) of 2007, U.S. Army Corps of Engineers (USACE) policy on Civil Works Review, EC 1165-2-214 (2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (2004).

The WRDA of 2007 authorized the Morganza to the Gulf of Mexico, Louisiana (Morganza to the Gulf) hurricane and storm damage reduction project for construction at a total cost of $887 million based on the reports of the Chief of Engineers dated 2002 and 2003. The Preconstruction Engineering and Design (PED) phase for the project was initiated in 2002. No Federal funds have been appropriated for construction of the Morganza to the Gulf project to date.

The 2002 and 2003 reports of Chief of Engineers which served as the basis for the project authorization in WRDA 2007 were developed well before Hurricane Katrina's devastating impact on the New Orleans hurricane levees in August 2005. Implementation of more robust Hurricane and Storm Damage Risk Reduction System (HSDRRS) design standards developed post Katrina and other changes since project authorization caused the Morganza to the Gulf project to exceed the 20 percent cost increase limit specified in WRDA 1986, Section 902, requiring a Post Authorization Change (PAC) analysis. The PAC analysis provides the basis for Report of the Chief of Engineers updating the authorized Morganza to the Gulf of Mexico project. The Louisiana Coastal Protection and Restoration Authority Board (LACPRAB) and the Terrebonne Levee and Conservation District (TLCD) have expressed their intent to be non-Federal co-sponsors for the Morganza to the Gulf project.

Battelle Memorial Institute (Battelle), a non-profit science and technology organization with experience in establishing and administering peer review panels for the USACE, engaged the Louisiana Water Resource Council (LWRC) to conduct the IEPR of the Morganza to the Gulf PAC Report and Revised Programmatic Environmental Impact Statement (RPEIS). The LWRC is the exclusive peer review panel for activities conducted by USACE in the State of Louisiana that fall under the purview of section 7009 of the Water Resources Development Act of 2007. The LWRC review panel consisted of 7 panel members with expertise in coastal engineering, geotechnical engineering, structural engineering, civil engineering, civil works planning, economics, fisheries biology, and wetland ecology.

The Panel conducted its review of the Morganza to the Gulf PAC Report/RPEIS documents in two phases starting in June 2012. During the Panel's review, USACE revised the economic analysis, requiring that the Morganza to the Gulf PAC Report/RPEIS documents be revised and

followed by an IEPR of these revisions conducted by the same Panel. The IEPR of the revised documents included additional economics-related charge questions. Because the Panel had essentially completed its review of the original documents and the economics revisions would take several months to complete, Battelle and USACE decided to allow the Panel to complete its review (hereinafter, Review 1) and prepare Final Panel Comments to document the issues identified during Review 1. In January 2013, USACE provided the revised documents to Battelle and the Panel, accompanied by a list of the changes that had been made. This list allowed the Panel to focus its review of the revised documents (hereinafter, Review 2) only on those parts of the documents that had changed. This Final IEPR Report includes activities conducted during both Reviews 1 and 2.

For each review, Final Panel Comments were prepared. After Review 1, 21 draft Final Panel Comments were prepared and supplied to USACE. During Review 2, the Panel was asked to re-examine the 21 draft Final Panel Comments and determine whether the comments were still applicable based on the revised documents. Of the original 21 Final Panel Comments, 4 were eliminated because the revised documents addressed the issues presented, 11 were revised based on the revised documents, and 6 were unchanged. One new Final Panel Comment was developed based on the economics and civil/construction engineering panel members' review of the revised Economics Appendix. In the end, 18 Final Panel Comments were identified and presented.

IEPR on PAC Report/RPEIS

Battelle issued the final IEPR report on March 5, 2013 with 18 Final Panel Comments. No comments were rated as having high significance; 13 comments were rated as having medium significance; and 5 comments were rated as having low significance as defined below:

The following discussions present the USACE Final Response to the 18 IEPR comments.

1. IEPR Comment – Medium Significance: The effectiveness of the Morganza to the Gulf project design and construction is uncertain given the limited amount of site data.

The panel experts recommended the following actions to resolve this comment:

a. Add discussion in the PAC clearly stating why USACE believes the risk and cost contingency associated with the current level of geotechnical information is considered acceptable for the purpose of the PAC. The following recommendations should be included in the PAC or, if not included in the PAC, identified in the PAC as being part of future project preconstruction engineering and design.

<u>USACE Response: Adopted</u>

Action Taken: The following discussion was included in section 10.4.2, High Risk Cost and Schedule Items, of the PAC report: "The risk and cost contingency associated with the current level of geotechnical information is considered acceptable for the purpose of the PAC report; there is always some geotechnical uncertainty associated with limited data available during

feasibility studies, and the post-authorization feasibility-level design is based on a typical amount of site data for a feasibility report. The Morganza to the Gulf plan contained in the PAC report is not intended to be the final design, but to be a basis for a cost estimate which would be within 25 percent of the actual cost. A detailed cost risk analysis has been conducted, and although there is a risk that costs could be underestimated, there is also the risk that costs could be overestimated. For example, for the tentatively selected plan, contingencies range from 26 to 35 percent, which results in a contingency of over $2 billion as shown in figure 10-1."

b. Conduct additional geotechnical exploration and testing, as identified in the PAC.

USACE Response: Adopted

Action to be Taken: Additional geotechnical exploration and testing as identified in the PAC report will be conducted during development of Plans and Specifications for the updated project.

c. Add documentation and explanation of geotechnical characterization for analysis and design for the levee reaches and individual structures. The geotechnical characterization should describe the principles, hypotheses, and assumptions used to interpret the site- or reach-specific geotechnical field and laboratory data to develop the geotechnical properties used for analysis and design, reach by reach, and structure by structure. For example, the 5,143 pages of soil index and engineering test data results reported in the supplemental documents file ('14_soil_lab_testing_ results_optimized.pdf') should be first clearly summarized, analyzed, interpreted, and discussed to define levee reaches and formulate their analysis and design properties before being directly input to the geotechnical analyses, as presented in the supplemental document file 'annex_2_soils_reduced.pdf.'

