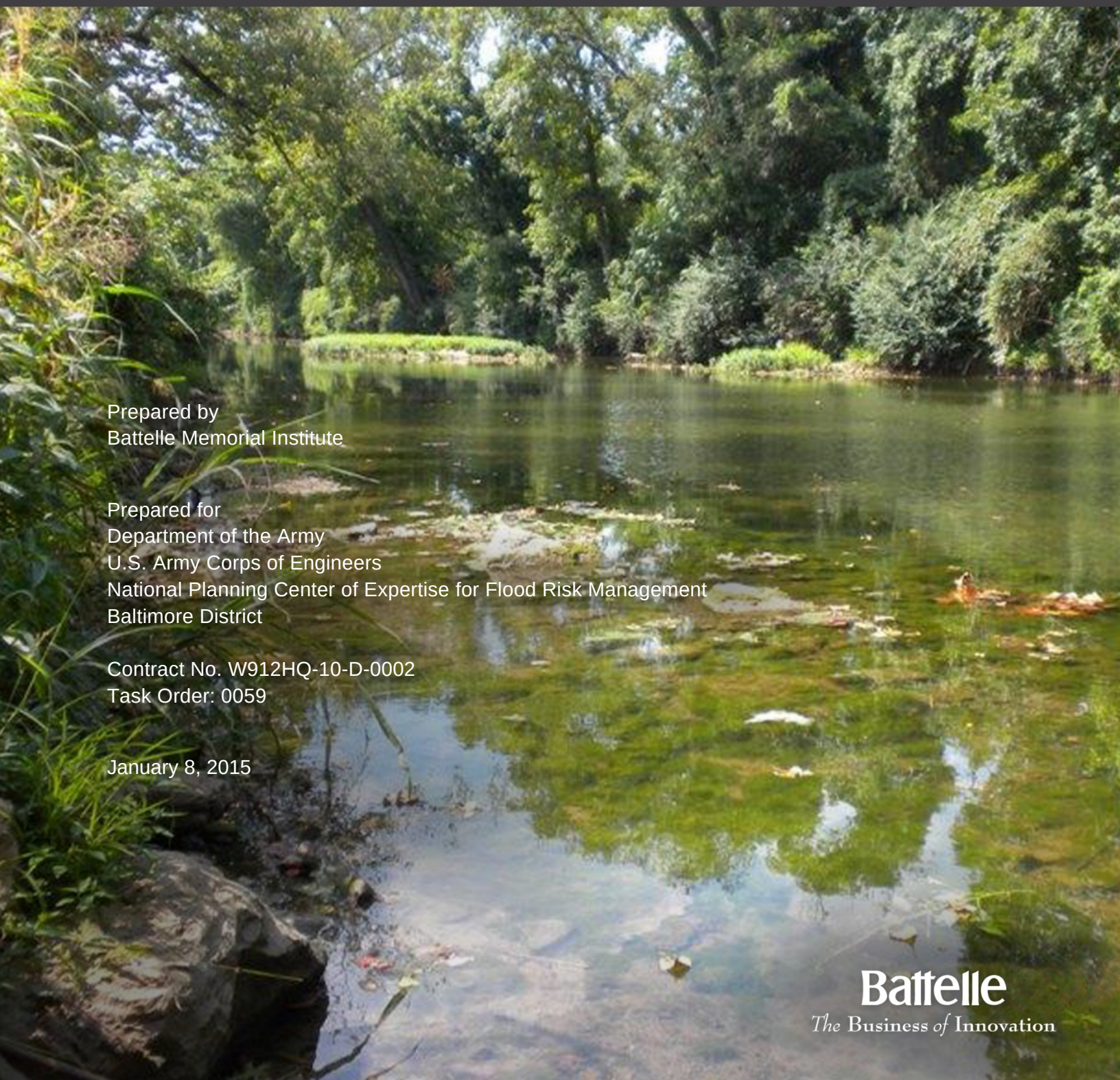
Final Independent External Peer Review Report
Mill Creek, Davidson County, Feasibility Report



Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0059

January 8, 2015

Battelle
The Business of Innovation

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Executive Summary

PROJECT BACKGROUND AND PURPOSE

The U.S. Army Corps of Engineers (USACE) Mill Creek project is located in one of the most rapidly urbanizing areas of Middle Tennessee. The 108-square-mile Mill Creek Watershed drains about 13% of Nashville, Davidson County, and 6% of Williamson County. About two-thirds of the watershed is within Davidson County and one-third in Williamson County. The Mill Creek Watershed is subject to frequent flooding, with major flooding occurring in May 1979, which caused an estimated $93 million in damages; and again in May 2010, which caused an estimated $185 million in damages and two fatalities in the Mill Creek watershed.

The Metropolitan Government of Nashville and Davidson County (Metro Nashville) are the study non-Federal sponsors. The Feasibility Cost Sharing Agreement was signed in April 2003, and was originally scoped for both Flood Risk Management (FRM) and Ecosystem Restoration (ER). The study involved an update of the Flood Insurance Study (FIS), which occurred prior to alternative analysis. The FIS update and alternative analysis were completed by 2006, leading to a Feasibility Scoping Meeting (FSM) in September 2007.

The FIS was completed following a particularly dry period of record, and the updated statistical flow analysis essentially had the effect of lowering the base flood elevation (BFE) for several areas in the Mill Creek Watershed. This led to lower existing condition damages and, at the time, it appeared that only a nonstructural FRM plan would be justifiable.

In May 2010, record flooding hit the Mill Creek Watershed, along with much of Middle Tennessee. As mentioned previously, this flood event caused two fatalities and an estimated $185 million in the Mill Creek Watershed alone. This event sparked the need for a re-evaluation of the FIS update. From June 2011 through December 2012, the FIS was revised to include the wetter intervening period of record since the 2006 analysis. Additionally, a screening level alternative analysis confirmed that several alternatives previously not economically justifiable could now be justified. The non-Federal sponsors also decided to drop the ER portion of the study and to move forward focusing solely on FRM opportunities.

USACE Nashville District completed an updated hydrologic and hydraulic (H&H) analysis to develop a recommended plan to complete the Feasibility Phase of the study. Both local and regional structural and nonstructural measures were evaluated. Regional Peak Flow Control Structures (PFCS) were considered, for in-channel detention dams, along with channel improvements, bridge modifications, structure evacuations, flood proofings, structure elevations, and a quarry diversion. An effort was made to develop a FRM plan that provides ancillary ecosystem benefits.

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 Mill Creek, Davidson County, Feasibility Report (hereinafter: Mill Creek 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 Mill Creek project. 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 (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 Mill Creek review documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: economics/Civil Works planning, environmental, H&H engineering, and geotechnical/structural engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates to confirm that they had no COIs, but Battelle made the final selection of the four-person Panel.

The Panel received an electronic version of the Mill Creek review documents (680 pages in total), 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), and they 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 Mill Creek 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, 14 Final Panel Comments were identified and documented. Of these, one was identified as having high significance, three had medium/high significance, seven had medium significance, and three had medium/low significance.

Battelle received public comments from USACE on the Mill Creek Feasibility study (approximately six pages of written comments) and provided them to the IEPR panel members. The panel members were charged with determining if any information or concerns presented in the public comments raised any additional discipline-specific technical concerns with regard to the Mill Creek review documents. After completing their review, the Panel confirmed that no new issues or concerns were identified other than

those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

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 Mill Creek review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the report is well-written, well-organized, and comprehensive. The hydrology & hydraulic technical analysis and environmental review were conducted in a logical manner. The Panel was able to follow USACE plan development process, and was able to identify the key objectives of the study. While the report assessed the economic, engineering, and environmental issues, the Panel identified some elements of the project where additional analysis is warranted and places where clarification of project findings and objectives need to be documented in the Mill Creek Feasibility report.

Economics and Civil Works Planning: The planning process followed a systematic procedure that identified and evaluated a diverse group of potential alternatives and the economic analysis utilized the current fiscal year dollars and appropriate discount rate of 3.5%. The Panel's most significant concern is on the non-Federal sponsor's limitation on raise-in-place measures within the floodway which may eliminate potentially productive management measures from consideration. This can be addressed by evaluating key raise-in-place measures and determining their viability without respect to the conflict with the non-Federal codes. The Panel also found a lack of discussion of how the Recommended Plan would perform under benchmark flood events. This is required by USACE guidance (ER 1105-2-101) and can be addressed by including the required performance analysis, displays and a discussion of how the risk analysis demonstrates that the project is a worthwhile investment. Lastly, the Panel noted that the final costs for the Recommended Plan is uncertain due to inconsistencies in the contingency account, missing costs for several features shown on the drawings, and lack of costs for items required for the construction of the Ellington Detention structure. This creates a high level of uncertainty surrounding the design assumptions and accuracy of the cost estimate. An update to the cost estimate to include the revised design and quantities would be helpful in reducing the uncertainties associated with the design and associated cost estimates.

Engineering: The most significant engineering finding was on the assumptions presented regarding the breach location and depth for the Ellington Detention Structure. The depth of the breach was limited to the elevation of the existing ground, no consideration was given to overtopping failures therefore the potential downstream hazards, and loss of life under high flow conditions may not have been accurately identified. This issue can be addressed by obtaining sufficient subsurface information to estimate the depth of the non-erodible bedrock and by conducting a dam breach evaluation. Additionally, the dam breach modeling used in the analysis of the Ellington Detention Structure was not the National Weather Service (NWS) DAMBRK model recommended by HEC, which may result in a further underestimate of the potential downstream hazards. The Panel recommends that the NWSDAMBRK model be utilized during the design phase of the project. The Panel is also concerned about the concept design for the selected articulated concrete mat: it is unclear whether the articulated concrete mat has a demonstrated performance record and whether the embankment including the crest section is protected against

overtopping flows. The Panel recommends that the manufacturer of the concrete mats be contacted to verify that this product will withstand the Inflow Design Flood (IDF). Based on the results of these actions the design and cost estimate for the overtopping protection may need to be revised to address this concern.

Environmental: This section of the report is comprehensive and detailed. The Panel did however note three environmental concerns. First in the formulation of the alternatives, there is no discussion of an evaluation of flood attenuation through new upland flood water controls. These controls may provide some mitigation of flood risk. This can be addressed by documenting and discussing the upland storm water reduction and retrofit opportunities that have been identified by the non-federal sponsor, as well as evaluating changes to land development and storm water controls that could be implemented or likely to be implemented at the Federal, state, and local level. Second, there is no discussion of sediment supply and transport in the Mill Creek project area, which is particularly relevant considering the presence and status of the Nashville crayfish as an endangered species. This issue can be addressed by characterizing the sediment supply and the movement of sediment within the project area, as well as evaluating the potential for aggradation above and degradation below the Ellington Ag Bridge in-stream detention facility. The Panel also notes that the report should address how the loss of bedload transport and may impact nursery habitat for the Nashville crayfish.

