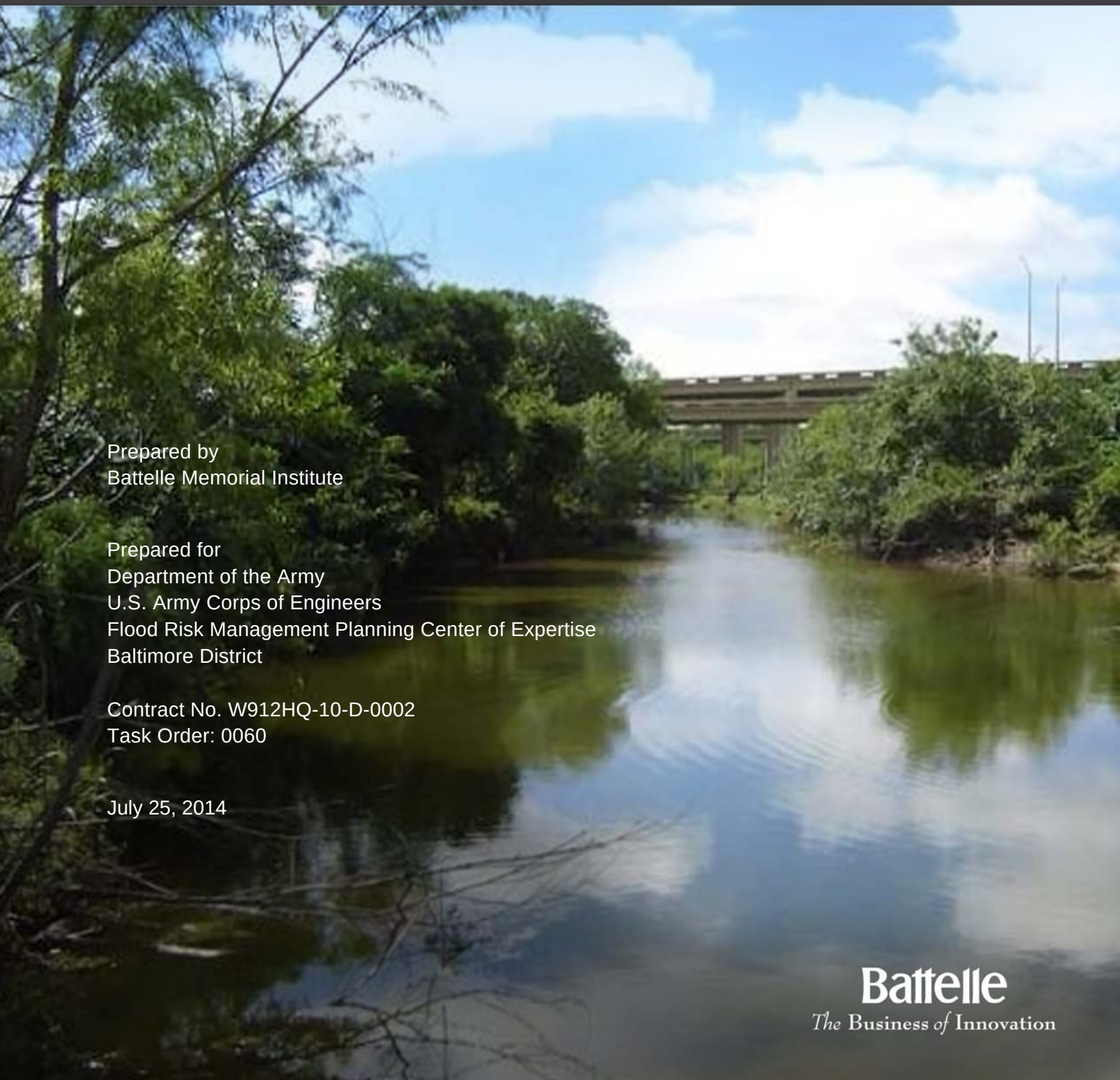
Final Independent External Peer Review Report
Manhattan, Kansas, Local Protection
Flood Risk Management Feasibility Study



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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Prepared by

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The U.S. Army Corps of Engineers (USACE) Kansas City District and the local project sponsor (City of Manhattan, Kansas) have conducted a feasibility study of the existing local protection project, which serves a highly developed area around downtown Manhattan, Kansas. This is a single purpose study focusing on flood risk management. The existing Manhattan, Kansas local protection project consists primarily of one levee unit and associated appurtenances. The levee unit withstood the Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levee may provide less than the authorized benefits for which it was designed.

The City of Manhattan is located in central Kansas, and lies at the confluence of the Big Blue River and the Kansas River. The Big Blue River is on the east side of the downtown area and connects to the Kansas River on the southeast side of the city. The Manhattan levee unit is located generally west and north of the confluence of the Big Blue River and the Kansas Rivers, and is approximately 28,850 feet long. The levee was typically constructed with a 10-foot crown width and three horizontal to one vertical embankment slopes. A limited number of major structural features are associated with this levee. The Corps of Engineers' Tuttle Creek Lake is situated just to the north of Manhattan with the Big Blue River flowing into and out of Tuttle Creek Lake. Tuttle Creek is a major lake in the Kansas River basin system of lakes, which are critical to the Corps' flood risk management mission for both the Kansas and Missouri Rivers.

The City of Manhattan, Kansas owns and operates the Manhattan, Kansas local protection project and is the local sponsor of this feasibility study. The City serves as the primary local point of contact for all community-related matters regarding this study. City staff work with the Corps of Engineers study team members on a routine basis and ensure that City and local considerations are taken into account as the study progresses. The feasibility study updated and verified data on the level of flood risk management provided by the existing project and developed alternative plans for increasing the reliability of the existing project. The current estimated costs for cost-shared alternative plans range from $15 to $40 million. This study is not designated as a SMART planning effort.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. USACE is conducting an Independent External Peer Review (IEPR) of the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study (hereinafter Manhattan, Kansas 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 (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Manhattan, Kansas Feasibility Study. The

IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) 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 Manhattan, Kansas review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: planning/ economics, environmental, structural/geotechnical engineering, hydrologic and hydraulic (H&H) engineering, and civil engineering/construction. USACE was given the list of candidate panel members, but Battelle selected the final five members of the Panel.

The Panel received an electronic version of the 574-page Manhattan, Kansas review documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

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

IEPR panel members reviewed the Manhattan, Kansas documents individually. 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, 8 Final Panel Comments were identified and documented. Of these, four had medium significance, and four had medium/low significance.

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, 2012; p. D-4) in the Manhattan, Kansas review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The Panel identified some elements of the project where additional analyses are warranted and places where clarification of project findings and objectives need to be documented in the DFR. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Planning/Economics: From a planning perspective, the without-project condition is realistic and the alternatives evaluated to reduce damages and flood risks are justified. The Panel noted that the DFR does not include information on whether additional alternatives were considered for the protection of the northern residential area, beyond the economically unfeasible levees under the 0.33 percent annual chance scenario. The Panel believes the project's plan formulation would benefit from a thorough evaluation of a variety of alternatives and levels of protection for the northern residential area.

Environmental: Overall, the report is well sourced and the modeling is done well. The Panel did have concerns that the hydrologic and hydraulic (H&H) models assume climate stationarity, i.e., that climate will remain constant over the course of the project planning window, despite there being a large amount of evidence that climate will change between 2023 and 2073. Although the specific changes in climate are difficult to predict, the H&H modeling should have accounted for this uncertainty rather than assuming stationarity. The Panel believes this issue can be resolved by developing plausible climate change scenarios and modeling flood discharge rates under these scenarios to determine how climate change may be expected to affect target levels of protection.

Structural/Geotechnical Engineering: The Panel was impressed by the level of detail in the existing condition structural and levee analyses and the evaluation used to determine the needed improvements. The Panel observed that the DFR does not include a comprehensive discussion of how and why the "as constructed" levee does not meet the original design assumptions. Providing this information would help communicate the reasons behind the underperformance of the original levee during the 1993 flood. The Panel suggests that a short paragraph containing this information could be added to the report.

