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Final Independent External Peer Review Report Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment

Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-10-D-0002
Task Order: 0028

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Feasibility Study Report and Environmental Assessment

by

Battelle
505 King Avenue
Columbus, OH 43201

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Final Independent External Peer Review Report for the

Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment

EXECUTIVE SUMMARY

Project Background and Purpose

The U.S. Army Corps of Engineers (USACE) is working with the City of Springfield, Missouri, the non-federal sponsor, to address city flooding issues that are a result of urbanization and insufficient flow capacity along Jordan Creek. The study area is located within the White River Basin, extending approximately 6 miles along Jordan Creek. Jordan Creek, including North Branch and South Branch Jordan Creek, at its confluence with Wilsons Creek has a 13.75-square-mile drainage basin. The project area is generally centered on the Chestnut Expressway between U.S. Highway 65 to the east and U.S. Highway 160 to the west in the northern half of the City of Springfield, Missouri.

Jordan Creek, North Branch Jordan Creek, and South Branch Jordan Creek are classic urban streams throughout most of their length. The upstream reaches consist of grass ditches with small culverts capable of carrying only small, frequent storm events. The middle portion of each reach includes concrete and natural channels; some regional detention, large-diameter culverts capable of conveying a storm that has a 10-percent to 20-percent chance of happening in any given year; and a number of long tunnel reaches capable of carrying larger flows. The downstream portion of the stream is mostly natural channel with an assortment of conveyance improvements, bridges, culvert structures, and grade controls. When storms of a higher frequency happen, the water sheet flows on streets and through buildings, moving with it the debris it picks up along the way.

The overall objective of the planning study is to improve flood risk management and improve the overall quality of life for the residents of Springfield, Missouri. The Jordan Creek flood risk management feasibility study is one of several USACE pilot projects selected to demonstrate the agency's modernized planning initiative, which is to complete investigations leading to a decision in less time by utilizing a risk-informed evaluation with less detailed information. The risk register will accompany the feasibility study decision document. Although one of the objectives of Independent External Peer Review (IEPR) is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

Independent External Peer Review Process

USACE is conducting an IEPR of the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment (hereinafter Springfield Integrated Report). 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 (2012a, 2012b). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Springfield Integrated Report. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012a, 2012b) and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Based on the technical content of the Springfield IEPR review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: structural/geotechnical engineering, civil/cost engineering, Civil Works planning/economics, hydrologic and hydraulic engineering, and biology/ecology. Four panel members were selected for the IEPR from more than 20 candidates identified, with one panel member covering both the structural/geotechnical engineering and civil/cost engineering roles. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received an electronic version of the 697 pages included in the Springfield Integrated Report, 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 (2012a) and OMB (2004), which were included in the draft and final Work Plans.

The USACE Project Delivery Team (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. Other than this teleconference, there was no direct communication between the Panel and USACE during the peer review process. The Panel produced more than 169 individual comments in response to the 73 charge questions.

IEPR panel members reviewed the Springfield Integrated Report individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to 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, or low); and (4) recommendations on how to resolve the comment. Overall, 15 Final Panel Comments were identified and documented. Of these, three were identified as having high significance, seven had medium significance, and five had low significance.

Results of the Independent External Peer Review

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012a, 2012b; p. D-4) in the Springfield Integrated Report. The following summarizes the Panel's findings.

The Panel generally agreed that the project is technically sound from an overall hydraulic engineering, structural engineering, geotechnical engineering, civil/cost engineering, and environmental and planning perspective, and that the Springfield Integrated Report provides adequate detail as to the technical soundness of the proposed solution for the project. However, a few inconsistencies and deficiencies in information made it hard for the Panel to assess the adequacy and acceptability of the data used to select the National Economic Development (NED) Plan, determine risks and uncertainties, and determine costs.

Engineering: Although the assumptions used for the hydraulic modeling are well documented, the hydrologic impact of the without-project assumptions and the model inputs associated with the hydrologic modeling are not fully documented. Therefore, the Panel could not determine whether the associated risks and uncertainties are sufficiently considered. The cost estimate for Plan J is very detailed; however, the review documents present very little detail of actual proposed structures, which affects the Panel's ability to determine if the costs are representative of the engineering plans. In particular, the description of some of the structures to be built and impacts to/from these structures is not clear. In other instances, the description of the proposed work does not match the cost estimates. Inconsistent details provided for bridge replacements and modifications limit the Panel's ability to determine the actual proposed activities and structures (e.g., type and length of bridges being replaced).