USACE Response: Adopted

Action Taken: The soils report was edited to address the general design decisions and data interpretation on a reach by reach basis for the levees. All structure general design decisions were addressed along with data interpretation as it relates to that structure.

d. Clearly define assumed or expected conditions and their basis.

USACE Response: Adopted

Action Taken: Section 3 (Geotechnical) of the Engineering Appendix was revised to describe expected conditions and their basis, which includes geotechnical explorations and experience working with other levee projects in the area, e.g. Larose to Golden Meadow.

e. Develop a comprehensive plan to monitor field conditions and address conditions more adverse than assumed or expected (e.g., using geotechnical engineering observational methods (Peck, 1969), a particular form of adaptive management).

USACE Response: Adopted

Action to be Taken: During construction of the project, settlement and pore water pressures will be measured to assess shear strength gain and rate of settlement. The monitoring plan for a particular levee reach will be determined prior to construction. Typically, settlement plates are placed during construction and monitored periodically to assess settlement. Piezometers may be placed in certain levee sections to assist in determining settlement rates. Surveys are taken immediately post construction and at periodic intervals to determine settlement that has occurred. Borings will be taken prior to design of future levee lifts to assess shear strength gain.

f. Add illustrative or explanatory figures of soil profiles and cross-sections of relevant soil conditions used in analyses or otherwise affecting the project. Include appropriately generalized figures to help reader understanding.

USACE Response: Adopted

Action Taken: The PAC report was revised to add representative soil profiles and cross sections from the geotechnical report to the Engineering Appendix.

g. Implement technically appropriate and representative full-scale test sections for levee construction where side-borrow material is excavated and dried to see how long drying would take and prove out the construction methodology.

USACE Response: Adopted

Action to be Taken: Full-scale test sections will be considered during development of Plans and Specifications for the updated project; however, the Corps has sufficient experience with levee construction in wet soils to prove the construction methodology even without full-scale test sections. Drying time is more of a cost consideration.

h. Conduct further exploration and characterization of borrow sources to reduce uncertainty associated with borrow quality and quantity.

USACE Response: Adopted

Action to beTaken: Additional geotechnical exploration and testing as identified in the PAC will be conducted during the detailed design phase for the updated project. In the Cost Schedule Risk Analysis (CSRA), the cost contingency accounts for the risk and uncertainty in the assumed borrow distance. For the 3% AEP alternative, the cost estimate assumes a 20 mile average one-way haul and in the CSRA with a risk range from 15 miles to 25 miles. For the 1% AEP alternative, the cost estimate assumes a 25 mile average one-way haul with a risk range from 20 to 30 miles. Within those distance ranges, the team has confidence that sufficient quality borrow can be found.

2. IEPR Comment – Medium Significance: A borrow availability assessment (BAA) has not been conducted; therefore, the likelihood of project success and the potential impacts (environmental, cost, schedule) of the project cannot be fully assessed.

The panel experts recommended the following actions to resolve this comment:

a. Develop, in the design phase, a comprehensive Borrow Availability Assessment (BAA) including geotechnical testing at borrow sites to confirm material suitability. Consider possible demands of other concurrent projects in the development of the BAA

USACE Response: Adopted

Action to be Taken: The primary reason that the updated project is covered by a Programmatic EIS is that specific borrow sites have not yet been identified. The environmental impacts of borrow will be explored in more detail in supplemental NEPA documents before construction of project components.

b. Given the selected borrow locations, analyze possible environmental, cost, and schedule impacts of the required mining and transport operations.

USACE Response: Adopted

Action to be Taken: The geology of southeast Louisiana is sufficiently known to reasonably assume that sufficient clay borrow sources would exist in the project vicinity. As demonstrated by implementation of the post-Katrina Greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS) upgrades, the demand for large quantities of borrow can be met without impacting the assumed construction schedule. In the Cost and Schedule Risk Analysis (CSRA), the cost contingency accounts for the risk and uncertainty in the assumed borrow distance. For the 3% AEP alternative, the cost estimate assumes a 20 mile average one-way haul and in the CSRA with a risk range from 15 miles to 25 miles. For the 1% AEP alternative, the cost estimate assumes a 25 mile average one-way haul with a risk range from 20 miles to 30 miles. Within those distance ranges the Corps is confident that sufficient quality borrow can be found. The Larose to Golden Meadow project has identified borrow sites that could potentially supply borrow for the Morganza to the Gulf project as well. The environmental impacts of borrow will be explored in more detail in supplemental NEPA documents before construction of project components.

3. IEPR Comment – Medium Significance: Environmental effects of operations of the Houma Navigation Canal (HNC) lock and environmental gates are not fully documented.

The panel experts recommended the following actions to resolve this comment:

a. Discuss operations of the entire HNC lock system more fully.

USACE Response: Adopted

Action to be Taken: Operation of the HNC Lock Complex and environmental gates for the enhancement or restoration of the interior project ecosystems is not an objective of the Morganza project. The purpose of the HNC lock complex (and operation plan under Morganza) is for storm surge reduction and salinity control at the water treatment plant; however, it could also be operated for ecosystem restoration purposes, such as distribution of freshwater. The PAC was revised to explain that it is premature to discuss multi-purpose operations at this time. The recommended action would be taken if the LCA project moves forward. The coastal restoration coordination is described in section 3.8.2 of the RPEIS and PAC section 10.1.6. Proposed operational changes for Louisiana Coastal Area (LCA) ecosystem restoration purposes, and associated impacts, are documented in the Final Integrated Feasibility Study and EIS for the Convey Atchafalaya River Water to Northern Terrebonne Marshes and Multipurpose Operation of Houma Navigation Lock (USACE, 2010).

b. Clarify whether there is still a "multipurpose" for HNC lock system operations.