Table ES-1. Overview of 14 Final Panel Comments Identified by the Mill Creek IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The non-Federal sponsor prohibition against raise-in-place for structures in the floodway removes potentially productive management measures from consideration.
Significance – Medium/High	
2	The Draft Integrated Feasibility Report (DIFR) does not discuss or display how the Recommended Plan is expected to perform under benchmark flood events per USACE guidance (ER 1105-2-101).
3	The analysis may have used less than conservative assumptions regarding breach location and depth for the Ellington Detention Structure, which may not have accurately identified all downstream hazards under very high flow conditions.
4	The final cost for the Recommended Plan is uncertain due to omissions, apparent inconsistencies, design assumptions, and lack of subsurface information.
Significance – Medium	
5	The future year is inconsistently identified, so it is unclear when future damages cease to increase.

Table ES-1. Overview of 14 Final Panel Comments Identified by the Mill Creek IEPR Panel (continued)

No.	Final Panel Comment
6	Public safety and loss of life due to flooding associated with the Recommended Plan are not addressed.
7	Uncertainty and residual risk as a result of climate variability have not been quantified and may have impacts over the life of the project.
8	It is not possible to determine if the occupancy type population was sampled appropriately or how the first floor elevations (FFEs) were obtained because the statistical analysis lacks detail.
9	Flood attenuation through new upland floodwater controls has not been evaluated during the formulation of the alternatives.
10	The impacts of sediment transport and deposition on the efficacy of the project have not been addressed.
11	The variables that contribute to uncertainty have not been discussed.
Significance – Medium/Low	
12	It is unclear if the concept design for the selected articulated concrete mat has a demonstrated performance record and if the entire embankment including the crest section is protected against overtopping flows.
13	The Recommended Plan does not clearly state how the project will address the non-Federal sponsor's objectives.
14	The HEC-recommended National Weather Service DAMBRK model has not been used to acquire higher accuracy data in the analysis of the Ellington Detention structure and may result in an underestimate of potential downstream hazards and loss of life.

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LIST OF ACRONYMS

ACE	annual chance exceedance
ATR	Agency Technical Review
BA	Biological Assessment
BFE	base flood elevation
CECW	Corps of Engineers Civil Works
COI	Conflict of Interest
DAMBRK	Dam Break
DIFR	Draft Integrated Feasibility Report
DrChecks	Design Review and Checking System
EC	Engineer Circular
EGM	Economic Guidance Memorandum
ER	Engineer Regulation
ER	Ecosystem Restoration
FDA	Flood Damage Reduction Analysis
FERC	Federal Energy Regulatory Commission
FFE	first floor elevation
FIA	Flood Impact Analysis
FIS	Flood Insurance Study
FRM	Flood Risk Management
FSM	Feasibility Scoping Meeting
HEC	Hydrologic Engineering Center
HEC-FDA	Hydrologic Engineering Center Flood Damage Reduction Analysis
HEC-FIA	Hydrologic Engineering Center Flood Impact Analysis
H&H	hydrology and hydraulics
IDF	Inflow Design Flood
IEPR	Independent External Peer Review
NTP	Notice to Proceed
NWS	National Weather Service
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PFCS	Peak Flow Control Structures
PDT	Project Delivery Team
RCC	roller compacted concrete
SAR	Safety Assurance Review
USACE	United States Army Corps of Engineers

USFWS HEP U.S. Fish and Wildlife Service Habitat Evaluation Procedure

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) Mill Creek project is located in one of the most rapidly urbanizing areas of Middle Tennessee. The 108-square-mile Mill Creek Watershed drains about 13% of Nashville, Davidson County, and 6% of Williamson County. About two-thirds of the watershed is within Davidson County and one-third in Williamson County. The Mill Creek Watershed is subject to frequent flooding, with major flooding occurring in May 1979, which caused an estimated $93 million in damages; and again in May 2010, which caused an estimated $185 million in damages and two fatalities in the Mill Creek watershed.

The Metropolitan Government of Nashville and Davidson County (Metro Nashville) are the study non-Federal sponsors. The Feasibility Cost Sharing Agreement was signed in April 2003, and was originally scoped for both Flood Risk Management (FRM) and Ecosystem Restoration (ER). The study involved an update of the Flood Insurance Study (FIS), which occurred prior to alternative analysis. The FIS update and alternative analysis were completed by 2006, leading to a Feasibility Scoping Meeting (FSM) in September 2007.

The FIS was completed following a particularly dry period of record, and the updated statistical flow analysis essentially had the effect of lowering the base flood elevation (BFE) for several areas in the Mill Creek Watershed. This led to lower existing condition damages and, at the time, it appeared that only a nonstructural FRM plan would be justifiable.

In May 2010, record flooding hit the Mill Creek Watershed, along with much of Middle Tennessee. As mentioned previously, this flood event caused two fatalities and an estimated $185 million in the Mill Creek Watershed alone. This event sparked the need for a re-evaluation of the FIS update. From June 2011 through December 2012, the FIS was revised to include the wetter intervening period of record since the 2006 analysis. Additionally, a screening level alternative analysis confirmed that several alternatives previously not economically justifiable could now be justified. The sponsors also decided to drop the ER portion of the study and to move forward focusing solely on FRM opportunities.

Nashville District completed an updated hydrologic and hydraulic (H&H) analysis to develop a recommended plan to complete the Feasibility Phase of the study. Both local and regional structural and nonstructural measures were evaluated. Regional Peak Flow Control Structures (PFCS) were considered, along with channel improvements, bridge modifications, structure evacuations, flood proofings, structure elevations, and a quarry diversion. An effort was made to develop a FRM plan that provides ancillary ecosystem benefits.

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 Mill Creek, Davidson County, Feasibility Report (hereinafter: Mill Creek 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) *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 Mill Creek 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 March 21, 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 Mill Creek 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 Mill Creek IEPR. Due dates for milestones and deliverables are based on the award/effective date of February 28, 2014 and the receipt of the review documents on October 28, 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 Design Review and Checking System (DrChecks) project file (the final deliverable) on March 9, 2015. The actual date for contract end will depend on the date that all activities for this IEPR are completed.

Table 1. Major Milestones and Deliverables of the Mill Creek IEPR

Task	Action	Due Date
1	Award/Effective Date	2/28/2014
	Review documents available	10/28/2014
2	Battelle submits list of selected panel members	3/10/2014
	USACE confirms the panel members have no COI	3/18/2014
3	Battelle convenes kick-off meeting with USACE	3/7/2014
	Battelle convenes kick-off meeting with USACE and panel members	3/31/2014
	Battelle convenes follow-up kick-off meeting with USACE and panel members	11/6/2014

Table 1. Major Milestones and Deliverables of the Mill Creek Name IEPR (continued)

Task	Action	Due Date
4	Panel members complete their individual reviews	11/25/2014
	Panel members provide draft Final Panel Comments to Battelle	12/12/2014
	Battelle receives the Public Comments from USACE	12/12/2014
	Battelle sends public comments to Panel	12/16/2014
	Panel completes their review of the public comments	12/19/2014
	Panel confirms no additional Final Panel Comment is necessary with regard to the public comments	12/22/2014
5	Battelle submits Final IEPR Report to USACE	1/8/2015
6[a]	Battelle convenes Comment-Response Teleconference with panel members and USACE	2/17/2015
	Battelle submits pdf printout of DrChecks project file to USACE	3/11/2015
3	CWRB Meeting (Estimated Date)[b]	4/16/2015
	Contract End/Delivery Date	5/30/2015

[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 four panel members to participate in the IEPR based on their expertise in the following disciplines: economics/Civil Works planning, environmental, hydrology and hydraulics (H&H) engineering, and geotechnical/structural engineering. The Panel reviewed the Mill Creek document and produced 14 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.

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 Mill Creek IEPR review document. The following summarizes the Panel's findings.

Based on the Panel's review, the report is well-written, well-organized, and comprehensive. The hydrology & hydraulic technical analysis and environmental review were conducted in a logical manner. The Panel was able to follow USACE plan development process, and was able to identify the key objectives of the study. While the report assessed the economic, engineering, and environmental issues, the Panel identified some elements of the project where additional analysis is warranted and places where clarification of project findings and objectives need to be documented in the Mill Creek Feasibility report.

Economics and Civil Works Planning: The planning process followed a systematic procedure that identified and evaluated a diverse group of potential alternatives and the economic analysis utilized the current fiscal year dollars and appropriate discount rate of 3.5%. The Panel's most significant concern is on the non-Federal sponsor's limitation on raise-in-place measures within the floodway which may eliminate potentially productive management measures from consideration. This can be addressed by evaluating key raise-in-place measures and determining their viability without respect to the conflict with the non-Federal codes. The Panel also found a lack of discussion of how the Recommended Plan would perform under benchmark flood events. This is required by USACE guidance (ER 1105-2-101) and can be addressed by including the required performance analysis, displays and a discussion of how the risk analysis demonstrates that the project is a worthwhile investment. Lastly, the Panel noted that the final costs for the Recommended Plan is uncertain due to inconsistencies in the contingency account, missing costs for several features shown on the drawings, and lack of costs for items required for the construction of the Ellington Detention structure. This creates a high level of uncertainty surrounding the design assumptions and accuracy of the cost estimate. An update to the cost estimate to include the revised design and quantities would be helpful in reducing the uncertainties associated with the design and associated cost estimates.

Engineering: The most significant engineering finding was on the assumptions presented regarding the breach location and depth for the Ellington Detention Structure. The depth of the breach was limited to the elevation of the existing ground, no consideration was given to overtopping failures therefore the potential downstream hazards, and loss of life under high flow conditions may not have been accurately identified. This issue can be addressed by obtaining sufficient subsurface information to estimate the depth of the non-erodible bedrock and by conducting a dam breach evaluation. Additionally, the dam breach modeling used in the analysis of the Ellington Detention Structure was not the National Weather Service (NWS) DAMBRK model recommended by HEC, which may result in a further underestimate of the potential downstream hazards. The Panel recommends that the NWSDAMBRK model be utilized during the design phase of the project. The Panel is also concerned about the concept design for the selected articulated concrete mat: it is unclear whether the articulated concrete mat has a demonstrated performance record and whether the embankment including the crest section is protected against

overtopping flows. The Panel recommends that the manufacturer of the concrete mats be contacted to verify that this product will withstand the Inflow Design Flood (IDF). Based on the results of these actions the design and cost estimate for the overtopping protection may need to be revised to address this concern.