H&H Engineering: Overall, the H&H team did outstanding work analyzing the complex and unique challenges of the study area, such as working with a regulated system, the confluence of two large rivers, and the flooding conditions. The Panel believes that the assumption of static hydrologic and hydraulic conditions during the project planning period (2023-2073) could be increasingly incorrect toward the end of the project planning period due to development pressures on any available tracts of open land, in addition to floodplain and vegetation encroachment issues. This issue can be resolved by performing a sensitivity analysis of plausible development scenarios and vegetation and floodplain encroachment conditions within and upstream of the study area to assess the potential impacts on the flood discharges and associated top of levee elevations. The Panel also noted that additional sensitivity analyses could be conducted to quantify the uncertainties associated with channel roughness and backwater effects from the downstream boundary conditions. Finally, the Panel believes that the DFR would benefit from discussion about the residual risk to the communities located downstream of the Tuttle Creek Dam, including (but not limited to) discussion about dewatering scenarios to communicate clearly the potential depths and duration of inundation should the levees overtop or breach.

Civil Engineering/Construction: The Panel observed that the alternative screening process is not described well, noting that the DFR would benefit from supporting documentation for why various alternatives (e.g., channel widening modification, channel vegetation clearing, and operational changes) were eliminated. In addition, the Panel found that the comparison of the final array of alternatives (as provided in DFR Enclosure 5) does not compare the impact of construction for the various alternatives, or discuss construction differences among the preliminary alternatives screened. The completeness of the DFR would be improved by adding this construction-related information.

Table ES-1. Overview of Eight Final Panel Comments Identified by the Manhattan, Kansas IEPR Panel

No.	Final Panel Comment
Medium – Significance	
1	The alternatives analysis is not fully documented, and a justification for screening out some alternatives is not presented.
2	The modeling unrealistically assumes there will be no measureable effect on hydrology and hydraulics from development during the project planning window (2023-2073) between the existing and the future with-project conditions.
3	The modeling unrealistically assumes that there will be no measureable effect on hydrology and hydraulics from climate change during the project planning window (2023-2073) between the existing and the future with-project conditions.
4	The uncertainty associated with the hydrology and hydraulics modeling, which is important for determining if the specified level of protection will be achieved (particularly toward the end of the planning period), is insufficient and/or not adequately expressed.
Medium/Low – Significance	
5	Other levels of protection for the northern residential area and potentially feasible alternatives are not considered or documented, except for one levee alternative, which was not feasible.
6	Residual risks as a result of the recommended plan are not fully discussed.
7	The differences in construction impact for the alternatives are not described in the screening process.
8	The failure of the existing levee design is not discussed, particularly the reasons why the existing levee unit failed to meet its original design requirements.

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LIST OF ACRONYMS

ATR	Agency Technical Review
COI	Conflict of Interest
DFR	Draft Feasibility Report
DrChecks	Design Review and Checking System
EC	Engineer Circular
ERDC	Engineer Research and Development Center
H&H	hydrology and hydraulics
IEPR	Independent External Peer Review
NEPA	National Environmental Policy Act
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
USACE	United States Army Corps of Engineers

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) Kansas City District and the local project sponsor (City of Manhattan, Kansas) have conducted a feasibility study of the existing local protection project, which serves a highly developed area around downtown Manhattan, Kansas. This is a single purpose study focusing on flood risk management. The existing Manhattan, Kansas local protection project consists primarily of one levee unit and associated appurtenances. The levee unit withstood the Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levee may provide less than the authorized benefits for which it was designed.

The City of Manhattan is located in central Kansas, and lies at the confluence of the Big Blue River and the Kansas River. The Big Blue River is on the east side of the downtown area and connects to the Kansas River on the southeast side of the city. The Manhattan levee unit is located generally west and north of the confluence of the Big Blue River and the Kansas Rivers, and is approximately 28,850 feet long. The levee was typically constructed with a 10-foot crown width and three horizontal to one vertical embankment slopes. A limited number of major structural features are associated with this levee. The Corps of Engineers' Tuttle Creek Lake is situated just to the north of Manhattan with the Big Blue River flowing into and out of Tuttle Creek Lake. Tuttle Creek is a major lake in the Kansas River basin system of lakes, which are critical to the Corps' flood risk management mission for both the Kansas and Missouri Rivers.

The City of Manhattan, Kansas owns and operates the Manhattan, Kansas local protection project and is the local sponsor of this feasibility study. The City serves as the primary local point of contact for all community-related matters regarding this study. City staff work with the Corps of Engineers study team members on a routine basis and ensure that City and local consideration are taken into account as the study progresses. The feasibility study updated and verified data on the level of flood risk management provided by the existing project and developed alternative plans for increasing the reliability of the existing project. The current estimated costs for cost-shared alternative plans range from $15 to $40 million. This study is not designated as a SMART planning effort.

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 Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study (hereinafter Manhattan, Kansas IEPR) in accordance with procedures described in the Department of the Army, USACE, Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012) and the Office of Management and Budget (OMB) bulletin *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 Manhattan, Kansas IEPR documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted. 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 on July 22, 2014.

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 (ATR), as described in USACE (2012).

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 the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Manhattan, Kansas project was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). 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. Table 1 presents the major milestones and deliverables of the Manhattan, Kansas IEPR. Due dates for milestones and deliverables are based on the award/effective date of March 10, 2014. Note that the work items 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 August 20, 2014. The actual date for contract end will depend on the date that all activities for this IEPR, including Civil Works Review Board (CWRB) preparation and participation, are completed.

Table 1. Major Milestones and Deliverables of the Manhattan, Kansas IEPR

Task	Action	Due Date
1	Award/Effective Date	3/10/2014
	Review documents available	6/16/2014
2	Battelle submits list of selected panel members	3/24/2014
	USACE confirms the panel members have no COI	3/26/2014
3	Battelle convenes kick-off meeting with USACE	3/17/2014
	Battelle convenes kick-off meeting with USACE and panel members	6/19/2014
4	Panel members complete their individual reviews	7/1/2014
	Panel members provide draft Final Panel Comments to Battelle	7/14/2014

Table 1. Major Milestones and Deliverables of the Manhattan, Kansas IEPR (continued)

Task	Action	Due Date
5	Battelle submits Final IEPR Report to USACE	7/25/2014
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	8/12/2014
	Battelle submits pdf printout of DrChecks project file to USACE	8/20/2014
	CWRB Meeting (Estimated Date)[b]	TBD
	Contract End/Delivery Date	2/28/2015

[a] *Task 6 occurs after the submission of this report.*

[b.] *The CWRB meeting was listed in the Performance Work Statement under Task 3 but was relocated in this schedule to reflect the chronological order of activities.*

Battelle identified, screened, and selected five panel members to participate in the IEPR based on their expertise in the following disciplines: planning/economics, environmental, structural/geotechnical engineering, hydrology and hydraulic (H&H) engineering, and civil engineering/construction. The Panel reviewed the Manhattan, Kansas review documents and produced eight Final Panel Comments in response to 38 charge questions provided by USACE for the review. This charge included two questions added by Battelle that sought summary information from the IEPR Panel. 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 1165-2-214, Appendix D), 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, 2012; p. D-4) in the Manhattan, Kansas IEPR review document. The following summarizes the Panel's findings.

Based on the Panel's review, the Manhattan, Kansas Local Protection Project, Section 216 Feasibility Study, Draft Feasibility Report (DFR) is well-written and effectively describes the planning and decision-making process for this project. The Panel identified some elements of the project where additional analyses are warranted and places where clarification of project findings and objectives need to be documented in the DFR.

Planning/Economics: From a planning perspective, the without-project condition is realistic and the alternatives evaluated to reduce damages and flood risks are justified. The Panel noted that the DFR does not include information on whether additional alternatives were considered for the protection of the northern residential area, beyond the economically unfeasible levees under the 0.33 percent annual chance scenario. The Panel believes the project's plan formulation would benefit from a thorough evaluation of a variety of alternatives and levels of protection for the northern residential area.

Environmental: Overall, the report is well sourced and the modeling is done well. The Panel did have concerns that the hydrologic and hydraulic (H&H) models assume climate stationarity, i.e., that climate will remain constant over the course of the project planning window, despite there being a large amount of evidence that climate will change between 2023 and 2073. Although the specific changes in climate are difficult to predict, the H&H modeling should have accounted for this uncertainty rather than assuming stationarity. The Panel believes this issue can be resolved by developing plausible climate change scenarios and modeling flood discharge rates under these scenarios to determine how climate change may be expected to affect target levels of protection.