USACE Response: Adopted

Action to be Taken: The LCA plan relies on the operation of the HNC lock for environmental purposes after 2025 and proposes the modification of the operational plan for the lock complex structure authorized under Morganza, in order to maximize potential environmental benefits, both in terms of avoiding saltwater intrusion and optimizing flow distribution. For the multipurpose operation of the HNC lock to occur, the LCA project would need an operations plan that considers operation of the lock beyond the current authorization of the Morganza project. The current PAC Report/RPEIS cannot describe the operation and monitoring plan for multi-purpose use of the lock at this time because future multipurpose operation of the lock is dependent on the LCA project. These uncertainties are discussed in the PAC report, section 10.1.7, LCA Plan Uncertainties.

c. Describe in the PEIS the monitoring and adaptive management plan, if any, that will be used to make adjustments in future lock and full system operations.

USACE Response: Not Adopted

National Ecosystem Restoration (NER) benefits were not claimed as part of the Morganza to the Gulf project, but could come from a separate project (*Convey Atchafalaya River Water to Northern Terrebonne Marshes And Multipurpose Operation of Houma Navigation Lock Lafourche, Terrebonne, St. Mary Parish, Louisiana*) that is part of the LCA program. A description of the operation and monitoring plan for multi-purpose use of the lock cannot be included in the Morganza to the Gulf RPEIS at this time because future multi-purpose operation of the lock is dependent on the LCA project. If the LCA project moves forward, the operation and monitoring plan for multi-purpose use of the lock would be included in future NEPA documents supplementing the November 2004 *Final Programmatic EIS – Louisiana Coastal Area (LCA), Louisiana Ecosystem Restoration Study*, and the September 2010 supplement to that that report *Convey Atchafalaya River Water to Northern Terrebonne Marshes And Multipurpose Operation of Houma Navigation Lock Lafourche, Terrebonne, St. Mary Parish, Louisiana*.

d. Analyze, predict, and describe the potential effects of lock and system operations on ecological resources within the levee system under a variety of anticipated conditions.

USACE Response: Adopted

Action Taken and to be Taken: The Final PAC Report/RPEIS was revised to include a quantitative analysis of potential indirect impacts to wetlands for the constructible features, and a qualitative analysis of the potential indirect and cumulative impacts for the entire project. This information has been incorporated into sections 3.5.3, 6.2, 6.4, 6.5, 6.6, 6.12, 6.14 and 6.18 of the RPEIS. Since it is unknown what the exact lock operating schemes will be, and whether there will be a request in the future to close the system more often due to relative sea level rise, these impacts are presented as a range of potential future conditions. Additional hydrologic and hydraulic models and scenarios will be run for future supplemental NEPA documents.

e. Discuss required future analyses and required coordination in more detail

USACE Response: Adopted

Action Taken: Section 3.5.3 "Risk and Uncertainty" of the RPEIS was updated to include coordination with LCA, the HNC deepening project, the requirement for future NEPA documents for the programmatic features, explanation of future system wide model runs to look at sea level rise, and multipurpose operation of the lock. A similar section was added to the main PAC report section 10.3, Unresolved Issues.

4. IEPR Comment – Medium Significance: There are uncertainties in the TABS modeling caused by limited data available for testing, unresolved model-to-data discrepancies, and a lack of relative sea level rise (RSLR) simulations.

The panel experts recommended the following actions to resolve this comment:

a. Present the generality of hydrological conditions during 2004 relative to other years in the discussion

USACE Response: Adopted

Action Taken: The 2004 calendar year was utilized in the model simulations primarily due to the abundance of data for model validation. This time period was also utilized in the base to plan simulations due to the relatively average conditions for this time period. The Panel was provided a comparison of 2004 values with average values over multiple years. A discussion was added to section 2.6.4.2 of the PAC Engineering Appendix and Appendix J of the Hydrology, Hydraulics, and Water Quality Annex (Annex 1), which is a reference to the Engineering Appendix.

b. Undertake additional TABS model validation using additional periods of record (representing a range of environmental conditions and including RSLR scenarios) and report it in the documents.

USACE Response: Adopted

Action to be Taken: The existing TABS-MDS model does not contain the coverage required to do sea level rise simulations. The existing model was developed to include the portions of the domain that remain inundated with the remaining areas being omitted to reduce computation time. For an area such as southern Louisiana, a relatively small increase in sea level will result in vast areas becoming inundated. This increased inundation would then result in significant increases in tidal exchange and storage, significantly impacting the hydrodynamics and salinity transport. Therefore the existing model cannot be utilized to investigate the impacts associated with sea level rise. An Adaptive Hydraulics (AdH) numerical model will be developed during the detailed design phase for the updated project to determine the impacts of sea level rise.

c. Include uncertainty measures with model results and better communication of that uncertainty in the PEIS and PAC.

USACE Response: Adopted

Action Taken: The PAC report acknowledges that there are model and relative sea level rise uncertainties. The requested discussion was added to the section 3.5.3 of the RPEIS on model uncertainties.

5. IEPR Comment – Medium Significance: The accuracy of wetland impacts and mitigation requirements is constrained by the lack of site-specific wetlands data and an over-reliance on generic modeling assumptions.

The panel experts recommended the following actions to resolve this comment:

a. Field-verify the NWI information that serves as the basis for determining wetlands affected by the TSP.