Environmental: This section of the report is comprehensive and detailed. The Panel did however note three environmental concerns. First in the formulation of the alternatives, there is no discussion of an evaluation of flood attenuation through new upland flood water controls. These controls may provide some mitigation of flood risk. This can be addressed by documenting and discussing the upland storm water reduction and retrofit opportunities that have been identified by the non-federal sponsor, as well as evaluating changes to land development and storm water controls that could be implemented or likely to be implemented at the Federal, state, and local level. Second, there is no discussion of sediment supply and transport in the Mill Creek project area, which is particularly relevant considering the presence and status of the Nashville crayfish as an endangered species. This issue can be addressed by characterizing the sediment supply and the movement of sediment within the project area, as well as evaluating the potential for aggradation above and degradation below the Ellington Ag Bridge in-stream detention facility. The Panel also notes that the report should address how the loss of bedload transport and may impact nursery habitat for the Nashville crayfish.

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 non-Federal sponsor's prohibition against raise-in-place for structures in the floodway removes potentially productive management measures from consideration.

Basis for Comment

The non-Federal sponsor has an ordinance in place that prohibits raising structures in the floodway because doing so represents a major improvement of a floodway structure. This removes a significant number of management measures from consideration that, when combined with structural management measures, could change the makeup of the various alternative plans assembled from those measures.

With those measures evaluated, the alternative plans carried forward could show a higher degree of economic performance, thus potentially altering the final array of alternatives and the performance of the Recommended Plan itself. Although Federal law generally trumps state and local laws when formulating water resource projects such as that proposed for Mill Creek, historically it has been USACE practice to reasonably comply with local constraints. However, because of the subordination of local law to Federal law, USACE could still evaluate measures that conflict with the local ordinance, and USACE could still recommend implementation of these measures. The Six Step Planning Process calls for developing all reasonable management measures, even under conditions of such conflict.

If the non-Federal sponsor has not been asked to waive or change its policies regarding raise-in-place, there could be a missed opportunity for coordination between USACE and its non-Federal sponsor. Furthermore, if USACE were to evaluate such raising measures and the Corps of Engineers Civil Works (CECW) recommends implementing them without prior coordination with the non-Federal sponsor, USACE risks losing the sponsor's support for the project.

Significance – High

Project justification and selection of the Recommended Plan may be affected by the lack of evaluation of potentially productive management measures.

Recommendations for Resolution

1. Evaluate key or bellwether raise-in-place measures.
2. Determine the viability of these measures, without respect to their conflict with non-Federal codes.
3. Describe how raise-in-place measures were coordinated with the non-Federal sponsor.

Final Panel Comment 2

The Draft Integrated Feasibility Report (DIFR) does not discuss or display how the Recommended Plan is expected to perform under benchmark flood events per USACE guidance (ER 1105-2-101).

Basis for Comment

Both policy and practice require a discussion and display of the expected performance of the Recommended Plan under benchmark flood events. They are necessary to understand the risk of non-performance when subjected to low frequency, high flow events.

USACE Engineer Regulation (ER) 1105-2-101, Appendix A, describes the required displays. In practice, the performance displays would be accompanied by a discussion of how USACE developed the risk analysis that produced the displays.

Further, the significant residual risk that exists after implementation is missing and is needed to determine whether the project is a worthwhile investment.

Significance – Medium/High

Inclusion of performance under benchmark flood events is a policy requirement.

Recommendations for Resolution

1. Include tables consistent with ER 1105-2-101, Appendix A
2. Include a discussion of how the risk analysis of the Recommended Plan was conducted.

Literature Cited:

USACE (2000). Planning – Planning Guidance Notebook. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. April 22.

Final Panel Comment 3

The analysis may have used less than conservative assumptions regarding breach location and depth for the Ellington Detention Structure, which may not have accurately identified all downstream hazards under very high flow conditions.

Basis for Comment

The creation of an impoundment structure inherently sets up a potential for downstream hazard and loss of life under a dam failure scenario due to overtopping or other failure modes. This critical issue was not discussed in the DIFR, although USACE provided a copy of their dam breach analysis during the Panel's review. The limited analysis in the DIFR was developed to evaluate the dam failure issue; however, the full range of potential failure conditions and related downstream impacts was not considered in the analysis. The USACE analysis made the following assumptions regarding a failure mode for the detention structure:

- The breach configuration was limited only to the embankment section.
- The location of the breach was limited to the dam in the valley area. No consideration was given to overtopping failures occurring through the abutment under high flow conditions.
- The depth of the assumed breach was limited to the elevation of the existing ground rather than to the assumed depth of the bedrock at an elevation approximately 7 feet below the existing ground surface.
- The dam breach was assumed to occur under flow conditions equal to the 500-year flood event. No larger flood events were considered.

The assumptions employed in the USACE analysis do not reflect all possible dam breach scenarios. Actual failures of embankments, such as the Silver Lake Dam in Michigan, indicate that extensive erosion of the foundation can occur below the ground surface under a dam breach scenario (FERC, 2003). Since there is no subsurface information available, the erodibility of the overburden overlying the bedrock and the exact depth of the bedrock are unknown.

Under high flow events, overtopping of the abutment areas will occur. Since these areas are not armored in the same manner as the embankment section, it is likely that an overtopping failure could occur in these areas. The depth of a dam breach in this area would be limited by the depth of the bedrock, which is currently unknown.

Significance – Medium/High

The lack of a comprehensive dam break analysis under a variety of high flow conditions creates the possibility that the proposed project could increase downstream hazard and the potential for loss of life under high flow conditions.

Recommendations for Resolution

1. Obtain sufficient subsurface information to estimate the depth of non-erodible bedrock in both the valley and abutment areas
2. During the design phase of the project, conduct a dam breach evaluation for breach sections located in both the valley and abutment areas and use available subsurface information to locate the bottom of the breach at the elevation of the bedrock or other non-erodible material.
3. Using the breach evaluations, determine the appropriate Inflow Design Flood for the structure as described in ER 1110-8-2 (FR) (USACE, 1991). This flood is the largest flood under which a dam

failure will not increase downstream hazard significantly

4. Use the revised dam break analysis to refine the design of erosion protection on the embankment and on the abutments. This design update should address the extent of erosion protection and the type of protection that will be used.

Literature Cited:

FERC (2003). Silver Lake Dam: Root Cause Report on the May 14, 2003 Operation of the Fuse Plug Spillway and Subsequent Channel Erosion Resulting in the Uncontrolled Release of Silver Lake. Dead River Hydroelectric Project Federal Energy Regulatory Commission Licensed Project No. 10855. October 6. Upper Peninsula Power. Available online at: http://www.ferc.gov/industries/hydropower/safety/projects/silver-lake/rcr.pdf.

USACE (1991). Inflow Design Floods for Dams and Reservoirs. Engineer Regulation (ER) 1110-8-2 (FR). Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. March 1. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/ER1110-8-2(FR)_01Mar1991.pdf.

Final Panel Comment 4

The final cost for the Recommended Plan is uncertain due to omissions, apparent inconsistencies, the design assumptions, and lack of subsurface information.

Basis for Comment

During the Panel's review, USACE provided a breakdown cost estimate for the structural features in the Recommended Plan. This estimate does not include costs for several features shown on the drawings and does not incorporate costs for items required for the construction of the Ellington Detention structure, specifically:

- The cost of the 20-foot wide by 500-foot long concrete spillway at the Ellington Detention structure is missing. This is a significant cost item that would have a major impact on the cost of the Ellington Detention structure.
- The cost of stripping beneath the embankment section and/or treatment of the bedrock below the Ellington embankment is missing.
- Subsurface information is missing, which creates several uncertainties related to the foundation for the Ellington Detention structure and the Briley bridge modifications:
- The nature of the overburden at the Ellington site is unknown. If the foundation in this area is pervious, seepage control measures may be required. These measures could include a cut-off trench or seepage berms. Inclusion of these items would increase the estimated project costs
- The cross section of the Ellington embankment in Engineering Attachment C shows that the downstream stilling basin is founded directly on overburden material. Unless the overburden is extremely dense and compacted, it is likely that the stilling basin will need to be founded on the underlying bedrock. Lack of subsurface information at the site creates a large degree of uncertainty related to the depth of bedrock and the cost associated with the stilling basin.
- The profile view of the Briley bridge modification indicates that the bridge pier footings will be founded directly on the overburden material, which may be unsuitable to act as a foundation. There is no mention in Attachment C regarding the potential depth of bedrock at the Briley bridge site. If the depth of bedrock is great, a costly pile foundation could be required to support the bridge.

There is an inconsistency in the contingency amount stated in Engineering Attachment C and Cost Attachment B. The cost attachment indicates a contingency of 30%, whereas the engineering analysis under the heading 'Quantity Computations,' indicates a 45% contingency for the Old Hickory structure and a 44% contingency for the Briley bridge modifications. Engineering Attachment C does not give any contingency amount for the Ellington Detention structure.

Significance – Medium/High

The omission of costs for the stilling basin at the Ellington Detention structure and the lack of any subsurface information create a high degree of uncertainty regarding the assumptions made for the design and the accuracy of the resulting cost estimate.

Recommendations for Resolution

1. Obtain several borings at the Ellington Detention site to define the nature of the overburden material and the elevation of the bedrock, both in the valley and abutment areas.
2. Based upon the results of the subsurface exploration, revise the design cross-section and the

estimated quantities for the Ellington Structure. Prepare a cost estimate based on the revised design. This will reduce the uncertainties associated with both the design and the resulting cost estimate.

3. Obtain one boring in the valley section at the Briley bridge, and verify that the proposed foundation system for the bridge piers will adequately support the bridge structure or revise the support system.

Final Panel Comment 5

The future year is inconsistently identified, so it is unclear when future damages cease to increase.

Basis for Comment

There appears to be an inconsistency in how the future year is described. The DIFR and the Economics Appendix are inconsistent in this regard. The DIFR says that the floodplain will be fully developed by 2050, whereas the Economics Appendix states that the future year is 2017 or 2018.

Explicitly and consistently stating the future year is important to understanding the economic effects of the future without-project condition and the performance of the various alternatives. It also affects the hydrology and hydraulics (H&H) calculations that form the engineering side of the Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA) model.

If the H&H portion of the model uses one future year assumption and the economics portion uses a different one, this could significantly affect expected future flood flows and could affect how benefits and costs are discounted. From an engineering and economics perspective, it is then difficult to understand the point in the future when flood risk is expected to cease getting worse.

Significance – Medium

The understanding of when future flood damages cease to increase is affected by inconsistency in identifying the expected future year and may affect expected future flood flows and the discounting of expected future benefits and costs.

Recommendations for Resolution

1. Identify what the future year is expected to be.
2. Include in the affected appendices a brief narrative explaining why the future year is the most reasonable.

Final Panel Comment 6

Public safety and loss of life due to flooding associated with the Recommended Plan are not addressed.

Basis for Comment

The statement of objectives in the DIFR does not mention either the improvement of public safety or the potential reduction of loss of life. Public safety and avoidance of loss of life are always important planning objectives.