Structural/Geotechnical Engineering: The Panel was impressed by the level of detail in the existing condition structural and levee analyses and the evaluation used to determine the needed improvements. The Panel observed that the DFR does not include a comprehensive discussion of how and why the "as constructed" levee does not meet the original design assumptions. Providing this information would help communicate the reasons behind the underperformance of the original levee during the 1993 flood. The Panel suggests that a short paragraph containing this information could be added to the report.

H&H Engineering: Overall, the H&H team did outstanding work analyzing the complex and unique challenges of the study area, such as working with a regulated system, the confluence of two large rivers, and the flooding conditions. The Panel believes that the assumption of static hydrologic and hydraulic conditions during the project planning period (2023-2073) could be increasingly incorrect toward the end of the project planning period due to development pressures on any available tracts of open land, in addition to floodplain and vegetation encroachment issues. This issue can be resolved by performing a sensitivity analysis of plausible development scenarios and vegetation and floodplain encroachment conditions within and upstream of the study area to assess the potential impacts on the flood discharges and associated top of levee elevations. The Panel also noted that additional sensitivity analyses could be conducted to quantify the uncertainties associated with channel roughness and backwater effects from the downstream boundary conditions. Finally, the Panel believes that the DFR would benefit from discussion about the residual risk to the communities located downstream of the Tuttle Creek Dam, including (but not limited to) discussion about dewatering scenarios to communicate clearly the potential depths and duration of inundation should the levees overtop or breach.

Civil Engineering/Construction: The Panel observed that the alternative screening process is not described well, noting that the DFR would benefit from supporting documentation for why various alternatives (e.g., channel widening modification, channel vegetation clearing, and operational changes) were eliminated. In addition, the Panel found that the comparison of the final array of alternatives (as

provided in DFR Enclosure 5) does not compare the impact of construction for the various alternatives, or discuss construction differences among the preliminary alternatives screened. The completeness of the DFR would be improved by adding this construction-related information.

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 alternatives analysis is not fully documented, and a justification for screening out some alternatives is not presented.

Basis for Comment

The process to arrive at the recommended plan should clearly describe the screening process in detail in order to ensure that the plan formulation has looked at all potentially viable ways to reduce the risk to life and property per the original Congressional mandate in 1954 and Section 216. Numerous potential alternatives have been considered during the plan formulation (DFR, Section E) using a 50-year period of analysis. The criteria used to screen the alternatives are presented in the DFR, Section C2.0. The description of the screening process, however, does not provide sufficient explanation or supporting documentation as to why various alternatives were eliminated. In addition, the same criteria have not been used when comparing all the considered alternatives.

The following are examples of alternatives eliminated without sufficient explanation:

- Channel Widening Modification: dredging with sediment removal and reestablishment of the channel profile to pre-1963 conditions
- Clearing Vegetation from Channel: to reduce the "n" value to 1963 design assumptions
- Multiple Flood Protection Alternatives for Northern Residential Area: to include analysis of flood events at 1% ACE and higher
- Armoring of the Protected Side of the Manhattan Levee Unit: to prevent scour should an overtopping event occur
- Operational Changes: in phased releases from Tuttle Creek Dam when those releases exceed 35,000 fps or higher to minimize flooding risks downstream

The features of the recommended plan may remain the same regardless of these alternatives.

Significance – Medium

Additional documentation that explains the reasoning for screening out the preliminary alternatives could improve understanding of the process of selecting the recommended plan.

Recommendation for Resolution

1. Add a table similar to DFR, Enclosure 5 (dated February 2014), Final Alternatives Array - Evaluation Criteria and Comparison Matrix, that displays all preliminary alternatives considered in the DFR using the same criteria to document fully the analysis performed.
2. Include a discussion in the DFR that explains why preliminary alternatives identified in the preliminary stages were eliminated from further consideration.

Final Panel Comment 2

The modeling unrealistically assumes there will be no measureable effect on hydrology and hydraulics from development during the project planning window (2023-2073) between the existing and the future with-project conditions.

Basis for Comment

The modeling used in the design of the existing flood-risk management system appears to have assumed static hydrologic and hydraulic conditions during the lifespan of the project. This assumption was proven incorrect during the 1993 flood event. The modeling efforts completed in support of the DFR appear to be more comprehensive than previous model efforts, and the design assumptions will likely be reasonably correct at the beginning of the project planning period (i.e., 2023). However, the DFR, Section III.F, indicates that the population growth and development within and around the general study area continues to result in pressure for development of any available tracts of open land. Therefore, the assumption of static hydrologic and hydraulic conditions could be increasingly incorrect toward the end of the project planning period (i.e., 2073) due to development pressures.

In addition, FEMA typically allows fill within the fringe of the regulatory floodplain (i.e., the 1% chance floodplain) with up to a 1-foot increase in ground-surface elevation. This filling could occur and reduce the conveyance capacity of the assumed cross sections within and downstream of the study area. The resulting reduction in conveyance capacity would lead to an increase in flood elevations over time for a given event, thus reducing the level of flood-risk protection.

Furthermore, if the trend of additional vegetation growth continues within or downstream of the study area, as described in the DFR, Section II.D, channel and/or floodplain roughness could increase and there is the potential for the project to not meet the design intent toward the end of the project planning window because of a potential increase in design flood profiles.

Significance – Medium

Changes to the level of protection from the beginning of the project planning window (i.e., 2023) to the end of the project planning window (i.e., 2073) as a result of development conditions are not reflected in the future with-project conditions analysis.

Recommendation for Resolution

1. Perform a sensitivity analysis of plausible development scenarios within and upstream of the study area to assess the potential impacts on the flood discharges and associated top of levee elevations.
2. Expand the sensitivity analysis, including vegetation and floodplain encroachment conditions, within the hydraulic model reach to assess the potential impacts on the design flood elevations, top of levee elevations, and risk and uncertainty analysis.

Final Panel Comment 3

The modeling unrealistically assumes that there will be no measureable effect on hydrology and hydraulics from climate change during the project planning window (2023-2073) between the existing and the future with-project conditions.

Basis for Comment

The hydrologic and hydraulic models assume climate stationarity, i.e., that climate will remain constant over the course of the project planning window. This conclusion is reached after a brief discussion of model results that predict a trend toward wetter conditions over the project planning window (NOAA, 2013) and an independent analysis of historical data that shows some trends toward smaller magnitude inflows to Tuttle Creek Lake. Given this apparent conflict between model results and historic data, the potential effects of climate change are assumed negligible and are instead folded into standard estimates of uncertainty.

The Panel finds this analysis insufficient, as there is ample evidence that climate will change over the course of the project planning window. The direction and magnitude of these changes are hard to predict, and the effects of interactions between these changes – both positive and negative – are even harder to predict. Nevertheless, numerous climate change scenarios include substantial increases in annual rainfall (USACE, 2013) and in the frequency and magnitude of high intensity rainfall events (NOAA, 2013).

Singularly or in combination with one another, these and related changes could substantially increase the frequency and magnitude of flood flows, particularly by the end of the project planning window. Therefore, the hydrologic and hydraulic models could be expected to have increasingly large uncertainties by 2073 (e.g., Wuebbles and Hayhoe, 2004).

Significance – Medium

Changes to the level of protection from the beginning of the project planning window (i.e., 2023) to the end of the project planning window (i.e., 2073) as a result of climate change are not reflected in the future with-project conditions analysis.

Recommendation for Resolution

1. Conduct a more thorough analysis of the existing literature on climate change in the Midwest U.S.
2. Develop a manageable number of plausible climate-change scenarios as they affect flood discharge rates (e.g., best-case, worst-case, and expected scenarios).
3. Model flood discharge rates at the beginning of the project planning window to provide a baseline condition and then under each scenario at the end of the project planning window (i.e., 2073) to determine the extent to which climate change could plausibly be expected to affect target levels of protection.

Literature Cited:

NOAA (2013). Regional Climate Trends and Scenarios for the U.S. National Climate Assessment, Part 3: Climate of the Midwest US. NOAA Technical Report NESDIS 142-3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Washington, D.C.

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USACE (2013). Climate Change Impacts on USACE Water Supply Reservoirs: A Pilot Study of the Marion Reservoir Watershed in Kansas. U.S. Army Corps of Engineers, Institute for Water Resources. August.
http://www.corpsclimate.us/docs/Marion_Reservoir_Pilot_Study_(Aug_2013_Final).pdf

Wuebbles, D.J., and Hayhoe, K. (2004). Climate change projections for the United States Midwest. Mitigation and Adaptation Strategies for Global Change, 9(4):335-363.