USACE Response: Adopted

Action to be Taken: Use of the National Wetlands Inventory (NWI) data results in an overestimate of existing wetlands in the area. As GIS and mapping technology advanced, the process of data collection and map production became an integrated operation (single step) done on-screen by the image analysts. These analysts delineated wetlands onscreen and data were simultaneously entered into a digital data layer that could be used to generate maps at various scales using GIS technology (http://www.fws.gov/wetlands/NWI/Overview.html). Today, all of the NWI data are created through this on-screen process. This technology also facilitated the use of other sources in the interpretation process as other digital datasets (e.g., USDA digital soil surveys and USGS digital topographic map information) could be viewed with the source imagery to identify wetlands. More information on the standard used can be found at http://www.fws.gov/wetlands/Documents/FGDC-Wetlands-Mapping-Standard.pdf. Digital imagery from 1980 was used to create the NWI layer for coastal Louisiana

(http://www.fws.gov/wetlands/system/images/Image-Date-Map-2013.png). The number of acres measured actually needs to be reduced by including a land loss rate to bring them up to time of construction and to end of project life. The members of the Habitat Evaluation Team have visited these areas on many occasions and have no concerns about using the NWI for feasibility level estimates of impacts. The mitigation requirements will be updated for each reach during the design phase and supplemental NEPA document.

b. Adjust mitigation requirements based on wetland field observations and analysis of other potential effects (salinity).

USACE Response: Adopted

Action to be Taken: Site visits will be undertaken for each future NEPA document. Also, USGS multi-temporal analysis of land loss and habitat types will be used for the basis of the Wetland Value Assessments (WVAs). The WVA includes a salinity component.

c. Adjust the cost analysis based on wetland field observations, mitigation requirements, and additional analyses.

USACE Response: Adopted

Action to be Taken: Mitigation costs will be refined as the project is refined. There is a potential that mitigation costs could go down with more detailed engineering of the levees.

d. Broaden the scope of the effects analysis (direct, indirect, and cumulative) beyond the project footprint and seasonally averaged salinities

USACE Response: Adopted

Action Taken: Clarification of the indirect and cumulative impacts outside of the project footprint was incorporated into the Final RPEIS.

6. IEPR Comment – Medium Significance: Risk and uncertainty information associated with the base, project, and Multiple Lines of Defense Strategy (MLODS) conditions in the various coastal models (e.g., ADCIRC, STWAVE) has not been included in the Post Authorization Change (PAC) document.

The panel experts recommended the following actions to resolve this comment:

a. Provide additional validation of the ADCIRC and STWAVE results with respect to field measurements of other selected hurricanes in the project area.

USACE Response: Adopted

Action Taken: The ADCIRC + STWAVE model was validated with the "BRICKA" storms (Betsy, Rita, Ivan, Camille, Katrina, and Andrew) as part of USACE/FEMA efforts. All of these

storms were simulated. Measured and modeled water levels were then compared in the validation process. The BRICKA validation process is described in the following references: (1) Final Report: HMTAP Task Order 18, Mississippi Coastal Analysis Project, Coastal Documentation and Main Engineering Report, June 17, 2008, FEMA; (2) Flood Insurance Study: Southeastern Parishes, Louisiana, DRAFT, Intermediate Submission 2: Offshore Water Levels and Waves, Volume 1 of 7, 9 January 2008, FEMA; (3) A New Generation Hurricane Storm Surge Model for Southern Louisiana Joannes J. Westerink et al, September 4, 2004; (4) A High-Resolution Coupled Riverine Flow, Tide, Wind, Wind Wave, and Storm Surge Model for Southern Louisiana and Mississippi. Part I: Model Development and Validation, Bunya et al, February 2010.

b. Compare base conditions (1%) surge elevations with published Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps map results for the project area.

USACE Response: Not Adopted

The Panel's recommendation was not adopted since the current effective Federal FEMA FIS rate maps for Terrebonne Parish are over 20 years old. The effective study publication dates are 1981, 1985, and 1992. Hydrologic and Hydraulic Modeling techniques and algorithms have changed drastically in the last two decades, therefore, a comparison of the current effective study and ADCIRC results would not be useful.

7. IEPR Comment – Medium Significance: The Post Authorization Change (PAC) document may not accurately capture the risks and uncertainties associated with potential loss of life because of evacuation behavior assumptions.

The panel experts recommended the following actions to resolve this comment:

a. Provide documentation and empirical justification for the assertion that the evacuation compliance percentage with the project would be the same as is currently the case without the project.

USACE Response: Not Adopted

No empirical data is available to provide the requested justification.

b. If the statement cannot be empirically justified, acknowledge in the PAC document that it is uncertain whether the evacuation compliance rate will be the same, and that it is possible that the percentage of the population evacuating could be lower than is currently the case. Hence, it is possible that loss of life would not drop as much as would be expected with the project.

USACE Response: Adopted

Action Taken: The PAC report was revised to acknowledge the uncertainty associated with evacuation rates and loss of life once the project is in place. Whether the current effectiveness of

evacuation response of the affected population (generally in the 80 to 95 percent range) would change with the project in place is uncertain; it is possible that the percentage of the population evacuating could be lower than is currently the case. Hence, it is possible that loss of life would not drop as much as would be expected with the project.

8. IEPR Comment – Medium Significance: The cumulative effects analysis does not thoroughly consider reasonably foreseeable future actions unrelated to the project.

The panel experts recommended the following actions to resolve this comment:

a. Include in the PEIS a comprehensive inventory of reasonably foreseeable future actions (based on known future projects, planned and proposed projects, and past/predicted development patterns) that may be undertaken in the project area.