The DIFR (Section 4.2.4) states that "….only structures within the 1/5 [annual chance exceedance] ACE floodplain with life safety hazards were included in the final plan. Raise-in-place or buyout properties that did not meet this metric were removed." This decision was made as part of the Plan Optimization process, "…greatly reducing the cost of this measure and maximizing net benefits." The definition of life safety hazard is not included in the DIFR, nor is inundation mapping provided to show where these hazards are occurring.

The evaluation of management measures, and the alternative plans constructed from them, should discuss how these measures and plans address the threats to public safety and human life. While the relatively low numbers of lives lost during historic flood events indicate that a full-blown Hydrologic Engineering Center-Flood Impact Analysis (HEC-FIA) is likely unwarranted, some qualitative discussion of how the without-project condition affects the threats is warranted. So too is a discussion of how the various alternatives affect the risk to public safety and potential for reducing the risk of lost lives.

Significance – Medium

Not addressing public safety and loss of life due to flooding associated with the Recommended Plan affects the understanding of how the Recommended Plan reduces the threat to public safety.

Recommendations for Resolution

1. Include the reduction of risk to public safety in the statement of objectives.
2. Describe the threat to public safety in the discussion of the future without-project condition.
3. Discuss qualitatively how the various alternatives and the Recommended Plan address the objective of reducing the threat to public safety and the risk of loss of life.
4. If an alternative other than the Recommended Plan has a greater potential to reduce public safety risk, discuss why other factors resulted in the selection of the Recommended Plan.
5. Specifically define "life safety hazard" and how that is differentiated among different types of structures within the 5-year return frequency flood inundation area. Provide inundation mapping to show (1) where structures associated with life safety hazards exist, and (2) structures that are within the same inundation area but are not considered a life safety hazard.

Final Panel Comment 7

Uncertainty and residual risk as a result of climate variability have not been quantified and may have impacts over the life of the project.

Basis for Comment

Risk and uncertainty are discussed in Attachment A, Appendix C, Section 10 of the DIFR. The uncertainty analysis discussed therein appears to conform to the procedures outlined in Engineer Manual (EM) 1110-2-1619 (USACE, 1996b) and in Engineer Regulation (ER) 1105-2-101 (USACE, 1996a). However, no discussion is included in the DIFR on how climate variability might affect the anticipated level of flood protection.

The USACE Climate Change Adaptation Plan includes a commitment to "*…. continue to expand incorporation of climate uncertainty considerations into planning, design, construction, operation, and management of new and modified infrastructure…"* (USACE, 2014). There is no discussion or analysis in the DIFR on how climate uncertainty considerations have been incorporated into the planning process, or how the project might be adapted during its life span if climate variability becomes a significant issue.

The IEPR Panel is charged with reviewing the documents in accordance with the guidelines established in Engineer Circular (EC) 1165-2-214 (Appendix D, Section 2.c. Panel Responsibilities), which requires the Panel to assess the potential effects of climate change. Climate change is believed to create more extreme climate events. The 2010 flood event was an extreme event, acknowledged in the DIFR as the "flood of record." If extreme events are already occurring, and have caused the USACE to alter its hydrologic model of the watershed, then some acknowledgement of the potential effect of climate change on the project during its design life is appropriate.

Significance – Medium

The report does not document its conformance with the USACE Climate Change Adaptation Plan (2014).

Recommendations for Resolution

1. Include a brief section in the text that acknowledges that climate variability may affect the level of protection that is estimated from this project. Acknowledge that extreme flood events have occurred recently and others may occur during the life of this project.
2. Include an analysis in the design phase of this project to evaluate the stability and integrity of all project elements to withstand extreme flood events during the life of the project.

Literature Cited:

USACE (2014). Climate Change Adaptation Plan. U.S. Army Corps of Engineers, USACE Climate Preparedness and Resilience Steering Committee. June. Available online at: http://www.corpsclimate.us/docs/USACE_Adaptation_Plan_v50_2014_June_lores.pdf

USACE (1996a). Planning – Risk-Bask Analysis for Evaluation of Hydrology/Hydraulics, Geotechnical Stability, and Economics in Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. March 1. Available online at: http://www.fws.gov/nces/ecoconf/Additional%20Documentation/CORPS_Civil%20Works/MiscTechnical/ER1105-2-101.pdf.

USACE (1996b). Engineering and Design -- Risk-Based Analysis for Flood Damage Reduction Studies. Engineer Manual (EM) 1110-2-1619. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. August 1. Available online at: http://www.skagitriverhistory.com/Corps%20Docs/EM1110-2-1619.pdf.

Final Panel Comment 8

It is not possible to determine if the occupancy type population was sampled appropriately or how the first floor elevations (FFEs) were obtained because the statistical analysis lacks detail.

Basis for Comment

For both the FFE and structure values determination, there are no inferential statistical analyses that demonstrate the respective samples' representativeness of the population being sampled. In addition, the shape of the distributions used within the Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA) for these two variables are not included or discussed, nor is there justification for why these distributions were selected.

For budget and schedule purposes, it is often not possible to precision survey every FFE in a study area or to conduct appraisals on every structure. Sampling of structure FFEs and replacement costs is therefore necessary to conduct studies of flood risk in a mature, yet still developing, watershed. Section 3.2 of Appendix A explains that FFEs were obtained via three different methods. Each of these methods presents a different level of uncertainty.

Section 3.2.2 of Appendix A explains that 20% of the floodplain inventory was sampled to estimate structure values. Although this is a large sample, it is unclear whether this sample is representative, whether it was selected randomly, or whether it was chosen selectively.

Significance – Medium

The lack of statistical analysis affects the understanding of how key economic variables were developed and analyzed, which in turn affects how uncertainty in these variables affect the presentation of the future without-project condition and the performance of the Recommended Plan .

Recommendations for Resolution

1. Provide inferential statistical analysis of the representativeness of the FFE sample.
2. Provide inferential statistical analysis of the representativeness of the structure value sample.
3. Describe the shapes of the various distributions used in HEC-FDA.
4. Explain why these distribution shapes were used.

Final Panel Comment 9

Flood attenuation through new upland floodwater controls has not been evaluated during the formulation of the alternatives.

Basis for Comment

The DIFR does not provide a comprehensive watershed-based evaluation of upland best management practices, such as retrofitting drainage areas developed prior to stormwater management requirements with stormwater quantity and quality control measures comparable to other recent Federal projects such as the Anacostia River project (AWRP, 2010). In combination with the primary elements of the Recommended Plan, watershed based stormwater management may result in improved flood risk attenuation.

Despite Williamson County's current lack of participation, it should be clear that Williamson County's land use and development regulations are not static and have the potential to improve or further aggravate flooding issues in the USACE study area.

Evaluating a program of upland stormwater retrofitting and enhanced stormwater management requirements for all new development projects may materially change the flood hazard risk and economic analysis. A more comprehensive cost-benefit analysis may influence Federal and non-Federal sponsor decisions on the feasibility of the project.

USACE considers watershed-based flood mitigation measures as fundamental elements in a comprehensive plan. If upland flood mitigation measures can provide significant downstream flood mitigation, then the USACE should consider those measures even if the local building codes do not require those measures. This issue has not been addressed in the DIFR.

Significance – Medium

If flood attenuation through new upland floodwater controls is not evaluated, mitigation of flood risk may be less than optimal.

Recommendations for Resolution

1. Document and discuss upland stormwater reduction and retrofit opportunities throughout Williamson and Davidson Counties that have been or are under consideration for implementation with respect to their potential to attenuate peak discharges.
2. Provide an expanded discussion on the changes that have been implemented by Davidson County in the land development regulations that will require this type of flood mitigation infrastructure for future development.
3. Evaluate Federal, state, and local programs currently in place or likely to be adopted within the 50-year Federal planning horizon for this project to facilitate improved stormwater controls in Williamson and Davidson counties.

Literature Cited:

AWRP (2010). Anacostia River Watershed Restoration Plan and Report. Anacostia Watershed Restoration Partnership. February. Available online at: http://anacostia.net/Restoration_Plan/download/Anacostia-Report-Web-Quality.pdf

Final Panel Comment 10

The impacts of sediment transport and deposition on the efficacy of the project have not been addressed.

Basis for Comment

No discussion of sediment supply and transport in the Mill Creek project area are presented in the DIFR or the Biological Assessment (BA). Such information is particularly relevant considering the status of the Nashville crayfish as an endangered species and the proposed in-stream flood detention facility.

In particular, interrupting bedload transport may result in reduced flood detention performance and increased non-Federal sponsor maintenance. The potential formation bedload deposition zone in the backwater of the proposed Ellington Ag Bridge in-stream detention facility may adversely affect flood storage volume and flow characteristics. Such potential channel aggradation may result in increased lateral erosion and channel movement in the vicinity of the aggraded channel. Stream bank repair and potential need to remove in-stream accumulation of bedload immediately upstream of the facility have not been considered.

Perhaps more importantly, interruption of bedload transport by the proposed Ellington Ag Bridge modification to the stream reaches downstream of the proposed facility may adversely affect nursery habitat for the Nashville crayfish. The loss of bedload movement from upstream to downstream may result in sediment-starved reaches where nursery habitat is lost.

Interruption of bedload transport would be expected to result in in-channel deposition in the vicinity of the upstream limit of the flood pool associated with the Ellington Ag Bridge modification, which would lead to increased lateral migration pressures, increased bank erosion potential, an unidentified need for associated maintenance activities, and degradation of the downstream reach associated with loss of bedload transport into the reach.

Significance – Medium

Interruption of bedload transport may require greater long-term maintenance, increased need for stream bank stabilization, channel incision downstream of the in-stream facility, and channel aggradation upstream of the facility.

Recommendations for Resolution

1. Characterize sediment supply in the Mill Creek project area.
2. Evaluate aggradation above the proposed Ellington Ag Bridge in-stream detention facility.
3. Evaluate degradation below the proposed Ellington Ag Bridge in-stream detention facility.
4. Analyze the potential for aggradation to adversely affect flood storage attenuation and channel stability in the vicinity of the upstream pool limit.
5. Discuss the loss of bedload transport and loss of nursery habitat for the Nashville crayfish for the section of Mill Creek downstream of the proposed Ellington Ag Bridge.

Final Panel Comment 11

The variables that contribute to uncertainty have not been discussed.

Basis for Comment

USACE standard planning practice, as referenced in several ERs, Economic Guidance Memoranda (EGMs), and the NED procedure manuals, calls for identifying those variables that contribute to uncertainty and for those with the highest contribution, some discussion is needed to explain what steps were taken to reduce uncertainty.

These can include economic as well as engineering variables. For example, first-floor elevations, content-to-structure value ratios, depth-damage functions, flow-frequency, stage-frequency, return intervals, and any number of other key variables could affect project performance.

These variables need to be identified and discussed in the DIFR, particularly surrounding the development and performance of the Recommended Plan.