Economics/Civil Works Plan Formulation: The economic analysis was performed utilizing accepted models and procedures. However, verifying the adequacy and acceptability of the economic analysis was limited by a lack of documentation that would have normally been provided for studies of this type. Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate. In addition, the reasonableness of the without-project condition assumptions and projections could not be determined, but are essential in estimating the impacts on existing and future hydrology. In the absence of documentation regarding the without-project condition assumptions, effects on hydrology, and benefits claimed, it is more difficult to determine whether the National Economic Development (NED) Plan was properly identified. Regarding the plan formulation, the Panel believes that the screening of alternatives to identify the NED Plan may not have identified maximum net benefits for upper and lower reaches of Jordan Creek because an incremental analysis was not performed for these specific reaches. The Panel also believes that possible minor improvements for the middle reaches may have been overlooked.

Environmental: From a natural resources prospective, this project warrants a straightforward analysis given the degraded nature of the stream. However, several areas in the review documents could be strengthened to make the document more comprehensive. Without additional documentation, the Panel was not able to determine whether impacts to karst geology and to listed species associated with karst features could occur. Second, potential cumulative effects of the project along with the impacts of other actions that have occurred or may occur in the project area have not been considered. Finally, despite being currently listed as endangered throughout all counties in Missouri, there is no discussion of the Indiana bat, relative to its potential habitat in the project area.

Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report.

Table ES-1. Overview of 15 Final Panel Comments Identified by the Springfield IEPR Panel

No.	Final Panel Comments
Significance – High	
1	The Panel could not verify (1) impacts on the project's hydrology, (2) benefits, (3) the National Economic Development (NED) Plan, and (4) the benefit/cost ratio (BCR) because the reasonableness of the without-project assumptions and projections could not be determined based on the limited rationale provided.
2	The accuracy and robustness of the hydrologic and hydraulic modeling results could not be determined because the hydrologic impacts of without-project assumptions and the risks and uncertainties associated with hydrologic modeling were not documented.
3	The screening of alternatives to identify the National Economic Development (NED) Plan may not have identified maximum net benefits for the lower and upper reaches of Jordan Creek, and possible minor improvements for the middle reaches were not considered.
Significance – Medium	
4	Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate.
5	The hydrology and hydraulics analyses did not consider potential changes in rainfall frequency and rainfall intensity/duration due to climate change, or increased sedimentation and debris accumulation.
6	The Indiana bat, which is currently listed as endangered throughout all counties in Missouri, has not been discussed relative to its potential habitat in the project area.
7	Impacts to karst geology and cave-dwelling threatened and endangered species have not been considered, and the potential presence of losing stream segments has not been evaluated.
8	The potential cumulative effects of the Jordan Creek flood risk management project in conjunction with the impacts of other actions that have occurred or may occur in the project area have not been considered.
9	The climate information is limited to average rainfall, and it is not possible to relate the historical rainfall data to the data applied in the hydrologic modeling.
10	Descriptions of the Wilsons Creek Railroad Bridge replacement and the modifications required for the Scenic Bridge are inconsistent, which could result in minor changes to the project costs.
Significance – Low	
11	The Macroinvertebrate Stream Condition Indices (MSCI) scores in Table 4-5 do not corroborate the statement that Jordan Creek should support biological communities comparable to those found at the reference site.
12	The alternatives assessment does not provide a quantitative comparison of the alternatives' degree of flood inundation (elevation and coverage) and the duration of the flood inundation.

Table ES-1. Overview of 15 Final Panel Comments Identified by the Springfield IEPR Panel (Con't)

No.	Final Panel Comments
13	The estimated annual benefits and total construction costs for Plan J are inconsistent between the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) main text and the appendices.
14	National Wetlands Inventory (NWI) mapping alone is not sufficiently accurate to determine that the 0.4-acre wetland to be filled under Plans G and J is isolated.
15	Cost estimate details do not match the descriptions provided in the Engineering Appendix for the proposed retaining walls and outlet structures associated with the detention basins.

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LIST OF ACRONYMS

ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
BCR	Benefit/Cost Ratio
CN	Curve Number
COI	Conflict of Interest
DrChecks	Design Review and Checking System
EC	Engineer Circular
EGM	Economics Guidance Memorandum
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
H&H	Hydrology and Hydraulics
IEPR	Independent External Peer Review
IWR	Institute for Water Resources
MCACES	Micro-Computer Aided Cost Estimating System
MSCI	Macroinvertebrate Stream Condition Index
NED	National Economic Development
NEPA	National Environmental Policy Act
NWI	National Wetlands Inventory
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PCB	Precast Channel Bridge
PDT	Project Delivery Team
P.E.	Professional Engineer
POP	Period of Performance
SAR	Safety Assurance Review
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is working with the City of Springfield, Missouri, the non-federal sponsor, to address city flooding issues that are a result of urbanization and insufficient flow capacity along Jordan Creek. The study area is located within the White River Basin, extending approximately 6 miles along Jordan Creek. Jordan Creek, including North Branch and South Branch Jordan Creek, at its confluence with Wilsons Creek has a 13.75-square-mile drainage basin. The project area is generally centered on the Chestnut Expressway between U.S. Highway 65 to the east and U.S. Highway 160 to the west in the northern half of the City of Springfield, Missouri.