USACE Response: Adopted

Action Taken: Section 6.18.3 of the RPEIS was updated to list more potential projects, and supplemental documents will be updated with the most current listing of future projects as they are known. The following text was added to the RPEIS: "Descriptions of past, present, and reasonably foreseeable future projects related to the study area and the proposed project are located in section 3.11 of the RPEIS, Related Projects. In addition, the New Orleans District Regulatory Branch issued 125 and 173 permits (Section 10 and 404 combined) in 2011 and 2012, respectively. All of these permits were mitigated for. These include excavation, dredging, rock revetments, placement of structures, and removal of structures for bank stabilization, pipelines, sewers, aids to navigation, railroad, utilities, bulkheads, drilling drainage pumps, camps, flood control levees, artificial reefs, maintenance dredging, coastal restoration, etc."

b. Fully describe in the PEIS reasonably foreseeable future activities that are anticipated to occur in the project area (e.g., other federal projects, development, infrastructure expansion, BP Gulf restoration efforts, oil and gas exploration and production, pipeline system expansion and maintenance, and other similar activities). Forecast the cumulative effects, both adverse and positive, that the TSP may have on those activities as well as the potential effects that those activities may have on the federal investment in the TSP (both levee construction and mitigation). In particular, give greater attention to both positive and negative socioeconomic and ecological effects, including potential effects of climate change.

USACE Response: Adopted

Action Taken: Section 6.18.3 of the RPEIS was updated to list more potential projects, and supplemental documents will be updated with the most current listing of future projects as they are known.

c. Fully describe related flood damage reduction and restoration/mitigation projects anticipated to be performed under other authorities. Their adverse and positive effects should be described in combination with those anticipated for the TSP.

USACE Response: Adopted

Action Taken: Section 6.18.3 of the RPEIS was updated to list more potential projects, and supplemental documents will be updated with the most current listing of future projects as they are known.

d. Describe any anticipated measures to mitigate adverse cumulative effects, including those that may be adverse to the federal project.

USACE Response: Not Adopted

Cumulative environmental effects for the proposed project were assessed in accordance with guidance provided by the President's Council on Environmental Quality. Based on analysis done for the PEIS we did not identify any adverse cumulative effect requiring mitigation. Cumulative effects will be assessed in the future tiered documents. Any project from an external source that could modify the completed Federal project or have a potential adverse impact on it would require a Section 408 of 33 U.S.C permit granted by USACE.

9. IEPR Comment – Medium Significance: The indirect effects analysis does not thoroughly consider the potential impacts of the constructible features on ecological resources.

The panel experts recommended the following actions to resolve this comment:

a. Expand the interpretation of the TABS results beyond seasonally averaged salinities to include finer-scale (less than seasonal) variation in salinity, and more quantitative evaluation of model predictions of water elevations and water discharge.

USACE Response: Adopted

Action Taken: The Corps provided expanded TABS results to the Panel and added a discussion to section 2.6.4.2 of the PAC Engineering Appendix and Appendix J of the Hydrology, Hydraulics, and Water Quality Annex (Annex 1), which is a reference to the Engineering Appendix.

b. Strengthen the wetlands loss analysis using more site-specific parameter values in the WVA and further consider indirect effects arising from water level fluctuations and other hydroperiod-related changes.

USACE Response: Adopted

Action to be Taken: The indirect impacts caused by the operation of the lock complex and the rest of the system can range from positive to negative depending on the operation plan. The system wide model will be run in the future to attempt to quantify these impacts. The daily salinity ranges will be examined for future NEPA documents as a way of determining potential indirect impacts on aquatic resources. The WVA models that are used to describe impacts to

wetlands use seasonal averages, but for future NEPA documents the model results can be analyzed in more detail. Site visits will be undertaken for each future NEPA document. Also, USGS multi-temporal analysis of land loss and habitat types will be used for the basis of the WVAs. Existing WVAs will be updated based on the three sea level rise scenarios.

c. Increase the rigor of the indirect effects analysis on fish by using more quantitative habitat and density information. These data should be considered in the context of life stage and individual species sensitivity to changes in salinity, water levels, and access.

USACE Response: Adopted

Action to be Taken: Depending on whether the Habitat Evaluation Team (i.e. Federal and State resource agencies) thinks the additional analysis is necessary, the Corps may run a fisheries model such as CASM or do other aquatic species analysis during the design phase.

d. Update information on listed species and consider presenting it in a format that clearly gives the available information along with the assessment of potential direct and indirect effects on each species.

USACE Response: Adopted

Action to be Taken: Depending on whether the Habitat Evaluation Team (i.e. Federal and State resource agencies) thinks the additional analysis is necessary, the Corps may run a fisheries model such as CASM or do other aquatic species analysis during the design phase. The results will then be presented in a format that clearly gives the available information along with the assessment of potential direct and indirect effects on each species.

10. IEPR Comment – Medium Significance: Degradation of the road system from construction of the levees and an associated mitigation plan have not been considered in the project schedule and impact analysis.

The panel experts recommended the following actions to resolve this comment:

a. Develop, in the design phase, a comprehensive project plan for the optimum transport of borrow materials. Include an analysis of the possible impacts: road system degradation, congestion (level of service reductions), and traffic safety.

USACE Response: Adopted

Action to be Taken: A comprehensive project plan for the optimum transport of borrow materials will be developed during the detailed design phase of the updated project as more information is developed on borrow source locations.

b. Prior to construction operations, coordinate the planned project schedule, including haul routes and expected truck-trip volumes, with local roadway authorities with regard to traffic operations, expected route maintenance, and reconstruction activities.

USACE Response: Adopted

Action to be Taken: The Corps will address the panel's recommendation during the detailed design phase for the updated project prior to construction.

c. Consider the development of alternative strategies, in the design phase, to reduce the transport burden on the local road system. The following are offered as examples of options that may be considered:

- Using temporary haul routes within the levee right-of-way
- Reducing wheel loads by restricting on-road haul trucks to five-axle configurations
- Selectively using other material transportation methods, as practicable.

USACE Response: Adopted

Action to be Taken: The Corps will consider the development of alternative strategies to reduce the transport burden on the local road system during the development of Plans and Specifications for the updated project prior to construction.

11. IEPR Comment – Medium Significance: The impacts on fishery resources are uncertain because qualitative baseline fish data and seasonally averaged salinity results were used.

The panel experts recommended the following actions to resolve this comment:

a. Expand the determination of direct and indirect effects on fish and fish habitat, including EFH, beyond seasonally averaged salinities, particularly for the constructible elements.