Significance – Medium

There is ambiguity surrounding the development and performance of the recommended plan due to the lack of discussion surrounding the variables that contribute to uncertainty.

Recommendations for Resolution

1. Identify the variables contributing most to uncertainty.
2. Explain what steps were taken to reduce uncertainty.
3. Discuss how those efforts reduced uncertainty and improved confidence in the performance of the Recommended Plan.

Final Panel Comment 12

It is unclear if the concept design for the selected articulated concrete mat has a demonstrated performance record and if the entire embankment including the crest section is protected against overtopping flows.

Basis for Comment

Engineering Appendix C does not provide any description or information on the ability of the proposed articulated concrete mat to provide overtopping protection under the assumed flow conditions. Federal Emergency Management Agency (FEMA) guidance for overtopping (FEMA, 2014) states that "of great importance for providing overtopping protection is to select a product that has been tested under the flow conditions expected during overtopping." In response to Panel questions during the Battelle-facilitated mid-review teleconference on November 20, 2014, USACE confirmed it had discussed the use of the articulated concrete mats with manufacturers. There is no documentation in the report regarding these discussions or the ability of the proposed products to perform under the anticipated fall conditions.

The cross-section of the Ellington Detention embankment shown in Appendix C does not indicate that the articulated concrete mat will extend over the crest of the embankment section nor does it show how the mat will be anchored to the embankment or if any bedding material will be required under the mat. The lack of a mat over the crest section implies a tacit assumption that the roadway paving will be satisfactory to resist scour and erosion under high overtopping flow conditions. This assumption is not conservative and does not comply with the performance of actual dams subjected to overtopping flows.

Based upon a review of FEMA guidance (2014), it appears that no specific performance data or testing support the use of an articulated concrete mat for the anticipated flow conditions at the project site.

Significance – Medium/Low

The proposed embankment protection using an articulated concrete mat is less than robust and upgrades needed to provide a satisfactory protection system could significantly increase the cost of the detention structure.

Recommendations for Resolution

1. Determine Inflow Design Flood (IDF), which should form the basis for the design of the overtopping protection.
2. Interview manufacturers to determine whether their products have actually performed under the proposed hydraulic conditions. If it is determined that an articulated concrete mat will not provide the required degree of protection, other forms of overtopping protection such as roller-compacted concrete (RCC) should be considered.
3. Revise the design and cost estimate for the overtopping protection based upon the manufacturer's recommendations to provide complete protection for the embankment under the IDF.
4. Provide documentation in Appendix C describing the design process and the basis for the overtopping protection.

Literature Cited:

FEMA (2014). Technical Manual: Overtopping Protection for Dams. Federal Emergency Management Agency. P-1015. May 31.
Available online at:
https://www.fema.gov/media-library/assets/documents/97888.

Final Panel Comment 13

The Recommended Plan does not clearly state how the proposed project will address the non-Federal sponsor's objectives.

Basis for Comment

USACE entered into an agreement with the local non-Federal sponsor to assist in reducing flood damage potential in the Mill Creek watershed. At that time the non-Federal sponsor identified specific Damage Center locations along Mill Creek where the worst flood damage had occurred, and the greatest needs for flood mitigation measures were identified. The DIFR does not clearly state how the Recommended Plan addresses each of the Damage Centers identified by the non-Federal sponsor (MWS, 2013). The DIFR refers to Damage Centers in the Plan Formulation (Section 4.1, Management Measures; Section 3.4, Appendix A), but has no specific sub-section summarizing the proposed outcomes at each of these Damage Centers. That summary might include the following text:

- The proposed modifications to the Briley Parkway Bridge will lower the elevation of floodwater in Space Park (Damage Center No. 3)
- The non-Federal sponsor has already implemented buyout measures in the Wimpole Drive area (Damage Center No. 2).
- The Recommended Plan does not appear to mitigate flood damage potential at Massman Drive (Damage Center No. 1) or at Antioch Pike (Damage Center No. 4).

Significance – Medium/Low

The DIFR does not link the Recommended Plan with the non-Federal sponsor's expectations and making those links will ensure clarity and completeness in the report.

Recommendations for Resolution

1. Add a text section that specifically addresses how the non-Federal sponsor's goals for flood damage reduction in the four Damage Centers have been addressed.

Literature Cited:

MWS (2013). Unified Flood Preparedness Plan. Metro Water Services. January. Available online at: http://www.nashville.gov/Portals/0/SiteContent/WaterServices/docs/reports/UFPP%20Final%20report.pdf

Final Panel Comment 14

The HEC-recommended National Weather Service DAMBRK model was not used to acquire higher accuracy data in the analysis of the Ellington Detention structure and may result in an underestimate of potential downstream hazards and loss of life.

Basis for Comment

Information provided by USACE staff in response to Panel questions posed to USACE during the mid-review teleconference on November 18, 2014, which was facilitated by Battelle, indicates that a dam breach analysis was performed for the embankment section using a model by Von Thun and Gillette that was developed in 1990. The Panel believes that the more accurate and more widely accepted National Weather Service Dam Break (NWSDAMBRK) model should be employed to evaluate the downstream flow conditions related to a failure of the Ellington Detention structure.

The NWSDAMBRK model is commonly used throughout the engineering community and is recommended by both the Federal Energy Regulatory Commission (FERC) and the Corps of Engineer's Hydrologic Engineering Center (HEC). The Engineering Guidelines for Hydropower Projects (FERC, 2010; p. 2-9) states that:

> **"**The most widely used and recommended method for dam break analysis is the unsteady flow and dynamic routing method used in the National Weather Service dam break model. The Corps of Engineer's Hydrologic Engineering Center (HEC) HEC-1 Manual defers to the NWSDAMBRK model when studies require higher levels of accuracy."

Significance – Medium/Low

The analysis of this condition should use the most accurate and accepted modeling methods to avoid an over- or underestimate of potential downstream hazards and loss of life.

Recommendations for Resolution

1. During the design phase of this project, analyze the potential impacts caused by an overtopping breach of the Ellington Detention structure using the NWSDAMBRK model.

Literature Cited:

FERC (2010). Engineering Guidelines for the Evaluation of Hydropower Projects. Federal Energy Regulatory Commission. June 28. Available online at: http://www.ferc.gov/industries/hydropower/safety/guidelines/eng-guide.asp.

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FERC (2003). Silver Lake Dam: Root Cause Report on the May 14, 2003 Operation of the Fuse Plug Spillway and Subsequent Channel Erosion Resulting in the Uncontrolled Release of Silver Lake. Dead River Hydroelectric Project Federal Energy Regulatory Commission Licensed Project No. 10855. October 6. Upper Peninsula Power. Available online at: http://www.ferc.gov/industries/hydropower/safety/projects/silver-lake/rcr.pdf.

MWS (2013). Unified Flood Preparedness Plan. Metro Water Services. January. Available online at: http://www.nashville.gov/Portals/0/SiteContent/WaterServices/docs/reports/UFPP%20Final%20report.pdf

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USACE (2014). Climate Change Adaptation Plan. U.S. Army Corps of Engineers, USACE Climate Preparedness and Resilience Steering Committee. June. Available online at: http://www.corpsclimate.us/docs/USACE_Adaptation_Plan_v50_2014_June_lores.pdf

USACE (2012). Water Resources Policies and Authorities: Civil Works Review. Engineer Circular (EC) 1165-2-214. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. December 15.

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

USACE (1996a). Planning – Risk-Bask Analysis for Evaluation of Hydrology/Hydraulics, Geotechnical Stability, and Economics in Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. March 1. Available online at: http://www.fws.gov/nces/ecoconf/Additional%20Documentation/CORPS_Civil%20Works/MiscTechnical/ER1105-2-101.pdf.

USACE (1996b). Engineering and Design -- Risk-Based Analysis for Flood Damage Reduction Studies. Engineer Manual (EM) 1110-2-1619. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. August 1. Available online at: http://www.skagitriverhistory.com/Corps%20Docs/EM1110-2-1619.pdf.

USACE (1991). Inflow Design Floods for Dams and Reservoirs. Engineer Regulation (ER) 1110-8-2 (FR). Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. March 1. Available online at: http://planning.usace.army.mil/toolbox/library/ERs/ER1110-8-2(FR)_01Mar1991.pdf.

APPENDIX A

IEPR Process for the Mill Creek 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 Mill Creek, Davidson County, Feasibility Report Independent External Peer Review (hereinafter: Mill Creek IEPR). Due dates for milestones and deliverables are based on the award/effective date of February 28, 2014. The review documents were provided by the U.S. Army Corps of Engineers (USACE) on October 28, 2014. Battelle initiated activities in Tasks 1, 2, and 3 but were informed by USACE on March 31, 2014 date that the review documents would be delayed. The project was on hold and no additional work was completed until the receipt of review documents. Note that the work items listed under Task 6 occur after the submission of this report. Battelle will enter the 14 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. Mill Creek Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	2/28/2014
	Review documents available	10/28/2014
	Battelle submits draft Work Plan[a]	11/30/2014
	USACE provides comments on draft Work Plan	3/10/2014
	Battelle submits final Work Plan[a]	3/18/2014
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	3/21/2014
	USACE provides comments on COI questionnaire	3/5/2014
	Battelle submits list of selected panel members[a]	3/7/2014
	USACE confirms the panel members have no COI	3/10/2014
	Battelle completes subcontracts for panel members	3/18/2014
3	Battelle convenes kick-off meeting with USACE	3/7/2014
	Battelle sends review documents to panel members	11/3/2014
	Battelle convenes kick-off meeting with panel members	3/31/2014
	Battelle convenes kick-off meeting with USACE and panel members	3/31/2014
	Battelle convenes follow-up kick-off meeting with USACE and panel members	11/6/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	11/20/2014
4	Panel members complete their individual reviews	11/25/2014

Table A-1. Mill Creek Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Battelle provides panel members with talking points for Panel Review Teleconference	12/3/2014
	Battelle convenes Panel Review Teleconference	12/4/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	12/5/2014
	Panel members provide draft Final Panel Comments to Battelle	12/12/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	12/13/2014 - 12/22/2014
	Panel finalizes Final Panel Comments	12/23/2014
	Battelle receives the Public Comments from USACE	12/12/2014
	Battelle sends public comments to Panel	12/16/2014
	Panel completes their review of the public comments	12/19/2014
	Battelle and Panel review Panel's response to Public Comments	12/22/2014
	Public Comment Final Panel Comment Finalized (if needed)	12/29/2014
5	Battelle provides Final IEPR Report to panel members for review	12/30/2014
	Panel members provide comments on Final IEPR Report	1/6/2015
	Battelle submits Final IEPR Report to USACE[a]	**1/8/2015**
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	1/12/2015
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	1/12/2015
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	1/12/2015
	USACE Project Delivery Team (PDT) provides draft PDT Evaluator Responses to PCX	1/28/2015
	USACE provides draft PDT Evaluator Responses to Battelle	2/4/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	2/6/2015
	Panel members provide Battelle with draft BackCheck Responses	2/11/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	2/12/2015
	Battelle convenes Comment-Response Teleconference with panel members and USACE	2/17/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	2/24/2015
	Battelle provides final PDT Evaluator Responses to panel members	2/26/2015
	Panel members provide Battelle with final BackCheck Responses	3/3/2015

Table A-1. Mill Creek Complete IEPR Schedule (continued)

Task	Action	Due Date
6[b]	Battelle inputs the Panel's final BackCheck Responses in DrChecks	3/10/2015
	Battelle submits pdf printout of DrChecks project file[a]	3/11/2015
3	CWRB Meeting (Estimated Date)[c]	4/16/2015
	Contract End/Delivery Date	5/30/2015

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 Mill Creek 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). The final work plan was submitted prior to the anticipated receipt of the review documents on March 21, 2014. Revisions to the schedule were submitted to USACE via email after the receipt of the review documents on October 28, 2014. 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 and within four days of their subcontracts being finalized, all the members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. After these kick-off meetings were held, Battelle was informed by USACE that the review documents were delayed. After the receipt of the documents (six-month delay), Battelle facilitated a follow-up kick-off meeting with USACE and the Panel to review the changes in the project. Before the follow-up kick-off teleconference, the IEPR Panel received an electronic version of the final charge, as well as the Mill Creek 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.