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The overall objective of the planning study is to improve flood risk management and improve the overall quality of life for the residents of Springfield, Missouri. The Jordan Creek flood risk management feasibility study is one of several USACE pilot projects selected to demonstrate the agency's modernized planning initiative, which is to complete investigations leading to a decision in less time by utilizing a risk-informed evaluation with less detailed information. The risk register will accompany the feasibility study decision document. Although one of the objectives of Independent External Peer Review (IEPR) is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

The objective of the work described here was to conduct an IEPR of the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment (hereinafter Springfield Integrated Report) in accordance with procedures described in the Department of the Army, USACE Engineer Circular (EC) *Civil Works Review Policy, Change 1* (EC 1165-2-209, Change 1) (USACE, 2012a), *Civil Works Review* (EC 1165-2-214) (USACE, 2012b), and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004).[1] Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental,

[1] On December 15, 2012, USACE issued *Civil Works Review* (EC 1165-2-214), which supersedes EC 1165-2-209. The contract for this IEPR was awarded on September 14, 2012, before EC 1165-2-214 took effect. However, all tasks under this contract, including development of this IEPR report, were performed under EC 1165-2-209.

economic, and engineering analyses contained in the Springfield Integrated Report. The full text of the Final Panel Comments is presented in Appendix A.

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 (2012a, 2012b).

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 economic, engineering, and environmental analysis of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Springfield Integrated Report was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC Nos. 1165-2-209, Change 1, and 1165-2-214) under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

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

3.1 Planning and Schedule

At the beginning of the Period of Performance (POP), Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 73 charge questions were provided by USACE and included in the draft and final Work Plans. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of September 14, 2012. The review documents were provided by USACE on February 1, 2013. Note that the work items listed in Task 6 occur after the submission of this report. Battelle will enter the 15 Final Panel Comments developed by

Table 1. Springfield IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	09/14/2012
	Review documents available	02/01/2013
	Battelle submits draft Work Plan[a]	11/29/2012
	USACE provides comments on draft Work Plan	12/10/2012
	Battelle submits final Work Plan	12/13/2012
2	Battelle requests input from USACE on the COI questionnaire	09/18/2012
	USACE provides comments on COI questionnaire	11/05/2012
	Battelle submits list of selected panel members[a]	11/06/2012
	USACE confirms the Panel has no COIs	11/19/2012
	Battelle completes subcontracts for panel members	12/14/2012
3	Battelle convenes kick-off meeting with USACE	01/16/2013
	Battelle sends review documents to Panel	02/04/2013
	Battelle convenes Panel kick-off meeting	01/29/2013
	Battelle convenes USACE/Panel kick-off meeting	01/29/2013
4	Panel members complete their individual reviews	02/19/2013
	Battelle provides Panel merged individual comments and talking points for Panel Review Teleconference	02/25/2013
	Battelle convenes Panel Review Teleconference	02/26/2013
	Panel members provide draft Final Panel Comments to Battelle	03/06/2013
	Battelle finalizes Final Panel Comments	03/15/2013
5	Battelle submits Final IEPR Report to USACE[a]	03/26/2013
6[b]	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	03/27/2013
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	04/02/2013
	Battelle convenes teleconference with Panel and USACE to discuss Final Panel Comments and draft responses	04/11/2013
	USACE inputs final PDT Evaluator Responses in the Design Review and Checking System (DrChecks)	04/18/2013
	Battelle inputs the Panel's BackCheck Responses in DrChecks	04/25/2013
	Battelle submits pdf printout of DrChecks project file[a]	04/26/2013
	Project Closeout	09/14/2013

a Deliverable.

b Task 6 occurs after the submission of this report.

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 closure, as a final deliverable and record of the IEPR results.

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: structural/geotechnical engineering, civil/cost engineering, Civil Works planning/economics, hydrologic and hydraulic engineering, and biology/ecology. These areas correspond to the technical content of the Springfield Integrated Report and overall scope of the Springfield 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 initially identified more than 20 candidates for the Panel, evaluated their technical expertise, and inquired about potential COIs. Of these, Battelle chose the most qualified candidates and confirmed their interest and availability, and ultimately selected four experts for the final Panel.[2] 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.[3] These COI questions were intended to serve as a means of disclosure and to better characterize a candidate's employment history and background. Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

- Previous and/or current involvement by you or your firm[4] in the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment.