USACE Response: Adopted

Action to be Taken: The determination of direct and indirect effects on fish and fish habitat, including EFH, can be refined beyond seasonally averaged salinities during detailed design of the environmental control structures to ensure that the structures minimize fisheries impacts. Depending on whether the Habitat Evaluation Team (i.e. Federal and State resource agencies) thinks the additional analysis is necessary, the Corps may also run a fisheries model such as CASM during the design phase.

b. Use the Louisiana Department of Wildlife and Fisheries data more extensively and include more details in the PEIS.

USACE Response: Adopted

Action to be Taken: More details on fishery impacts can be developed during the design phase and in supplemental environmental documents to ensure that environmental control structure designs minimize fisheries impacts. At that time, the Louisiana Department of Wildlife

and Fisheries data can be used to run a fisheries model such as CASM or do other aquatic species analysis.

c. Thoroughly discuss and summarize uncertainties and limitations of the analyses.

USACE Response: Adopted

Action Taken: Section 3.5.3 of the RPEIS on "Risk and Uncertainty" was expanded to include discussion on uncertainties and limitations of the analyses. Specifically added information includes uncertainties in the indirect and cumulative impacts to wetlands, aquatic organisms including Essentials Fish Habitat (EFH), water quality, and navigation due to increased frequency and duration of water control structure closures in the future compared to without project conditions due to RSLR. For example, the potential impacts to fishery resources that would be attributable to the proposed operation of the Federal levees system (including the structures) is unknown at this time, but under some sea level rise and levee system operations plan scenarios, these impacts could be significant. The level of impact would be dependent on the amount of background wetland loss due to relative sea level rise (sea level rise and subsidence) and how the project is constructed and operated by the State of Louisiana and Terrebonne Levee and Conservation District. During development of Plans and Specifications, the design of individual structures can be examined to verify that they are being designed in such a way as to reduce the impact on ingress and egress. As part of the trade off analysis between benefits from salinity intrusion prevention and aquatic access restriction, additional fisheries impact analysis (such as CASM) can be done to determine if there are any additional impacts. The modeling and analysis would include sea level rise.

d. Re-evaluate the potential effects on fisheries resources based on a more thorough examination and discussion of the TABS modeling for constructible elements.

USACE Response: Adopted

Action to be Taken: The TABS model is limited in that it does not allow evaluation of multiple sea level rise scenarios. Another model such as the systemwide AdH model coupled with a fisheries model such as CASM may be used during the design phase for modification of environmental control structures to minimize fisheries impacts.

e. Expand and update literature citations for the fish, benthos, and plankton.

USACE Response: Adopted

Action to be Taken: An expanded and updated review of relevant literature will occur during the detailed design phase and be incorporated into future NEPA documents.

12. IEPR Comment – Medium Significance: Residual risk has not been thoroughly described, the associated communication plan for the affected population is not presented, and no adaptive management plan is included.

The panel experts recommended the following actions to resolve this comment:

a. Incorporate a fuller discussion of residual risk-its sources, its impacts, and how to adapt to it-in the documents.

USACE Response: Adopted

Action Taken: The PAC report, RPEIS, and associated public meetings provide the opportunity to communicate risk and raise risk awareness in the study area. The PAC report was revised to include a diagram and description on how to buy down risk that was presented at the public meeting in Houma, LA.

b. Develop and describe in the project documents a specific communication plan to increase awareness of individuals in areas of risk.

USACE Response: Adopted

Action Taken: Additional text on outreach, communication, and the National Levee Safety Program has been added to the Residual Risk section of the PAC report.

c. Develop and describe in the project documents an adaptive management plan that can respond to updated sources of risk as project implementation continues.

USACE Response: Adopted

Action Taken: The detailed design phase phase provides opportunities to adapt to near-term changes in residual risk (for example if new data/guidance were to come out on sea level change during design). A Risk Management Plan was also developed to outline the process for implementing the comprehensive and proactive management of risk as part of the overall management of the Morganza to the Gulf of Mexico, Louisiana project. Risk management is a project management tool to handle events that might adversely impact the program, thereby increasing the probability/likelihood of success. (Note: An adaptive management plan was only developed for the mitigation component of this project. Adaptive management plans for this project are described in RPEIS Appendix K.)

13. IEPR Comment – Medium Significance: The description of the content-to-structure value ratios (CSVRs) is missing some important information on the representativeness and demographics of the sample of property owners selected and the specific locations and representativeness of the residential and commercial units used to develop the ratios.

The panel experts recommended the following actions to resolve this comment:

a. Provide documentation of process that was used to select the 10 residential property owners and the 10 non-residential property owners.

USACE Response: Adopted

Action Taken: The following information was added to pages 18 and 19 of the PAC Economic Appendix. Efforts were made to keep the selection of survey participants as random as possible within each of the 3 residential and 8 non-residential categories; however, since participants could not be financially compensated for their time and efforts, the sample of property and business owners was based on availability within the evaluation area. In general, homeowners for the residential content surveys were contacted through local government officials and business owners. For the non-residential surveys, the Corps' contractor attempted to select businesses within each category that were typical in size and value to other businesses within that non-residential category. The contractor entered the businesses with a survey form and requested participation. Some businesses were reluctant to participate or could not provide meaningful information, which limited the group of participants within the evaluation area. A detailed discussion of the methods used to contact homeowners for the residential contents surveys is on pages 87 and 88 of the Depth-Damages for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSVRs) in Support of the Lower Atchafalaya Revaluation and Morganza to the Gulf, Louisiana Feasibility Studies dated May 1997, and a discussion of the methods used to contact commercial operators for non-residential content categories is on pages 91 and 92.

b. Provide an assessment of how well (1) the selected residential and non-residential property owners represent the population of these two groups of property owners and (2) the structures owned by the selected property owners represent the types of structures in the study area.