- **Feasibility Report Integrated EA (146 pages)**
- **Appendix A: Economics Analysis (41 pages)**
- **Appendix B: Real Estate Plan (11 pages)**
- **Appendix C: Engineering Appendix (28 pages)**
- **Attachment A: Hydrology & Hydraulics (H&H) (129 pages)**
- **Attachment B: Cost Engineering (17 pages)**
- **Attachment C: Abbreviated Risk Analysis (ARA) (10 pages)**
- **Attachment D: Hazardous, Toxic, and Radioactive Waste (HTRW) (77 pages)**
- **Attachment E: Geographic Information System (GIS) (8 pages)**

- **Public Comments (6 pages)**
- **Scoping Letter 2 pages)**
- **Scoping responses (13 pages)**
- **Memorandum for record of meeting with USFWS (1 page)**
- 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 Mill Creek 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 17 panel member questions to USACE. USACE was able to provide responses to all of the questions during the teleconference or via email.

In addition, throughout the review period, USACE provided documents at the request of panel members. The following documents were provided to Battelle and then sent to the Panel as additional information only and were not part of the official review: .

- Appendix C1 – Mill Creek Watershed Feasibility Study Flood Frequency Profiles
- Appendix C2 – Mill Creek Watershed Feasibility Study Floodway Data
- Appendix C4 – Hydrology and Hydraulics – Future Without Project Conditions – Water Surface Profiles
- Appendix C5– Hydrology and Hydraulics – Historic Floods – Inundation Maps
- Appendix C6– Hydrology and Hydraulics – Historic Floods – Water Surface Profiles
- Appendix C7– Mill Creek Watershed Feasibility – HEC-SSP – Bulletin 17B – Frequency Analysis Reports
- Appendix C8– RCC Structure Above Old Hickory Boulevard – Process to Evaluate Real Estate Acquisition
- Ellington Ag Center Pertinent Data Revised.docx
- Ellington Ag Roadway Profile.xlsx
- Final Mill Creek Biological Assessment Report – 6 November 2014
- Draft Legacy Study Requirements
- Mill Creek Feasibility Estimate (MII).docx

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 12 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 3-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 13 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 Mill Creek 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. An additional Final Panel Comment was submitted for consideration after the panel review teleconference, bringing the total from 13 to 14 Final Panel Comments. At the end of this process, 14 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.

A.5 Conduct of the Public Comment Review

On December 11, 2014, Battelle received a pdf file from USACE containing six pages of written public comments on the Mill Creek project. Battelle then sent the public comments to the panel members on December 12, 2014, who were also charged with responding to the following two additional charge questions:

1. Does information or concerns expressed in the public comments raise any additional discipline-specific technical concerns with regard to the overall report?

2. Has adequate stakeholder involvement occurred to identify issues of interest and to solicit feedback from interested parties?

The Panel produced individual comments in response to the two charge questions. Battelle reviewed the comments to identify any new technical concerns that had not been previously identified during the initial IEPR. Upon review, Battelle determined and the Panel confirmed that no new issues or concerns were identified other than those already covered in their Final Panel Comments. The Panel also determined that adequate stakeholder involvement had occurred.

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APPENDIX B

Identification and Selection of IEPR Panel Members for the Mill Creek Project

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B.1 Panel Identification

The candidates for the Mill Creek, Davidson County, Feasibility Report (hereinafter: Mill Creek IEPR) Panel were evaluated based on their technical expertise in the following key areas: economics/Civil Works planning, environmental, hydrologic and hydraulic (H&H) engineering, and geotechnical/structural engineering. These areas correspond to the technical content of the Mill Creek IEPR review documents and overall scope of the Mill Creek project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected four experts for the final Panel.

The four selected reviewers constituted 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 Mill Creek, Davidson County, Feasibility Report
- Previous and/or current involvement by you or your firm[2] in flood management, ecosystem restoration studies in the Middle Tennessee area, including Nashville, Davidson County, or Williamson County
- Previous and/or current involvement by you or your firm[2] in the Mill Creek, Davidson County, Feasibility Report related projects.

[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 a panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime.

- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operation and maintenance of any projects in the Mill Creek, Davidson County, Feasibility Report related projects.
- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to Mill Creek, Davidson County, Feasibility Report.
- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors: Metropolitan Government of Nashville and Davidson County (i.e., Metro Nashville) (for pay or *pro bono*).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Middle Tennessee area, including Nashville, Davidson County, or Williamson County.
- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research and Development Center [ERDC], etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Nashville District.
- Previous or current involvement with the development or testing of models that will be used for or in support of the Mill Creek, Davidson County, Feasibility Report.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Nashville 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 Nashville District. Please explain.
- Any previous employment by USACE as a direct employee, notably if employment was with the Nashville 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 Nashville 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 ecosystem review or flood management, and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in Mill Creek, Davidson County, Feasibility Report-related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last three years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last three years came from contracts with the non-Federal sponsor (Metropolitan Government of Nashville and Davidson County (Metro Nashville)).
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to Mill Creek, Davidson County, Feasibility Report

- Participation in relevant prior and/or current Federal studies relevant to this project and/or Mill Creek, Davidson County, Feasibility Report
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or Mill Creek, Davidson County, Feasibility Report
- Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe:

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. Three of the four final reviewers are affiliated with a consulting company; the other is an independent consultant. 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 four 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. Mill Creek IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Luckie	Berg	Philips	Spaulding
Economics/Civil Works Planning				
Minimum 15 years of demonstrated experience in economics	X			
Familiarity with large, complex Civil Works projects with high public and interagency interests	X			
Minimum of 10 years of expertise in flood risk management	X			
Senior water resources planner with experience in specifically authorized watershed and feasibility studies	X			
Direct experience working for or with USACE	X			
Experience in demonstrating feasibility-level benefits for both structural and nonstructural measures	X			
Experience with use of standard USACE computer programs including:				
Institute for Water Resources (IWR) Planning Suite	X			
High familiarity with USACE plan formulation process, procedures, and standards as they relates to flood risk management.	X			
Familiarity with watershed planning and experience relevant to both structural and nonstructural flood risk management plan formulation. Minimum of 5 years of experience directly dealing with the USACE six-step planning process, which is governed by ER 1105-2-100, Planning Guidance Notebook.	X			
Active participation in related professional societies encouraged				
M.S. degree or higher in economics	W[1]			
Environmental Review				
Minimum 15 years of experience directly related to water resource environmental evaluation or review.		X		
Minimum 15 years of experience directly related to National Environmental Policy Act (NEPA) compliance		X		
Familiarity with large, complex Civil Works projects with high public and interagency interests		X		
Familiarity with the habitat, fish, and wildlife in this study area (Middle Tennessee)		X		
Familiarity with the U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP) (USFWS, 1980)		X		
Familiarity with the Environmental Protection Agency Habitat Assessment Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers.		X		

W[1]-Waiver statement provided as part of Task 2 deliverable and approved by USACE

Technical Criterion	Luckie	Berg	Philips	Spaulding
Active participation in related professional and scientific societies		X		
M.S. degree in related field		X		
Hydrology and Hydraulic Engineering				
Registered P.E. with a minimum 15 years of experience in hydrologic and hydraulic engineering			X	
Familiarity with large, complex Civil Works projects with high public and interagency interests			X	
Experience with all aspects of hydrology and hydraulic engineering including:				
urban hydrology and hydraulics			X	
open channel systems			X	
effects of management practices and low impact development on hydrology			X	
design of earthen dams and detention ponds			X	
use of nonstructural systems as they apply to flood proofing, warning systems, and evacuation			X	
Experience with modeling regional detention measures as well as other local structural measures			X	
Familiarity with standard methods of flood risk management analysis and Hydraulic Engineering Center (HEC) modeling computer software, including HEC River Analysis System (RAS) and HEC Hydrologic Modeling System (HMS).			X	
Active participation in related professional engineering and scientific societies			X	
Degree in engineering			X	
Geotechnical/Structural Engineering				
Registered P.E. with a minimum 15 years of experience in geotechnical and structural engineering				X
Familiarity with large, complex Civil Works projects with high public and interagency interests				X
Familiarity with both structural and nonstructural measures				X
Demonstrated experience in performing structural engineering, as well as geotechnical evaluation and geo-civil design for all phases of flood risk management projects				X
Experience in the design and construction of:				
levees				X
culverts				X
channel stability				X

Technical Criterion	Luckie	Berg	Philips	Spaulding
bridges				X
Experience in design and construction for:				
detention/retention basins				X
utility relocations				X
positive closure requirements				X
interior drainage requirements				X
application of nonstructural flood risk management measures				X
Familiarity with, and demonstrated experience related to, USACE geotechnical practices associated with:				
flood management channels				X
construction				X
soil engineering				X
Experience in:				
geotechnical risk analysis				X
fragility analysis				X
HTRW impacts				X
Experience with cost engineering/construction management				X
Ability to address the USACE Safety Assurance Review (SAR) aspects of all projects in accordance with ER 1110-2-1150				X
Active participation in related professional engineering and scientific societies				X
M.S. degree or higher in engineering				X

B.3 Panel Member Qualifications

David Luckie

Role: Economics/Civil Works planning expertise.
Affiliation: Independent Consultant

Mr. Luckie is an independent consultant with 25 years of professional experience in water resource economics, planning, plan formulation, benefit-cost analysis, and risk-based analysis. He earned his B.S. in economics from the University of South Alabama in 1986, and his professional experience includes working with multidisciplinary teams to provide complex planning studies including flood control, water supply, water quality and ecosystem restoration. He has extensive experience in conducting, managing and reviewing flood risk management (FRM) study projects, dating to the 1990 Choctawhatchee-Pea Rivers Watershed studies to address flood risk management issues in Southeast Alabama.