[2] One candidate was selected for a dual role in civil/cost engineering and the structural/geotechnical engineering.
[3] 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."
[4] 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[4] in flood risk management and flood control studies or projects in the greater Springfield, Greene County, Missouri region.
- Previous and/or current involvement (conceptual or actual design, construction, or O&M) by you or your firm[4] in projects related to the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Previous and/or current involvement with paid or unpaid expert testimony related to the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment.
- Previous and/or current employment or affiliation with members of the cooperating agencies or local sponsors: the City of Springfield, Missouri; Missouri State University, Missouri Environmental Protection Agency, and/or the Missouri Department of Natural Resources (for pay or pro bono).
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or children related to the greater Springfield, Greene County, Missouri area.
- Current personal involvement with other USACE projects, including authorship of any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Little Rock District.
- Previous or current involvement with the development or testing of models that will be used for or in support of the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment project, including but not limited to HEC-FDA, HEC-HMS, HEC-RAS, UNET, TABS, IWR-Planning Suite, MCACES II, River Morph, or Utaxas4.
- Current firm[4] involvement with other USACE projects, specifically those projects/contracts that are with the Little Rock 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 Little Rock District. Please explain.
- Any previous employment by the USACE as a direct employee or contractor (either as an individual or through your firm[4]) within the last 10 years, notably if those projects/contracts are with the Little Rock District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning flood risk management or flood control and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment-related contracts/awards from USACE.

- A significant portion (i.e., greater than 50%) of personal or firm[4] revenues within the last 3 years from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[4] revenues within the last 3 years from contracts with the non-federal sponsor (City of Springfield, Missouri).
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study and/or Environmental Assessment.
- Participation in prior federal studies relevant to this project and/or Jordan Creek-Springfield, Greene County Missouri Feasibility Study and/or Environmental Assessment.
- Previous and/or current participation in prior non-federal studies relevant to this project and/or Jordan Creek-Springfield, Greene County Missouri Feasibility Study and/or Environmental Assessment.
- 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?

Other Considerations:

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

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. The four final reviewers were affiliated with consulting companies. 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 made the final selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of the IEPR

Prior to beginning their review, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. After the kick-off meetings, the IEPR Panel received an electronic version of the final charge as well as the Springfield 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.

- **Jordan Creek Flood Risk Management Study Springfield, Missouri Draft Feasibility Report and Environmental Assessment, February 2013 (120 pages)**
- **Risk Register (4 pages)**
- **Appendix A Economic Analysis Appendix (68 pages)**
- **Appendix B Draft Real Estate (12 pages)**

- **Appendix C Engineering Appendix - Design (Hydrologic and Hydraulic Analyses, Civil Design, Geotechnical and Structural Engineering, HTRW, Cost Engineering) (476 pages)**
- Appendix D Draft FONSI
- Appendix E Response Letters
- USACE guidance Civil Works Review, (EC 1165-2-209) dated 31 January 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

3.4 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 169 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. As a result of the review, Battelle summarized the 169 comments into 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.

3.5 IEPR Panel Teleconference

Battelle facilitated a 4.5-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to nine 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 16 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

Following the teleconference, Battelle prepared a summary memorandum for the Panel documenting each Final Panel Comment (organized by level of significance). The memorandum

provided the following detailed guidance on the approach and format to be used to develop the Final Panel Comments for the Springfield 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 members as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
  1. Comment Statement (succinct summary statement of concern)
  2. Basis for Comment (details regarding the concern)
  3. Significance (high, medium, low; see description below)
  4. Recommendation(s) for Resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
  1. High: Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a "showstopper" issue.
  2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
  3. Low: Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.
- Guidance for Developing Recommendations: The recommendation section 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).

An additional Final Panel Comment was submitted for consideration after the panel review teleconference, bringing the total from 16 to 17 Final Panel Comments. However, during the Final Panel Comment development process, the Panel determined that two of the Final Panel Comments were covered by other Final Panel Comments or no longer met the criteria for a low-

level significance; therefore, the total Final Panel Comment count was reduced to 15. 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. 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 Appendix A of this report.