Final Panel Comment 4

The uncertainty associated with the hydrology and hydraulics modeling, which is important for determining if the specified level of protection will be achieved (particularly toward the end of the planning period), is not thoroughly quantified.

Basis for Comment

There is uncertainty associated with all hydrologic and hydraulic modeling. Such uncertainty can result from numerous factors, including regional factors (e.g., uncertainty about future climate) and local factors (e.g., uncertainty about future channel roughness). With the proposed project being located at the confluence of two major rivers, there are inherent uncertainties about the frequencies, magnitudes, timings, and durations of flood flows on each river, as well as uncertainties about the potential backwater effects on the immediately upstream reaches on both rivers.

The previous model results were incorrect, as shown during the 1993 flood event, which the DFR partly attributes to changes in channel roughness. The newer model results are undoubtedly better. Still, uncertainty remains.

Sensitivity analyses are commonly used to quantify uncertainty in similar modeling efforts. Although some sensitivity analyses have been conducted here, they were conducted only on the Big Blue River and were focused on uncertainty in inflows alone. These sensitivity analyses failed to adequately account for other sources of uncertainty that may be more important in determining the level of reach-scale flood protection, such as channel roughness and backwater effects from the downstream boundary conditions.

Significance – Medium

There may be substantial uncertainty associated with the hydrology and hydraulics modeling that is not thoroughly reported, making risk-based decision-making difficult.

Recommendation for Resolution

1. Expand the uncertainty analyses to include potential key sources of uncertainty, including, but not necessarily limited to, potential differences in channel roughness and backwater effects from the downstream backwater effect.
2. Clearly report the uncertainty in the DFR to better facilitate risk-based decision-making.

Final Panel Comment 5

Other levels of protection for the northern residential area and potentially feasible alternatives are not considered or documented, except for one levee alternative, which was not feasible.

Basis for Comment

The DFR concludes that implementation of the recommended plan for the City of Manhattan would incur an insignificant amount of induced damage to the northern residential area, and therefore no mitigation is required. However, the DFR includes a separate analysis of inundation reduction for the northern area, which identified only one alternative (levees), later determined not to be economically feasible.

The Panel believes that plan formulation for the northern area should have been consistent with the way all water resources projects are formulated, that is, that all reasonable alternatives should be considered prior to concluding that no project is economically feasible. Without the evaluation of alternatives and varying levels of protection for the northern area, the plan formulation for that area is not complete. If other alternatives were considered, the documentation is not provided in the DFR. Other potential alternatives to consider for evaluation include widening and clearing of the Big Blue River, modification to flow discharges/operations at Tuttle Creek Dam, armoring the channel and landside to prevent scour, and nonstructural alternatives.

In addition, the levees considered for the northern area are only considered for the 0.33 percent annual chance event. Lesser levels of protection such as the 1.0 percent annual chance event are not discussed in the report and may be feasible either for the levee alternative or other potential alternatives.

Significance – Medium/Low

Additional evaluation of inundation reduction alternatives and varying levels of protection could potentially result in a feasible solution for the northern residential area.

Recommendation for Resolution

1. Conduct an evaluation of other alternatives for the northern residential area or document that other alternatives were evaluated to establish whether any of the alternatives to reduce flooding are potentially feasible.

Final Panel Comment 6

Residual risks as a result of the recommended plan are not fully discussed.

Basis for Comment

The documents provided to the Panel include a discussion about Tuttle Creek Dam and its influence on the discharges in the Big Blue River adjacent to the proposed project location. However, the residual risk discussion in the DFR, Section I, does not include any mention of the potential residual risk to the community of being located downstream of the dam. Without explicit mention of the residual risk, it is possible that the community could potentially assume that the levee system improvements would protect the community in the event of a dam failure.

In addition, should the levee be overtopped and/or breached during the design event (i.e., 0.33% ACE), there is limited information presented concerning the potential flood depths or the time required to remove the floodwaters on the landward side of the levee system. A projection (DFR, p. 65) simply states, "Prohibitive depths of water would likely remain inside the levees for several weeks."

Significance – Medium/Low

Adding some discussion about the topics mentioned above would improve the overall completeness of the report because the DFR, Section I, does not include any mention of the potential residual risk to the community of being located downstream of the dam.

Recommendation for Resolution

1. Add a brief discussion concerning the residual risks associated with being located downstream of the Tuttle Creek dam and how the proposed improvements may or may not reduce the risk.
2. Enhance the discussion related to potential dewatering scenarios so the local community understands the potential depths and duration of inundation should the levee overtop and/or breach.

Final Panel Comment 7

The differences in construction impact from the alternatives are not described in the screening process.

Basis for Comment

The Panel found that DFR Enclosure 5, a comparison of the final array of alternatives, does not compare the impact of construction for the various alternatives, or discuss construction differences among the preliminary alternatives screened.

In addition, the Panel found no detailed explanation as to why three construction contracts are currently proposed for the recommended plan, and whether the logic for separating the construction into three contracts would be the same for the other alternatives.

Finally, the DFR provides a general discussion of a significant construction effort completed by the local sponsor in 2012 along the Big Blue levee segment without explaining why this was required. The fundamental reason for the construction effort could have an impact, direct or indirect, on any of the alternatives considered. A clear explanation of the need for the requirement is important to the overall analysis and the screening process.

Significance – Medium/Low

Comparing critical criteria like construction impacts for alternatives can have a material impact on the ultimate cost of any solution proposed for this area.

Recommendation for Resolution

1. Provide additional explanation of the construction impacts for each of the alternatives considered, similar to the presentation in DFR Enclosure 5.
2. Explain the need for the Big Blue levee segment construction effort and its impact, if any, on any of the alternatives considered.

Final Panel Comment 8

The failure of the existing levee design is not discussed, particularly the reasons why the existing levee unit failed to meet its original design requirements.

Basis for Comment

The Panel could not locate a comprehensive discussion of how and why the “as constructed” levee does not meet the original design assumptions. There is some discussion in Section I.B of the Draft Feasibility Report as well as Engineering Appendix Volume 1, Section 1.3, about the peak flows in 1993 and the design peak flows and in Section 3.2.2, about how the levee performed from a geotechnical perspective in the 1993 flood. It is important to understand the reasons behind the underperformance of the original levee during the 1993 flood since the assumptions and methods used to compute the original flow line may have been incorrect, or the long-term settlement of the embankment and/or foundation may have had an effect.

Significance – Medium/Low

A complete discussion of the reasons why the existing levee does not meet the original design requirements would help in understanding the deficiencies experienced in the 1993 flood event and, in turn, assessing the methods, models, and analyses used to remedy future such events.

Recommendation for Resolution

1. Add a paragraph that discusses the failure of the existing levee design to perform as it was expected to in the 1993 flood to Part 1, Volume 1 of the Engineering Appendix Report.

5. REFERENCES

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Wuebbles, D.J., and Hayhoe, K. (2004). Climate change projections for the United States Midwest. Mitigation and Adaptation Strategies for Global Change, 9(4):335-363.

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APPENDIX A

IEPR Process for the Manhattan, Kansas Project

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

Table A-1 presents the schedule followed in executing the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study Independent External Peer Review (hereinafter: Manhattan, Kansas IEPR). Due dates for milestones and deliverables are based on the award/effective date of March 10, 2014. The review documents were provided by U.S. Army Corps of Engineers (USACE) on June 16, 2014. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the eight Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that 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.