USACE Response: Adopted

Action Taken: Since the original sample contains 10 observations for each of the residential and non-residential categories, the standard deviation for each of the samples may not have accurately represented the population standard deviation. A bootstrapping sampling method was employed to correct for small sample size. Over 100,000 iterations were executed using the @Risk model to calculate the mean and standard deviation values. The mean values did not change from the original sample, but the revised standard deviation values were equal to or lower than those in the original samples. The following statement was added to the main report: "The samples used to develop the CSVRs for the various residential and non-residential damage categories could not be randomly selected due to the difficulty in obtaining volunteers to participate in the surveys. Consequently, there is the risk that the CSVRs used in the economic analysis may not accurately reflect the true mean CSVRs of the population of residential and non-residential properties in the evaluation area."

14. IEPR Comment – Low Significance: Rainfall-related damages to the interior project area have not been presented for each alternative and therefore cannot be evaluated.

The panel experts recommended the following actions to resolve this comment:

a. Include the UNET model results showing that no interior drainage improvements are necessary.

USACE Response: Adopted

Action Taken: Impacts of the proposed Federal levee on the interior area were initially modeled using UNET (Unsteady flow through a NETwork of open channels). The purpose of the UNET model was to determine the relative change in water surface elevation between without and with project conditions. The only appreciable difference in water surface occurs when the levees are overtopped at the less frequent return intervals. The UNET interior drainage study is included as Appendix N to Annex 1 to the engineering Appendix.

b. Discuss how the environmental control structures can be operated to reduce rainfall-related damages.

USACE Response: Not Adopted

The purpose of the Morganza to the Gulf project is storm surge damage reduction, not rainfall-related damage reduction. Therefore, the purpose of the environmental control structures is for circulation and drainage, and the structures are not to be operated to reduce rainfall-related damages. Consequently, no discussion on how rainfall damages can be reduced is included in the PAC report.

c. Indicate whether interior rainfall damages in the project area vary during the construction and operation of the Tentatively Selected Plan (TSP), especially during storm surge events.

USACE Response: Adopted

Action Taken: The PAC report was revised to clarify that rainfall is not part of the damage calculations because the proposed Federal levee is not expected to impact rainfall damages in the populated areas during or after construction (i.e. rainfall would be the same both with and without the proposed Federal levee). The populated areas are located within forced drainage levee systems, i.e. a system of levees and pumps that provide controlled drainage for an area, allowing the area to remain dry under normal tidal conditions, even if the area is below sea level. Rainfall would continue to be pumped outside of the local forced drainage levee systems and into an area that would be surrounded by the proposed hurricane levee, leaving storage between the Federal and local levee systems. Local drainage improvements are outside the scope of the project purpose and authority.

d. Indicate if there is any pooling of water behind the levees and what, if any, consequences this may have on natural resources, properties, and infrastructure.

USACE Response: Adopted

Action Taken: The Environmental Structure Report (Annex 1, Appendix H) addresses ponding areas in the project. The report recommends placement and sizes of the culverts based on detailed design criteria developed to minimize ponding duration and impacts to biological resources. The PAC report was also revised to clarify why rainfall-related damages are not

presented for each alternative and to explain how rainfall and interior drainage were addressed. See Final PAC Report section 2.5, which was revised to include the following explanation. Rainfall is not part of the HEC-FDA damage model because the proposed Federal levee is not expected to impact rainfall damages in the populated areas during or after construction (i.e. rainfall would be the same both with and without the proposed Federal levee). The populated areas are located within forced drainage levee systems, i.e. a system of levees and pumps that provide controlled drainage for an area, allowing the area to remain dry under normal tidal conditions, even if the area is below sea level. Rainfall would continue to be pumped outside of the local forced drainage levee systems and into an area that would be surrounded by the proposed hurricane levee, leaving storage between the Federal and local levee systems. Impacts of the proposed Federal levee on the interior area were initially modeled using UNET (Unsteady flow through a NETwork of open channels). The purpose of the UNET model was to determine the relative change in water surface elevation between without and with project conditions. The only appreciable difference in water surface occurs when the levees are overtopped at the less frequent return intervals.

In the areas where natural drainage has been cut off by the proposed levees, environmental structures have been evaluated and sized using an ADH model for general flow patterns; designs were then refined using a HEC-RAS model. These models were used to assess rainfall and interior drainage on the protected side of the proposed hurricane levee system and the structures were sized to prevent induced ponding of any additional water during normal open operating conditions. The environmental structures are to be closed only during a tropical event that affects the local area. The proposed levee system will cause the water to remain in the system for a longer duration than without the proposed levee. The storage time of 7 days has been coordinated with the Habitat Environmental Team and the water in the system is fresh rather than saline. The environmental control structures cannot and are not intended to be operated to reduce rainfall-related damages.

In the areas not cut off by the proposed Federal levee, natural drainage is not affected and so no further studies or drainage improvements were considered. Given the large storage areas behind the Federal levee (e.g. Lake Boudreaux), and environmental control structures throughout the levee alignment, additional pumping capacity for rainfall is not needed.

15. IEPR Comment – Low Significance: The modeling documentation for the Post Authorization Change (PAC) document does not explain why the Dokka Real Time Kinematic (RTK) data are considered to be more accurate than the light detection and ranging (LIDAR) measurements prior to adjustment.

The panel experts recommended the following action to resolve this comment:

Information provided by the U.S. Army Corps of Engineers (USACE) (June 26, 2012)[a] in response to the Panel's questions should be included in the final USACE documents to improve the understanding and quality of the documents.

[a] "If there was an adjustment based on the [Louisiana State University Virtual Reference Station] surveys of roads and levees, then the motivation for that action would have been to convert the FEMA LIDAR data to 2004.65 epochs in the project area (Terrebonne Parish).