Mr. Luckie is familiar with large, complex Civil Works projects and has worked with large, multidisciplinary teams consisting of members from state and local agencies in addition to technically adept non-Federal sponsors of flood risk management projects. His experience also includes technical and policy review to ensure that planning studies comply with applicable guidance and current law. During his 17-year career with USACE, Mr. Luckie led or worked on numerous multidisciplinary teams to produce complex Federal water resource studies and was involved in various high-profile public works projects. For example, he provided the economic analyses and plan formulation services for the Buffalo Bayou & Tributaries Studies in Houston, Texas.

Mr. Luckie's involvement in such studies as the White Oak Bayou FRM study in Houston, Texas reflect his extensive experience with USACE FRM analysis and economic benefit calculations, including use of standard USACE computer programs such as the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA). He is very familiar with the USACE six-step planning process governed by ER 1105-2-100, Planning Guidance Notebook, and has worked in close coordination with multidisciplinary teams to identify, formulate and evaluate alternatives. Using the six-step planning process, he identified cost effective solutions to water resource problems and flood risk management throughout the Southeast and across the United States. He also has considerable expertise in the Institute for Water Resources Planning Suite (IWRPS) and has used it to determine cost effectiveness and "best buy" plans, as well as reviewing studies prepared using IWRPS and examining determinations of cost-effectiveness and identification of best investments.

He is also familiar with watershed planning. His leadership in the Village Creek Watershed Studies and ACT-ACF studies demonstrated a comprehensive understanding of complex watershed management and watershed planning. In addition, he is experienced in both structural and nonstructural flood risk management plan formulation, with project experience including The Village Creek Watershed Study in Birmingham, Alabama and Buffalo Bayou & Tributaries Studies in Houston, Texas, that incorporated a broad array of both structural and nonstructural management measures.

Joseph Berg

Role: Environmental Review expertise.
Affiliation: Biohabitats, Inc.

Mr. Berg is an ecological restoration practice lead for Biohabitats, Inc. with 31 years of professional experience in the assessment, analysis, evaluation, and documentation for water resource environmental evaluation and review. Areas of expertise include wetland restoration; stream restoration; stormwater best management practices (BMP) retrofitting; fish, amphibian, and aquatic invertebrate assessment; water quality assessment; Endangered Species Act compliance work; and National Environmental Policy Act (NEPA) compliance. He earned his M.S. in Marine, Estuarine and Environmental Science from the University of Maryland in 1984 and holds certifications as USACE Wetland Delineator, Senior Ecologist with the Ecological Society of America, Professional Wetland Scientist with the Society of Wetland Scientists, and in Erosion and Sediment Control for the State of Maryland.

Mr. Berg is familiar with the habitat, fish, and wildlife in the Middle Tennessee study area and is experienced with the dominant species and communities of the region. Relevant studies include the Vector Control Supplemental Environmental Impact Statement, Tennessee, and Tates Creek Road, Madison County, Kentucky projects. He is experienced with large, complex Civil Works projects with high public and interagency interests and has been involved in a number of USACE projects requiring NEPA and water resource evaluation and review, including dredge material, dam removal, and stream and wetland restoration. Example studies are the Gwynns Falls Ecosystem Restoration Phase I (MC-10), Baltimore, Maryland, USACE/Baltimore City and the Nine Mile Run Aquatic Ecosystem Restoration, Pittsburgh, Pennsylvania, USACE, Pittsburgh District, which entailed planning, engineering, environmental investigations, analyses, concept, preliminary, and detailed designs.

Mr. Berg is familiar with the U.S. Fish and Wildlife Service Habitat Evaluation Procedure (HEP) (USFWS, 1980) and is trained and certified by USFWS in HEP. He has used the approach in USACE cost-benefit analysis, restoration design, and impact assessment on studies such as the USACE Philadelphia District, Wissahickon Feasibility Study, Philadelphia, Pennsylvania. He is familiar with the U.S. Environmental Protection Agency Habitat Assessment Rapid Bioassessment Protocols (USEPA RBP) and other RBPs for use in streams and wadeable rivers in the eastern United States. As part of the Cub Run Watershed Study in Fairfax Virginia, he used EPA's RBP to document habitat conditions for more than 10 miles of stream. The resulting data were integrated into the watershed study to identify stable and unstable stream reaches. Ultimately, this information was used to identify areas where excessive erosion was occurring, locations where good buffer conditions persisted, and to identify potential restoration opportunities.

Mr. Berg is a member and former officer of the Society of Wetland Scientists; member and former officer for the Ecological Society of America; member and current officer/ board member of the Society of Ecological Restoration; and member and Associate Editor for the American Water Resources Association.

Chris Philips, P.E.

Role: Hydrology and hydraulic engineering expertise.
Affiliation: Riverbend Engineering, LLC.

Mr. Philips is the owner and senior engineer at Riverbend Engineering, LLC in Albuquerque, New Mexico. He earned his Master's degree in civil engineering with a specialty in water resources in 1996 from the University of New Mexico. He is a registered professional engineer in New Mexico, Colorado, and Texas, a certified floodplain manager in New Mexico, and NRCS Technical Services Provider in New Mexico and Colorado. He has 28 years of experience in all aspects of hydrologic and hydraulic engineering, with an emphasis on large public works projects associated with ecosystem restoration and natural channel design. His experience with urban hydrology and hydraulics, open channel systems, effects of management practices, and low impact development on hydrology is reflected in his experience in urban areas in New Mexico and Texas. He has designed hundreds of open channel systems, including physical modeling of some complex systems for studies including the Lisbon Arroyo Energy Dissipator Structure study and the Pagosa Springs Whitewater Waves Nos. 2 & 3 Structures project.

Mr. Philips is versed in the design of earthen dams and detention ponds, and has designed numerous small earthen embankments and detention basins to retain flood waters for such projects as the South Hobbs flood Control Project, the Santa Ana Dam Rehabilitation Project, and the Alamogordo Flood Control Channels Project. His knowledge of both floodplain restoration for ecological restoration as well as flood reduction and peak flow attenuation reflects his experience in the use of nonstructural systems as they apply to flood proofing, warning systems, and evacuation and is demonstrated in his work on the San Juan Botanic Gardens project in Farmington, New Mexico project. He is experienced with modeling regional detention measures and other local structural measures and has designed more than 20 detention basins, including routing of flood waves through a facility.

Mr. Philips has more than 25 years direct experience using the HEC suite of H&H tools and is familiar with USACE hydrologic and hydraulic computer models. Expertise includes HEC-River Analysis System (HEC-RAS) 4.0, and HEC-Hydrologic Modeling System (HEC-HMS) models. He also has project experience using HEC-1, HEC-2. Specific hydraulic modeling experience includes two Alamogordo Flood Control channels for the USACE Albuquerque District; the Rio Fernando in Taos, New Mexico; the San Juan River at Pagosa Springs, Colorado; La Cueva arroyo in Albuquerque, New Mexico; and the Uncompahgre River in Ridgway, Colorado. Additionally, he is experienced in both computer simulation and physical modeling of large river systems and has project experience using HEC-6 and SAMwin. Relevant projects include watershed-based sedimentation studies and reach level sediment transport analyses on the Zuni River and sediment transport studies on numerous arroyos in New Mexico.

In addition to his work experiences, Mr. Philips actively participates in related professional societies including the American Society of Civil Engineers and the American Water Resources Association.

Douglas Spaulding, P.E.

Role: Geotechnical engineering expertise.
Affiliation: Spaulding Consultants, LLC

Mr. Spaulding is a Principal and geotechnical engineer with Spaulding Consultants, LLC. He earned his M.S. in geotechnical engineering from Purdue University and is a licensed professional engineer in Wisconsin, Minnesota, Michigan, North Dakota, and Arkansas. He has more than 46 years of experience in the design, evaluation, and inspection of water-retaining structures, providing structural and geotechnical engineering civil design services for all phases of flood risk management control levees and embankments. During his 10 years with USACE, where he served as Chief of the Levee and Channel Design Section for the St. Paul District, he acquired broad experience related to USACE geotechnical practices associated with flood management channels, construction and soil engineering.

Mr. Spaulding is familiar with large, complex Civil Works projects with high public and interagency interests, illustrated in projects such as the Pembina levee project in North Dakota where he provided geotechnical design services for over $200 million worth of local flood protection projects in Minnesota and North Dakota. Experience in cost engineering/construction management was acquired during his tenure with a private civil construction firm where he prepared bid estimates for the construction of earthwork projects, including bulk material handling facilities and hydroelectric projects. He is familiar with the USACE Micro-Computer Aided Cost Estimating System (MCAES) system.

Mr. Spaulding is familiar with both structural and nonstructural flood control measures and has designed and managed the design of numerous levee floodwall and flood control channel projects. These include concrete-lined channels, earth diversion channels, earth levees, and floodwall projects. Example projects include the relocation of the City of Soldiers Grove in Wisconsin and the recent participation in the USACE IEPR for the West Shore Flood Protection Project near New Orleans. He is experienced in the design and construction of levees, culverts, and channel stability, having worked on the project evaluation of stability of levee and river slopes and the evaluation of levees constructed for eight projects located in the Red River of the North, USACE St. Paul District. He has extensive experience with culverts of various sizes, ranging from smaller corrugated metal pipe to large cast-in-place concrete culvert systems. He has also participated in the design or peer review of six major channel projects, most recently the three-billion dollar Fargo-Moorhead, North Dakota flood diversion channel project. Mr. Spaulding has also worked on the design and construction of bridges, both highway and pedestrian bridges founded on soft clay and granular deposits.

Mr. Spaulding is experienced in geotechnical risk analysis, fragility analysis, and the impact of Hazardous, Toxic, and Radioactive Waste (HTRW). Over the last 10 years, Mr. Spaulding has participated in more than 75 Potential Failure Mode Analysis (PFMA) evaluations of levees, USACE flood control dams, and hydroelectric projects. He has served as a participant and facilitator for potential failure mode evaluations for both large arch dams and gravity structures in the western United States and liquefaction studies for embankments in the Midwest. These valuations have included review of seismic computations and impacts on the integrity of the various structures. As a Federal Energy Regulatory Commission (FERC) authorized facilitator of PFMA evaluations, Mr. Spaulding has directed more than 50 evaluations of embankment dams, concrete gravity structures, and arch dam structures. His background in HTRW impacts is reflected in such projects as the remediation study for HTRW compliance at the USACE boatyard and maintenance facility in Fountain City Wisconsin and the evaluation of the impact of buried of landfill deposits along the alignment of the Breckenridge, Minnesota Levee Project.