Table A-1. Manhattan, Kansas Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	3/10/2014
	Review documents available	6/16/2014
	Battelle submits draft Work Plan[a]	3/18/2014
	USACE provides comments on draft Work Plan	3/21/2014
	Battelle submits final Work Plan[a]	7/22/2014
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	3/17/2014
	USACE provides comments on COI questionnaire	3/19/2014
	Battelle submits list of selected panel members[a]	3/24/2014
	USACE confirms the panel members have no COI	3/26/2014
	Battelle completes subcontracts for panel members	4/9/2014
3	Battelle convenes kick-off meeting with USACE	3/17/2014
	Battelle sends review documents to panel members	6/17/2014
	Battelle convenes kick-off meeting with panel members	6/19/2014
	Battelle convenes kick-off meeting with USACE and panel members	6/19/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	6/25/2014
4	Panel members complete their individual reviews	7/1/2014
	Battelle provides panel members with talking points for Panel Review Teleconference	7/3/2014
	Battelle convenes Panel Review Teleconference	7/7/2014

Table A-1. Manhattan, Kansas Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Battelle provides Final Panel Comment templates and instructions to panel members	7/7/2014
	Panel members provide draft Final Panel Comments to Battelle	7/14/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	7/14-21/2014
	Panel finalizes Final Panel Comments	7/21/2014
5	Battelle provides Final IEPR Report to panel members for review	7/22/2014
	Panel members provide comments on Final IEPR Report	7/24/2014
	Battelle submits Final IEPR Report to USACE[a]	**7/25/2014**
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	7/28/2014
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	7/22/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	7/22/2014
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	7/31/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	8/1/2014
	Panel members provide Battelle with draft BackCheck Responses	8/6/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	8/7/2014
	Battelle convenes Comment-Response Teleconference with panel members and USACE	8/12/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	8/14/2014
	Battelle provides final PDT Evaluator Responses to panel members	8/15/2014
	Panel members provide Battelle with final BackCheck Responses	8/19/2014
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	8/20/2014
	Battelle submits pdf printout of DrChecks project file[a]	8/20/2014
	CWRB Meeting (Estimated Date)[c]	TBD
	Contract End/Delivery Date	2/28/2015

[a] *Deliverable.*
[b] *Task 6 occurs after the submission of this report*
[c] *The CWRB 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 Manhattan, Kansas 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., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 36 charge questions were provided by USACE and included in the draft and final Work Plans. Battelle added two questions that seek summary information from the IEPR Panel. The final charge also included 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, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which 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 Manhattan, Kansas review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Manhattan, Kansas Local Protection Project Section 216 Feasibility Study: Draft Feasibility Report (92 pages)**
- **Draft Environmental Assessment and Finding of No Significant Impact (114 pages)**
- **Engineering Appendix, Volume 1: Existing Conditions Engineering Analysis (115 pages)**
- **Engineering Appendix, Volume 2: Alternatives Engineering (165 pages)**
- **Economics Appendix (55 pages)**
- **Real Estate Appendix (33 pages)**
- Cost Engineering Appendix (28 pages)
- USACE guidance *Civil Works Review*, (EC 1165-2-214, 15 December 2012)
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

About halfway through the review of the Manhattan, Kansas IEPR documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 21 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or later that day via email. The Panel also submitted 11 additional clarifying questions during the Final Panel Comment development process. USACE provided responses to those additional questions three days later.

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.

- Manhattan, KS Levee System - Feasibility Study – Hydraulic Analysis (November 2007)

- Kansas River Basin Hydrology with special attention to Kansas River Hydrology near Topeka, KS (March 2002)
- Manhattan Levee – Peer Review of UNET Model Results (January 2009)
- Curve Breakdowns, Summary Values
- Enclosures 1, 2, 3, 4, and 5 to the Manhattan, Kansas Local Protection Project Section 216 Feasibility Study: Draft Feasibility Report.

A.2 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced individual comments in response to the charge questions/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 in a preliminary list of 11 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

A.3 IEPR Panel Teleconference

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

The Panel also discussed responses to two specific charge questions where there appeared to be disagreement among panel members. The conflicting comments were resolved based on the professional judgment of the Panel, and all sets of comments were determined not to be conflicting. Each comment was either incorporated into a Final Panel Comment, determined to be consistent with other Final Panel Comments already developed, or determined to be a non-significant issue.

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

A.4 Preparation of Final Panel Comments

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

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.

- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel member as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.

- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:

  1. Comment Statement (succinct summary statement of concern)

  2. Basis for Comment (details regarding the concern)

  3. Significance (high, medium/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:** Describes a fundamental issue with the project that affects the current recommendation or justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a “showstopper” issue.

  2. **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the Planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the Planning process and has determined that if the issue is not addressed, it could lead to a “showstopper” issue.

  3. **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the Planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.

  4. **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.

5. **Low:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

- 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, eight 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 Final Panel Comments are presented in the main report.

APPENDIX B

Identification and Selection of IEPR Panel Members
for the Manhattan, Kansas Project

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B.1 Panel Identification

The candidates for the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study (hereinafter: Manhattan, Kansas IEPR) Panel were evaluated based on their technical expertise in the following key areas: planning/economics, environmental, structural/geotechnical engineering, hydrologic and hydraulic (H&H) engineering, and civil engineering/construction. These areas correspond to the technical content of the Manhattan, Kansas IEPR review documents and overall scope of the Manhattan, Kansas 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 five experts for the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

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

- Previous and/or current involvement by you or your firm[2] in the Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study
- Previous and/or current involvement by you or your firm[2] in flood risk management or feasibility study projects in highly developed urban areas.
- Previous and/or current involvement by you or your firm[2] in the Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study-related projects.
- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operation and maintenance of any projects in the Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study-related projects.
- Current employment by the U.S. Army Corps of Engineers (USACE).

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

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

- Previous and/or current involvement with paid or unpaid expert testimony related to Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study.
- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors (for pay or pro bono) including the city of Manhattan, Kansas.
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the City of Manhattan, Kansas.
- 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, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Kansas City District.
- Previous or current involvement with the development or testing of models (including HEC models) that will be used for or in support of the Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study project.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Kansas City 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 Kansas City District. Please explain.
- Current or previous affiliation with any business, firm, local governmental entity, educational institution, nonprofit organization or community association currently located or seeking to develop, buy, finance, locate, or otherwise affect land or property development within the City of Manhattan and the surrounding Kansas counties.
- Any previous employment by USACE as a direct employee, notably if employment was with the Kansas City District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Any previous employment by USACE as a contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Kansas City District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning flood management, and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study project related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the non-Federal sponsor (city of Manhattan, KS).
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study project.
- Participation in relevant prior and/or current Federal studies relevant to this project and/or Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study project.

- Previous and/or current participation in prior non-Federal studies relevant to this project and/or Manhattan, Kansas Local Protection Flood Risk Management Feasibility Study project.

Other considerations:

- Participation in previous USACE technical review panels
- Other technical review panel experience.

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. The five final reviewers were either affiliated with consulting companies or were independent consultants. 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.

An overview of the credentials of the final five members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table B-1. More detailed biographical information regarding each panel member and his area of technical expertise is presented in Section B.3.

Table B-1. Manhattan, Kansas IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Shoudy	Rains	Fleming	Sobiech	Fowler
Planning/Economics					
Minimum 15 years' demonstrated experience in economics	X				
Minimum 15 years' expertise in flood risk management analysis and benefits calculations, including:	X				
flood risk management problem identification	X				
solution development for major river watersheds and the associate urban area	X				
Direct experience working for or with USACE	X				
Familiarity with USACE flood risk management analysis and economic benefit calculations (NED Evaluations)	X				
Experience with the use of standard USACE computer programs included HEC-FDA	X				
Familiarity with USACE plan formulation process, procedures, and standards as they relate to flood risk management.	X				
Minimum 5 years' experience with the USACE six-step planning process (governed by ER 1105-2-100) Planning Guidance Notebook	X				
Experience evaluating levee raising projects near urban areas preferred	X				
Active participation in related professional societies	X				
Bachelor's degree or higher in economics	X				
Environmental Review					
Minimum 15 years' experience directly related to assessing environmental impacts and NEPA compliance		X			
Expertise in environmental regulations with NEPA, CWA, FWCA, and ESA		X			
Familiarity with Midwestern U.S. river ecology		X			
Familiarity with changes in river function and processes resulting from the implementation of flood risk management measures.		X			
M.S. degree or higher in a related field		X			
Structural/Geotechnical Engineering					
Minimum 15 years' experience in engineering			X		
Demonstrated extensive experience in geotechnical evaluation of flood risk management structures including:			X		
static and dynamic slope stability evaluation			X		
evaluation of seepage through earth foundations of large urban levees.			X		
Experience with all phases of alternatives development and evaluation			X		
Capable of addressing the USACE SAR aspects of all projects			X		