Louisiana State University ran an uncalibrated survey and had no metadata, survey report, or other supporting documentation for their survey. There was an effort to independently verify their survey and measure its accuracy relative to the 2004.65 epoch and potentially perform an adjustment to use in ADCIRC modeling. The conclusion was that in lower Terrebonne parish, the accuracy of the data was within the tolerance of the survey equipment used and the ADCIRC model, so no adjustment was suggested. (Other areas like East Jefferson and St. Charles were more suspect.) In effect, we were also implying that the data could be considered congruent with 2004.65 specifically in this region.

USACE Response: Adopted

Action Taken: The following text was added to the Hydrology, Hydraulics and Water Quality reference to the Engineering Appendix (Annex 1, Appendix A):
"There was an effort to independently verify their survey and measure its accuracy relative to the 2004.65 epoch and potentially perform an adjustment to use in ADCIRC modeling. The conclusion was that in lower Terrebonne Parish, the accuracy of the data was within the tolerance of the survey equipment used and the ADCIRC model, so no adjustment to the Dokka data was suggested."

16. IEPR Comment – Low Significance: The accuracy of the estimated highway and street flood monetary damages is uncertain because the basis of the estimate has not been described.

The panel experts recommended the following actions to resolve this comment:

a. Describe in the Economics Appendix the qualifications of the expert who provided the estimate of highway and street damages versus cost of repair.

USACE Response: Adopted

Action Taken: The road expert, who provided information for the streets and highways category, worked 28 years for the Louisiana Department of Transportation and Development (DOTD) and participated in the Roads and Streets Rebuilding Program following Hurricane Katrina. Since a primary focus of this analysis featured high-cost State highways, the Corps concluded the referenced expert was appropriate for addressing repair costs for this benefit category and further solicitations did not add significant value to the analysis relative to the resources required to obtain them. The valuation of each of the components of the streets and highways provided by the expert was similar to in-house USACE estimates developed for another large evaluation in coastal Louisiana. A brief statement on the expert's qualifications was added to the PAC Economic Appendix.

b. Obtain three additional estimates of highway and street cost of repairs, including from the State of Louisiana and from parish highway departments so that these benefit estimates are as credible as those for debris removal.

USACE Response: Not Adopted

Do to the relatively small percentage (less than 3%) of total damages and benefits for this infrastructure category and the confidence in the data provided by the road expert, solicitation of other experts is not deemed necessary.

17. IEPR Comment – Low Significance: The Post Authorization Change (PAC) document does not consider public access to, and recreational use of, the levees.

The panel experts recommended the following actions to resolve this comment:

a. Add a brief discussion in the PAC of the U.S. Army Corps of Engineers' (USACE's) intent to allow public access to the project levees.

USACE Response: Not Adopted

The topic of recreation was not addressed in the PAC report because it is already covered throughout the Revised PEIS and specifically in RPEIS sections 5.2.15 and 6.16. Public access is not a significant issue for the project since it will depend on whether the levees are on public or private lands and is not expected to change from current use.

b. Add a full discussion in the OSE of the miles of levees and likely levee segments that would be open for public access.

USACE Response: Not Adopted

Public access is not a significant issue for the project since it will depend on whether the levees are on public or private lands and is not expected to change from current use.

c. Add a list in the OSE of the public recreation activities that would be permitted (e.g., walking, biking, etc).

USACE Response: Not Adopted

The topic of recreation was not addressed in the PAC report because it is already covered throughout the Revised PEIS and specifically in RPEIS sections 5.2.15 and 6.16. RPEIS section 6.16.2 indicates that additional levees could be beneficial to recreation by providing new recreational opportunities such as the development of walking (and biking) trails along the levees that may connect with existing trails, however such opportunities are constrained by the fact that most of the levee alignment will abut private lands.

18. IEPR Comment – Low Significance: The Post Authorization Change (PAC) document does not discuss the desired final level of redundancy, resiliency, and robustness of the interfaces between structures, materials, or members.

The panel experts recommended the following action to resolve this comment:

Provide a discussion in the PAC or DEA, at an appropriate level of detail, of the desired or expected final level of redundancy, resiliency, and robustness of the interfaces between structures, materials, or members expected or intended for the alternatives, including the TSP.

USACE Response: Adopted

Action Taken: To emphasize that applying the HSDRRS guidelines provides the desired level of redundancy, resiliency, and robustness, section 1.5 of the PAC report was revised as follows:

"Several policy, procedural, and design criteria changes have been made since the 2002 Morganza to the Gulf Feasibility Report was completed. Lessons learned from Hurricane Katrina and other recent storms have been incorporated into new design guidelines referred to as the Hurricane and Storm Damage Risk Reduction System (HSDRRS) Design Guidelines (USACE, 2/2011). These guidelines were developed by members of the USACE, academia, and industry and have been peer reviewed. The Assistant Secretary of the Army (Civil Works) has required the HSDRRS guidelines to be applied to all hurricane levee system work in the New Orleans District, including the Morganza to the Gulf PAC project. The HSDRRS guidelines provide a comprehensive collection of best practices and were developed to provide redundancy, resiliency, and robustness of the interfaces between structures, materials, and members of the hurricane risk reduction system for the desired level of risk reduction. The HSDRRS guidelines are available at www.mvn.usace.army.mil/ENG/PageA.asp."

The HSDRRS guidelines include a detailed series of guidelines covering hydraulic design (surge elevations, allowable wave overtopping rates, wave forces, design loads and armoring), structural superiority, use of I-wall, T-wall and L-wall sections, lengths of L-wall and T-wall monoliths, load factors, connections, impact loads for designs, gate designs, etc. Section 5.6.9 of HSDRRS criteria contains the guidelines for levee tie-ins, transitions and scour protection. Typical tie-in sections and details and typical scour protection sections were also developed and included in the guidelines. These guidelines were used in the development of the designs for the levees, structures and transitions for the Morganza to the Gulf study.