Mr. Spaulding is experienced in the design and construction of detention/retention basins and positive closure designs, and is familiar with interior drainage requirements. For a major period of his career he worked on the design, inspection, and rehabilitation of dams and other water-retaining structures, for example, he worked on the Mankato Stage III Project, which used ponding areas in its design. His experience with positive closure designs includes the evaluation and design of earth closures with stock-piled fill, where pre-flood time permitted installation, aluminum stop log closures, and gated closures are employed.

He also has a background in the design, management, or peer review of more than 15 levee and floodwall projects. All of these projects required evaluation of interior drainage and the design of suitable ponding areas, conveyance systems, and pumping stations. His project background also covers nonstructural solutions, including complete relocation of small communities, local ring levees to protect specific structures, and flood proofing of structures within the inundation area. In addition, he has served as the on-site USACE representative for temporary emergency construction and flood proofing during several major flood events in the upper Midwest.

Mr. Spaulding is familiar with all aspects of utility relocation, from simple utility realignment to project-specific design requirements. In his role as project manager for numerous local flood protection projects, such as the Pembina Local Flood Protection Project, he was responsible for the identification, design, and implementation of numerous utility relocations.

In the last four years, Mr. Spaulding has served on several IEPR review panels dealing with local flood protection projects, dam remediation, dam replacement, and seepage control system upgrades. This experience has provided extensive background in USACE's Safety Assurance Review (SAR) requirements. In addition, Mr. Spaulding has also participated in extensive Section 408 review for the installation of a large hydroelectric project at a USACE flood control dam.

Mr. Spaulding is a lifetime member of the American Society of Civil Engineers. He also is a member of the Minnesota Geotechnical Society, the National Hydropower Association, and the Construction Panel for the Minneapolis section of the American Arbitration Association.

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APPENDIX C

Final Charge to the IEPR Submitted to USACE on March 21, 2014 for the Mill Creek Project

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CHARGE QUESTIONS AND GUIDANCE TO THE PANEL MEMBERS FOR THE IEPR OF THE MILL CREEK, DAVIDSON COUNTY, FEASIBILITY REPORT

BACKGROUND

Located in one of the most rapidly urbanizing areas of Middle Tennessee, the 108-square-mile Mill Creek Watershed drains about 13% of Nashville, Davidson County, and 6% of Williamson County. About two-thirds of the watershed is within Davidson County and one-third in Williamson County. The Mill Creek Watershed is subject to frequent flooding, with major flooding occurring in May 1979, which caused an estimated $93 million in damages; and again in May 2010, which caused an estimated $185 million. The May 2010 flood also caused two fatalities in the Mill Creek basin alone.

The Metropolitan Government of Nashville and Davidson County (Metro Nashville) are the study sponsors. The Feasibility Cost Sharing Agreement was signed in April 2003, and was originally scoped for both Flood Risk Management (FRM) and Ecosystem Restoration (ER). The study involved an update of the Flood Insurance Study (FIS), which occurred prior to alternative analysis. The FIS update and alternative analysis were completed by 2006, leading to a Feasibility Scoping Meeting (FSM) in September 2007.

The FIS was completed following a particularly dry period of record, and the updated statistical flow analysis essentially had the effect of lowering the base flood elevation (BFE) for several areas in the Mill Creek Watershed. This led to lower existing condition damages and, at the time, it appeared that only a nonstructural FRM plan would be justifiable. Several sites were selected for ER alternatives.

In May 2010, record flooding hit the Mill Creek Watershed, along with much of Middle Tennessee. As mentioned previously, this flood event caused two fatalities and an estimated $185 million in the Mill Creek Watershed alone. This event sparked the need for a re-evaluation of the FIS update. From June 2011 through December 2012, the FIS was revised to include the wetter intervening period of record since the 2006 analysis. Additionally, a screening level alternative analysis confirmed that several alternatives previously not economically justifiable could now be justified. The sponsors also decided to drop the ER portion of the study and to move forward focusing solely on FRM opportunities.

Nashville District completed an updated hydrologic and hydraulic (H&H) analysis to develop a recommended plan to complete the Feasibility Phase of study, which is targeted for completion in December 2014. The scope of this study now includes only FRM analysis in the Davidson County portion of the Mill Creek Watershed. Both local and regional structural and nonstructural measures were evaluated. Regional Peak Flow Control Structures (PFCS) were considered, along with channel improvements, bridge modifications, structure evacuations, flood proofings, structure elevations, and a quarry diversion. An effort was made to develop a FRM plan that provides ancillary ecosystem benefits.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Mill Creek, Davidson County, Feasibility Report (hereinafter: Mill Creek 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 Mill Creek IEPR documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in areas relevant to the project: economics/Civil Works planning, environmental review, hydrologic and hydraulic engineering, and geotechnical/structural engineering. 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.

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:

Review Documents	
Title	**No. of Pages**
Feasibility Report Integrated EA	146
Appendix A: Economics Analysis	41
Appendix B: Real Estate Plan	11
Appendix C: Engineering Appendix	28
Attachment A: Hydrology & Hydraulics (H&H)	29
Attachment B: Cost Engineering	17
Attachment C: Abbreviated Risk Analysis (ARA)	10
Attachment D: Hazardous, Toxic, and Radioactive Waste (HTRW)	77
Attachment E: Geographic Information System (GIS)	8
Public Comments	6
Scoping Letter	2
Scoping responses	13
Memorandum for record of meeting with USFWS	1
Total Pages	**389**

Documents for Reference

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

SCHEDULE

This final schedule is based on the March 20, 2014, receipt of the final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	3/21/2014[1]
	Battelle convenes kick-off meeting with panel members	3/31/2014
	Battelle convenes kick-off meeting with USACE and panel members	3/31/2014
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	11/6/2014
	Panel members complete their individual reviews	11/20/2014
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	12/3/2014
	Battelle convenes Panel Review Teleconference	12/4/2014
	Battelle provides Final Panel Comment templates and instructions to panel members	12/5/2014
	Battelle receives the Public Comments from USACE	12/12/2014
	Battelle sends public comments to Panel	12/16/2014
	Panel completes their review of the public comments	12/19/2014
	Panel members provide draft Final Panel Comments to Battelle	12/12/2014
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	12/13/2014 - 12/22/2014
	Panel finalizes Final Panel Comments	12/23/2014
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	12/30/2014
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	1/8/2015
	USACE provides draft PDT Evaluator Responses to Battelle	1/12/2015
	Battelle provides the panel members the draft PDT Evaluator Responses	1/12/2015
	Panel members provide Battelle with draft BackCheck Responses	1/12/2015
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	1/27/2015

[1] Battelle was notified on March 21, 2014 date that the review documents were delayed. The panel was notified via email of the delay. Once the review documents were received on October 28, 2014, Battelle provided this charge with a revised schedule and the review documents to the panel.

Task	Action	Due Date
	Battelle convenes Comment-Response Teleconference with panel members and USACE	2/3/2015
	USACE inputs final PDT Evaluator Responses to DrChecks	2/4/2015
	Battelle provides PDT Evaluator Responses to panel members	2/9/2015
	Panel members provide Battelle with final BackCheck Responses	2/10/2015
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	2/12/2015
	Battelle submits pdf printout of DrChecks project file	2/20/2015

CHARGE FOR PEER REVIEW

Members of this IEPR Panel are asked to determine whether the technical approach and scientific rationale presented in the Mill Creek IEPR 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, and environmental resource analyses and on 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 Mill Creek IEPR 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 (Jessica Tenzar, tenzarj@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 Jessica Tenzar, **tenzarj@battelle.org**, no later than April 14, 2014, 10 pm ET (Revised to November 19, 2014 in charge to Panel, due to delay in Review Documents).

IEPR of the Mill Creek, Davidson County, Feasibility Report

CHARGE QUESTIONS AND RELEVANT SECTIONS AS SUPPLIED BY USACE

General

1. Were all models used in the analyses, including the models assessing the hazards, used in an appropriate manner?
2. Are the models used in a manner that supports the conclusions drawn from them (i.e., do they identify meaningful differences between alternatives)?
3. Are the assumptions that underlie the various analyses sound?
4. Are potential life safety issues accurately and adequately described under existing, future without-project, and future with-project conditions?
5. Are the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design?
6. Are the assumptions made for the hazards appropriate?
7. Does the analysis adequately address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project?
8. In your opinion, are there sufficient analyses upon which to base the recommendation?
9. Are the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design?
10. Does the decision document(s) adequately address the stated need and meet the intent?
11. Is the need for and intent of the decision document(s) clearly described?

Problem, Opportunities, Objectives, and Constraints

12. Are the problems, opportunities, objectives, and constraints adequately and correctly defined? Are there any gaps or overstatements?
13. Do the identified problems, opportunities, objectives, and constraints reflect a watershed approach, addressing 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 (i.e., evaluate the resources and related demands as a system)?
14. 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

15. Have the character and scope of the study area been adequately described, and is the identified study area appropriate in terms of undertaking a watershed-based investigation?

16. Do you agree with the general analyses of the existing social, financial, and natural resources within the study area?
17. Given your area of expertise, does this section appropriately address the existing conditions of all resources pertinent to the study?
18. 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? Is the discussion complete on the relationship between subsurface hydrology and the hydrodynamics of the project area?
19. 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)?
20. 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)? Were the potential effects of climate change addressed?
21. Are the future conditions expected to exist in the absence of a Federal project logical and adequately described and documented?
22. Please comment on the conclusion of the most probable future without-project condition. Do you envision other potential probable outcomes?

Plan Formulation/Alternative Development

23. Was a reasonably complete array of possible measures considered in the development of alternatives?
24. Did the formulation process follow the requirement to avoid, minimize, and then mitigate adverse impacts on resources?
25. Does each alternative meet the formulation criteria of being effective, efficient, complete, and acceptable?
26. Were the assumptions made for use in developing 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?
27. Have system perspectives been considered in the formulation of alternatives?
28. Is sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses?
29. 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?

30. Please comment on the screening of the proposed alternatives. Are the screening criteria appropriate? In your professional opinion, were any measures or alternatives screened out prematurely?
31. Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies? Was public safety adequately considered?
32. Are cumulative impacts adequately described and discussed? If not, please explain.

Recommended Plan

33. Please comment on whether you agree or disagree with how the selected alternative was formulated and selected. Also, please comment on the plan formulation. Does it meet the study objectives and avoid violating the study constraints?
34. Are there any unmitigated environmental impacts not identified? If so, could they impact plan selection?
35. Please comment on the likelihood of the recommended plan to achieve the expected outputs.
36. Please comment on the completeness of the recommended plan. Will any additional efforts, measures, or projects be needed to realize the expected benefits?

Overview Questions as Supplied by Battelle

37. Please identify the most critical concerns (up to five) you have with the project and/or review documents.
38. Please provide positive feedback on the project and/or review documents

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