Technical Criterion	Shoudy	Rains	Fleming	Sobiech	Fowler
Active participation in related professional engineering and scientific societies encouraged			X		
Licensed professional engineer			X		
Hydrology and Hydraulic Engineering					
Minimum 15 years' experience in hydrologic and hydraulic engineering				X	
Familiarity with large basin hydrology modeling, reservoir discharge-frequency evaluation				X	
Familiarity with the geometry and layout of urban levee systems				X	
Experience in the evaluation of residual and induced damages resulting from implementing flood risk management measures				X	
Experience in the application, evaluation, and modeling of both structural and nonstructural flood risk management measures including:				X	
levee system layout and modifications				X	
flood warning systems				X	
flood proofing				X	
Proficiency with HEC models, in particular, HEC-RAS				X	
Active participation in related professional societies				X	
Licensed professional engineer				X	
M.S. degree or higher in engineering				X	
Civil Engineering/Construction					
Minimum 15 years' experience in civil engineering and construction					X
Extensive experience in the design and construction of large earthen structures used in flood risk management applications					X
Ability to review for constructability issues within urban areas preferred					X
Ability to review for modification of large civil works structures preferred					X
Ability to address the USACE SAR aspects of all projects					X
Licensed professional engineer					X

B.3 Panel Member Qualifications

Harry Shoudy

Role: Planning/economics experience and expertise.
Affiliation: Independent Consultant

Harry Shoudy is an independent consultant with more than 40 years of water resources planning, plan formulation, policy, and economics experience with more than 32 years of that experience with USACE. He earned an M.S. in water resources planning from Colorado State University in 1980. In addition, he is a graduate of the USACE Executive Development Program and completed a 4-month executive development assignment as Acting Assistant Deputy Assistant Secretary of the Army (Civil Works). Before forming his consulting firm in 2003, he served in a dual assignment as Chief Economist and Senior Policy Advisor for USACE. During his career, he has served as Senior Economic and Policy Advisor for the Board of Engineers for Rivers and Harbors; Chief of Economics in USACE, South Atlantic Division; Chief of Economics in USACE, Buffalo District; and an economist with the New York State Environmental Conservation Department.

Mr. Shoudy has more than 40 years of experience and expertise in flood risk management analysis and benefit calculations. He is familiar with USACE structural flood risk management problem identification and solution development, including channel improvements, flood walls, levees, dams, diversion channels, and bridge replacements/modifications, as well as nonstructural flood risk management projects. He also has extensive experience in evaluating and reviewing complex multi-objective riverine and coastal flood damage reduction projects throughout the United States as a division and Headquarters level project reviewer. As a result of his extensive flood damage reduction expertise, he was selected to represent USACE on the interagency White House task force directed by General Galloway after the 1993 flood on the Mississippi River Basin. He is familiar with USACE flood risk management analysis and national economic development (NED) benefit calculations as were applied in the Rio Puerto Nuevo flood control feasibility study and project. In addition to attending training courses at HEC, he has also reviewed numerous flood control reports that have applied HEC-FDA. Example studies include the Las Vegas Wash and West Sacramento flood control feasibility studies. He also participated in the development and application of a national evaluation model for shore protection projects applying HEC-FDA as a starting point.

In addition, Mr. Shoudy is familiar with the USACE plan formulation process, procedures, and standards as they relate to flood risk management. He has participated in the formulation of flood damage reduction projects and reviewed flood damage projects for consistency with the formulation process, standards, and procedures. He has extensive experience dealing with the USACE planning process and has actively planned projects and performed economic analyses under Principles and Standards, Principles and Guidelines, and ultimately their inclusion into ER 1105-2-100, Planning Guidance Notebook. He has used the USACE six-step planning process for numerous planning studies and reviews of planning studies throughout his water resources planning career. As a Senior Policy Advisor for USACE Headquarters, he was involved in national policy development that was incorporated into revisions to the Planning Guidance Notebook.

Mr. Shoudy is active in professional engineering and scientific societies and has participated in a professional capacity with the American Shore and Beach Preservation Association prior to and after his retirement from USACE.

Mark Rains, Ph.D., PWS

Role: Environmental review experience and expertise.
Affiliation: University of South Florida

Dr. Rains is a professor in the School of Geosciences at the University of South Florida. He earned his Ph.D. in hydrologic sciences from University of California Davis in 2002 and is a licensed professional wetland scientist. He has more than 20 years of experience in the public and private sectors in the science, policy, and management of wetlands and rivers, including extensive experience in the functional assessment, restoration, and management of degraded wetlands and rivers. He has also worked full time in academia continuously since 2003, conducting research on local- and landscape-scale hydrological connectivity, the roles that hydrological processes play in governing ecosystem structure and function, and the roles that science plays in informing law and policy. He is a nationally acknowledged and award-winning expert on the role of science in the Clean Water Act (CWA), especially in regards to the definition of "Waters of the United States."

Dr. Rains has also worked as a consultant in the private sector since 1993, specializing in issues related to National Environmental Policy Act (NEPA), Endangered Species Act (ESA), CWA, and related programs, with both peer-reviewed papers[1,2] and technical reports[3,4]. His familiarly with Midwestern U.S. river ecology is reflected in both his consulting and research, as well as his involvement as the environmental expert on the Programmatic Environmental Impact Statement (PEIS) for the Mechanical Creation and Maintenance of Emergent Sandbar Habitat (ESH) on the Upper Missouri River USACE IEPR. He is familiar with changes in river function and processes resulting from the implementation of flood risk management measures and has authored numerous peer-reviewed papers[5,6] and technical[7,8] papers on river hydrology, geomorphology, and ecohydrology.

[1]Stein, E.D., M. Brinson, M.C. Rains, W. Kleindl, and F.R. Hauer. 2009. Wetland assessment alphabet soup: How to choose (or not choose) the right assessment method. Wetland Science and Practice 26:20–24.

[2]Leibowitz, S.G., P.J. Wigington, Jr., M.C. Rains, and D.M. Downing. 2008. Non-navigable streams and adjacent wetlands: Addressing science needs following the Supreme Court's Rapanos decision. Frontiers in Ecology and Environment 6:364–371.

[3]Kleindl, W.J., M.C. Rains, F.R. Hauer, J. Doskocil, and J. White. 2008. Jicarilla Rapid Assessment of Functions (JRAF): A Protocol for the Rapid Assessment of Functions on Riverine Floodplains in the San Juan River System. Prepared for the Jicarilla Apache Nation, Dulce, New Mexico.

[4]Lee, L.C., M.M. Brinson, D. DeWald, M. Gilbert, W.J. Kleindl, W.L. Nutter, M.C. Rains, D.F. Whigham, M. Whited. 1997. Operational Draft Guidebook to HGM Functional Assessments in Temporary and Seasonal Depressional Waters/Wetlands in the Northern Prairie Pothole Region. Prepared for the Natural Resources Conservation Service, Washington, D.C.

[5]Hammersmark, C.T., M.C. Rains, A.C. Wickland, and J.F. Mount. 2009. Vegetation – water-table relationships in a hydrologically-restored riparian meadow. Wetlands 29:785–797.

[6]Rains, M.C., J.F. Mount, and E.W. Larsen. 2004. Simulated changes in shallow groundwater and vegetation distributions under different reservoir operations scenarios. Ecological Applications 14:192–207.

[7]Larsen, E.W., and M.C. Rains. 2006. Meander Migration Model Assessment for the 50- And 100-Year Storms, Whitman Property, San Antonio Creek, Ventura County, California. Prepared for Mr. John Whitman, Ojai, California.

[8]David Magney Environmental Consulting. 2002. Bankfull Discharge, Slope, and Bed-Material Particle Size on a Sand-Bed Stream in a Semi-Arid Region: Conejo Creek at Winding Brook Farm, Camarillo, California. (PN 00-0161). Prepared for the California State Coastal Conservancy, Oakland, California.

Robert Fleming, Jr. P.E.

Role: Structural/geotechnical engineering experience and expertise.
Affiliation: R.L. Fleming & Associates

Mr. Fleming is a geotechnical engineer specializing in project design and geotechnical and structural engineering for flood control projects. He earned his M.S. in geotechnical engineering from Texas A&M University in 1971 and is a licensed professional engineer in Mississippi. He has more than 45 years of experience in geotechnical and structural engineering, including working for USACE, Vicksburg District for 35 years where he was actively involved in the design, construction, and evaluation of all types of hydraulic structures. His career with USACE included 10 years as the Chief of the Geotechnical Branch, five years as the Chief of the Design Branch, and four years as the Chief of Engineering.

Mr. Fleming has extensive in-depth expertise in the geotechnical evaluation of flood risk management structures, including static and dynamic slope stability evaluation. Example studies include his engineering efforts associated with the Sardis Earthquake Study that led to a major remediation to the Sardis Dam. He was also responsible for numerous geotechnical designs of levees, floodwalls, and hydraulic structures, including the Lake Chicot Pumping Plant, the first structure built in the Lower Mississippi River Mainline levees, and Locks & 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. In addition, from 1980 to 1993, he was involved in and responsible for the Sardis Earthquake Study and Remediation of the large hydraulic fill dam in North Mississippi. His experience with the evaluation of seepage through earth foundations of large urban levees is reflected in his background working 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 Ouchita River in Monroe, Louisiana, and the Red River in Alexandria, Louisiana.

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 participated in the USACE Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment IEPR as the geotechnical/structural engineering panel expert. He can address the USACE SAR 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 the USACE, Vicksburg District. As Chief of the Engineering Division, he served as Dam Safety Officer for seven large high hazard dams with responsibility for ensuring the safe operation and maintenance of these structures. He also served as Independent Consultant on the Interagency Performance Task Force for the New Orleans Hurricane Protection System.

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

Scott Sobiech, P.E., CFM

Role: Hydrologic and hydraulic engineering experience and expertise.
Affiliation: Barr Engineering Company

Mr. Sobiech is a hydrologic and hydraulic engineer in the Water Resource division of Barr Engineering, Inc. with more than 16 years of experience in the areas of civil and environmental engineering as a project manager and technical expert. His areas of expertise are levee evaluations/certification, evaluation of flood protection options, Federal Emergency Management Agency (FEMA) flood insurance studies, and detailed hydrologic, hydraulic, water quality modeling, and economic analyses. He has experience with complex floodplain and levee projects requiring USACE 33 USC 408 approval and project management and coordination with USACE, FEMA, local and state agencies, units of government, and residents and businesses in the affected areas. He earned his M.S. in civil engineering from North Dakota State University in 1997, is a registered professional engineer in Minnesota, North Dakota, and Michigan, and is a certified floodplain manager in Minnesota. He is familiar with large basin hydrology modeling and reservoir discharge-frequency evaluation, with relevant experience as the engineer of record for the Mouse River Enhanced Flood Protection Project in North Dakota where he oversaw HEC-HMS modeling of the entire Mouse River Basin, which includes numerous dams and reservoirs used for both flood control and wildlife management.

Mr. Sobiech is familiar with the geometry and layout of urban levee systems. The Mouse River Enhancement Flood Protection Project included a preliminary alignment for 21.6 miles of levee in and around the city of Minot (pop. 43,746). The system is designed to protect the area from flood flows of 27,400 cfs, comparable to flows seen during the 2011 flood of record and five times the rate that existing levees were designed to handle. He has experience in the evaluation of residual and induced damages resulting from implementing flood risk management measures. This project also included the development of a calibrated HEC HMS model covering roughly 4,300 square miles and a calibrated unsteady HEC RAS model of over 400 miles of the Souris River and its tributaries in North Dakota. His project experience includes completing an economic analysis as part of a limits study conducted for the USACE St. Paul District in Devils Lake, North Dakota. The study provided an economic analysis of flood impacts on communities, roads, railroads, state facilities, upland storage, and farmland near Devils Lake and also included a determination of costs and benefits for pumping and upland storage alternatives and the identification of selected strategies for 24 features.

In addition, Mr. Sobiech has experience in the application, evaluation, and modeling of both structural and nonstructural flood risk management measures, flood warning systems, and flood proofing. He is currently managing a large-scale levee system modification/certification for the city of Oslo, Minnesota, to meet USACE requirements, including major Section 408 approval, and achieve FEMA accreditation. Serving as the engineer of record for this project, he is responsible for overseeing detailed hydrologic and hydraulic design for the system, which includes over 3.0 miles of levees, floodwalls, interior drainage modifications, and a railroad closure structure. He is also managing a similar project for the city of Alvarado, Minnesota, which includes H&H analyses, freeboard review, review of closures, embankment protection analyses, embankment seepage and slope stability analysis, and settlement analysis. System improvements being considered include river realignments, levee realignments, floodwalls, and improved interior drainage elements.

Mr. Sobiech is proficient with HEC models including HEC-RAS, HEC-GeoRas, HEC-HMS, and HEC-1 models and has used them on numerous studies during his career. Such studies include his engineering

efforts on the Sherburne County digital flood insurance rate map (DFIRM) project and the development of hydrologic and hydraulic models for a portion of Roseau, Minnesota. Analysis and pump station sizing was performed according to USACE's coincident frequency analysis guidance and included a flood flow-frequency analysis, review of the updated model, transferred gage data, and coordination work with the MnDNR, USACE, and city of Roseau.

Mr. Sobiech actively participates in related professional societies including the Association of State Floodplain Managers and Minnesota Association of Floodplain Managers.

C. Deane Fowler P.E., CCM, CDT, PgMP

Role: Civil engineering/construction experience and expertise.
Affiliation: Independent Consultant

C. Deane Fowler is an independent consultant with 37 years of experience in civil and cost engineering, estimating, phased costing, and scheduling of complex, multi-year civil construction projects. He earned his M.S. in civil engineering/construction management in 1986 from the University of Florida, is a registered professional engineer in Florida and Virginia, and is a construction documents technologist (CDT), certified construction manager (CCM), and program management professional (PgMP). He has program, project, facilities, and construction contract management experience and has held positions in every facet of engineering, including daily and long-term budgeting, planning, scheduling, operations, and executive level management. He served with USACE from 1976 to 1998, ultimately as Deputy Commander for the Jacksonville District and was the principal engineer/senior officer/project manager on multiple USACE civil engineering projects for USACE Baltimore, Mobile, and Jacksonville Districts.

Mr. Fowler has extensive experience in the design and construction of large earthen structures used in flood risk management applications and has reviewed constructability issues within urban areas. Relevant studies include his design review of stability analysis and seepage control on Reaches J, H, F, and G on the Morganza to the Gulf Hurricane Protection Project (72 mile earthen levee project) for New Orleans District and his design review of relief wells for several projects for Jacksonville District from 1995 to2009. He was also the civil/cost engineer on two IEPRs for USACE Jacksonville District that included the analysis and construction of relief wells, slurry walls, and hydraulic barriers to prevent subsurface flows from reaching flow canals feeding the Florida Everglades; and the civil/cost engineer reviewer on the IEPR for C-111 Spreader Canal and L-31N that was developed to protect the Florida Aquifer. As Deputy District Engineer, he oversaw the operation, maintenance, and monitoring for the Cerrillos Dam and foundation development of the Portuguese Dam, for USACE, Jacksonville District from 1995 to1998.

Mr. Fowler is experienced and qualified to review modification of large Civil Works structures. Examples of his experience include his efforts on the change order review, design modifications, and final negotiations for Rio Puerto Nuevo Flood Control Project in San Juan, Puerto Rico with modifications of more than $8 million dollars; his review of change orders for the Antilles Office, USACE, Jacksonville District on four separate construction contracts, with total construction costs exceeding $1 billion dollars; and his assisting with the value engineering analysis, flood analysis, design review, and contact strategy on two projects exceeding $10 billion dollars for USACE, New Orleans District. He is practiced in the review and addressing of USACE SAR aspects of all projects. He was involved in the development and review of Dam Safety Plans for the Portuguese Dam, Ponce, Puerto Rico and performed Dam Safety

Inspections for 43 miles of Columbia River Levees in support of the Levee Inspection Program for Portland District in 2009-2010.

Mr. Fowler actively participates in related professional societies, including being a Fellow of the Society of American Military Engineers, Life Member of Chi Epsilon, and is a current member of the Certified Construction Management Association and Project Management Institute.

APPENDIX C

Final Charge to the IEPR Submitted to USACE on July 22, 2014 for the Manhattan, Kansas Project

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Charge Questions and Guidance to the Panel Members for the IEPR of the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study

BACKGROUND

The U.S. Army Corps of Engineers (USACE) Kansas City District and the local project sponsor (City of Manhattan, Kansas) have conducted a feasibility study of the existing local protection project, which serves a highly developed area around downtown Manhattan, Kansas. This is a single purpose study focusing on flood risk management. The existing Manhattan, Kansas, local protection project consists primarily of one levee unit and associated appurtenances. The levee unit withstood the Flood of 1993, but some elements of the system were seriously challenged as the flood crested. This event raised a concern that the levee may provide less than the authorized benefits for which it was designed.

The City of Manhattan, located in central Kansas, lies at the confluence of the Big Blue River and the Kansas River. The Big Blue River is on the east side of the downtown area and connects to the Kansas River on the southeast side of the city. The Manhattan levee unit is located generally west and north of the confluence of the Big Blue River and the Kansas River, and is approximately 28,850 feet long. The levee was typically constructed with a 10-foot crown width and three horizontal to one vertical embankment slopes. A limited number of major structural features are associated with this levee.

USACE's Tuttle Creek Lake is situated just to the north of Manhattan with the Big Blue River flowing into and out of Tuttle Creek Lake. Tuttle Creek is a major lake in the Kansas River basin system of lakes, which are critical to USACE's flood risk management mission for both the Kansas and Missouri Rivers.

The City of Manhattan, Kansas owns and operates the Manhattan, Kansas local protection project and is the local sponsor of this feasibility study. The City serves as the primary local point of contact for all community-related matters regarding this study. City staff work with USACE study team members on a routine basis and ensure that City and local consideration are taken into account as the study progresses.

The feasibility study updated and verified data on the level of flood risk management provided by the existing project and developed alternative plans for increasing the reliability of the existing project. The current estimated costs for cost-shared alternative plans range from $15 to $40 million.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study (hereinafter: Manhattan, Kansas IEPR) in accordance with the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity

of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Manhattan documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in planning, economics, environmental issues, structural/geotechnical engineering, hydrology and hydraulics and civil/construction engineering relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

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

DOCUMENTS PROVIDED

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

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages	Required Disciplines
Feasibility Report	92	All Disciplines
Environmental Appendix	114	Planning/Economics and Environmental Review
Engineering Appendices	280	Structural/Geotechnical, H&H Engineering, and Civil/Construction Engineering
Economics Appendix	55	Planning/Economics
Real Estate Appendix	33	Planning/Economics
Total Page Count	**574**	

Documents for Reference

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

SCHEDULE

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	6/17/2014
	Battelle convenes kick-off meeting with panel members	6/19/2014
	Battelle convenes kick-off meeting with USACE and panel members	6/19/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	6/25/2014
	Panel members complete their individual reviews	7/1/2014
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	7/3/2014
	Battelle convenes Panel Review Teleconference	7/7/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	7/7/2014
	Panel members provide draft Final Panel Comments to Battelle	7/14/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	7/14-21/2014
	Panel finalizes Final Panel Comments	7/21/2014
	Battelle provides Final IEPR Report to panel members for review	7/22/2014
	Panel members provide comments on Final IEPR Report	7/24/2014
	Battelle submits Final IEPR Report to USACE	7/25/2014
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	7/28/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	7/22/2014
	USACE provides draft PDT Evaluator Responses to Battelle	7/31/2014
	Battelle provides the panel members the draft PDT Evaluator Responses	8/1/2014
	Panel members provide Battelle with draft BackCheck Responses	8/6/2014
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	8/7/2014

Task	Action	Due Date
	Battelle convenes Comment-Response Teleconference with panel members and USACE	8/12/2014
	USACE inputs final PDT Evaluator Responses to DrChecks	8/14/2014
	Battelle provides PDT Evaluator Responses to panel members	8/15/2014
	Panel members provide Battelle with final BackCheck Responses	8/19/2014
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	8/20/2014
	Battelle submits pdf printout of DrChecks project file	8/20/2014
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	TBD
	Civil Works Review Board Meeting	TBD

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Manhattan 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 Manhattan documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-214; Appendix D).

1. Your response to the charge questions should not be limited to a “yes” or “no.” Please provide complete answers to fully explain your response.

2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.

3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and

uncertainty, and models used in evaluating economic or environmental impacts of the proposed project.

4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.

5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.

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

7. Please focus the review on assumptions, data, methods, and models.

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

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).

2. Please contact the Battelle Project Manager (Corey Wisneski, wisneskic@battelle.org) or Program Manager (Karen Johnson-Young, johnson-youngk@battelle.org) for requests or additional information.

3. In case of media contact, notify the Battelle Program Manager, Karen Johnson-Young (johnson-youngk@battelle.org) immediately.

4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Corey Wisneski, wisneskic@battelle.org, no later than July 1, 2014, 10 pm ET.

IEPR of the Manhattan, Kansas, Local Protection Flood Risk Management Feasibility Study

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

1. Are the need for and intent of the decision document clearly described?
2. Does the decision document adequately address the stated need and meet the intent?
3. Are the models used sufficiently discriminatory to support the conclusions drawn from them (i.e., to identify meaningful differences between alternatives)?
4. Are the assumptions that underlie the various analyses sound?
5. Have risks and uncertainties been sufficiently considered?
6. Are potential life safety issues accurately and adequately described under existing, future without-project, and future with-project conditions?
7. Are the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design?
8. Are the models and assumptions used to assess hazards appropriate?
9. Are there sufficient analyses upon which to base the recommendation?

Problem, Opportunities, Objectives, and Constraints

10. Are the problems, opportunities, objectives, and constraints adequately and correctly defined? Are there any gaps or overstatements?
11. Do the identified problems, opportunities, objectives, and constraints reflect a geographic area large enough to ensure that plans address the cause-and-effect relationships among affected resources and activities that are pertinent to achieving the study objectives?
12. In describing the criteria, goals, and objectives of the study, were the resources and issues important to the decision-making process clearly identified? Did the study address those resources and issues?

Existing and Future Without-Project Resources

13. Were there adequate general analyses of the existing social, financial, and natural resources within the study area?
14. For your particular area of expertise, provide an in-depth review of whether the analyses of the existing social, financial, and natural resources within the project area are sufficient to support the estimation of impacts of the array of alternatives.
15. Were surveys conducted to evaluate the existing social, financial, and natural resources adequate? If not, what types of surveys should have been conducted?

16. Were socioeconomic conditions adequately addressed? Were specific socioeconomic issues not addressed?

17. Was the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions?

18. Was the discussion of natural resources sufficient to characterize current baseline conditions and to allow for evaluation of forecasted conditions (with and without proposed actions)?

19. Were the assumptions used as the basis for developing the most probable future without-project conditions reasonable? Were adequate scenarios effectively considered (applied during analyses where relevant and/or reasonably investigated)?

20. Are the future conditions expected to exist in the absence of a Federal project logical and adequately described and documented?

21. Please comment on the conclusion of the most probable future without-project condition. Do you envision other potential probable outcomes?

Plan Formulation / Alternative Development

22. Was a reasonably complete array of possible measures considered in the development of alternatives?

23. Did the formulation process follow the requirement to avoid, minimize, and then mitigate adverse impacts on resources?

24. Does each alternative meet the formulation criteria of being effective, efficient, complete, and acceptable?

25. Were the underlying assumptions used to develop the future with-project conditions for each alternative reasonable? Were adequate scenarios considered? Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?

26. Are the changes between the without- and with-project conditions adequately described for each alternative?

27. Is sufficient information presented to identify, explain, and understand the assumptions that underlie the engineering conclusions?

28. Are the uncertainties inherent in our evaluation of benefits, costs, and impacts, and any risk associated with those uncertainties, adequately addressed and described for each alternative?

29. Are future Operation, Maintenance, Repair, Replacement, and Rehabilitation efforts adequately described, and are the estimated costs of those efforts reasonable for each alternative?

30. Please comment on the screening of the proposed alternatives. Are the screening criteria appropriate? Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies?

Recommended Plan

31. Are there any unmitigated environmental impacts identified? If so, could they impact plan selection?

32. Does the plan formulation meet the study objectives and avoid violating the study constraints? From a public safety perspective, is the proposed alternative reasonably appropriate?

33. Please comment on the likelihood that the recommended plan will achieve the expected outputs.

34. Please comment on the completeness of the recommended plan. Will any additional efforts, measures, or projects be needed to realize the expected benefits?

35. Please comment on the appropriateness of location, sizing, and design of plan features.

36. Are residual risks adequately described, and is there a sufficient plan for communicating the residual risk to affected populations?

Overview Questions

37. 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.

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

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