4. PANEL DESCRIPTION

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

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

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

Technical Criterion	Fleming	Shoudy	Kabiling	Stumne
Structural/Geotechnical Engineering				
Minimum 10 years of demonstrated experience in civil or construction engineering	X			
Experience in performing construction management for all phases of flood risk management projects	X			
Capable of addressing the USACE Safety Assurance Review (SAR) aspect of projects	X			
Experience in and familiarity with structural and geotechnical practices associated with the following levee and floodwall design	X			
Experience with culvert design	X			
Experience with building stabilization	X[a]			
Experience with wall design	X			
Experience with bridge design	X			
Experience with construction of channels	X			
Registered Professional Civil Engineer	X			

Table 2. Springfield IEPR Panel: Technical Criteria and Areas of Expertise (Con't)

Technical Criterion	Fleming	Shoudy	Kabiling	Stumne
Civil/Cost Engineering				
Minimum 10 years of demonstrated experience in civil or construction engineering	X			
Experience in performing cost engineering/construction management for all phases of flood risk management-related projects	X			
Demonstrated experience related to levee and floodwall design and construction	X			
Demonstrated experience related to drainage structures	X			
Demonstrated experience related to utility relocations	X			
Experience in associated contracting procedures, total cost growth analysis, and related cost risk analysis is desired	X			
Familiar with the construction industry	X			
Capable of addressing the USACE SAR aspects of all projects	X			
Civil Works Planning/Economics				
Minimum 10 years of demonstrated experience in public works planning		X		
Direct experience working directly for or with USACE		X		
Familiar with USACE plan formulation process, procedures, and standards as they relate to flood risk management		X		
Minimum 5 years of experience dealing directly with the USACE six-step planning process governed by Engineer Regulation (ER) 1105-2-100 Planning Guidance Notebook		X		
Familiar with USACE flood risk management analysis and benefit calculations		X		
Familiar with USACE HEC-FDA computer program		X		
Experience with the National Economic Development (NED) analysis procedures as they relate to flood risk management		X		
M.S. degree or higher in economics		X[a]		
Hydrologic and Hydraulic Engineering				
Minimum 15 years of experience in hydrologic and hydraulic engineering			X	
Extensive experience modeling water surface profiles for flood risk management projects, including with-project conditions associated with structural flood risk management features and floodwalls in urban settings			X	
Thorough understanding of the dynamics of both open-channel flow systems as well as enclosed/confined systems			X	

Table 2. Springfield IEPR Panel: Technical Criteria and Areas of Expertise (Con't)

Technical Criterion	Fleming	Shoudy	Kabiling	Stumne
Experience related to the application of detention basins and the effects that best management practices and low-impact development have on hydrology			X	
Experience in modeling multipurpose alternatives, including ecosystem restoration, and non-structural solutions involving flood proofing			X	
Familiar with standard USACE hydrologic and hydraulic computer models, including HEC-HMS			X	
Familiar with HEC-RAS			X	
Familiar with UNET			X	
Familiar with TABS			X	
Certified floodplain manager			X	
Registered Professional Engineer (P.E.)			X	
Minimum M.S. degree in engineering			X	
Biology/Ecology				
Minimum 10 years of experience in evaluating and conducting National Environmental Policy Act (NEPA) impact assessments, including cumulative effects analysis, for complex multi-objective publics works projects with competing trade-offs				X
Extensive background experience in and working knowledge of the implementation of the NEPA compliance process and Endangered Species Act (ESA) requirements				X
Experience related to ecosystem restoration practices				X
Minimum M.S. degree in appropriate field of study				X

[a] *Waiver statement presented as part of Task 2 deliverable and approved by USACE.*

Robert Fleming, P.E.

Role: Structural/Geotechnical Engineering and Civil/Cost Engineering
Affiliation: R.L. Fleming & Associates

Mr. Fleming is a geotechnical engineer and principal of R.L. Fleming & Associates in Vicksburg, Mississippi, where he specializes in project design and geotechnical and structural engineering for flood control projects. He earned his M.S. in geotechnical engineering from Texas A&M University in 1971 and is a licensed professional engineer (P.E.) in Mississippi. He has over 45 years of experience in geotechnical and structural engineering, including working for USACE's Vicksburg District for 35 years where he was actively involved in the design, construction, and evaluation of all types of hydraulic structures. His career with USACE

included 10 years as the Chief of the Geotechnical Branch, 5 years as the Chief of the Design Branch, and 4 years as the Chief of Engineering.

Mr. Fleming has extensive in-depth expertise with structural and geotechnical practices associated with levee and floodwall design, culvert design, wall design, bridge design, and channel construction. He has vast experience in construction management for all phases of flood risk management projects and, between 1995 and 2003, was responsible for the overall design, plans and specifications, and construction consultation for the $115-million Mississippi River Enlargement Program in Mississippi, Arkansas, and Louisiana. The project included raising levees up to 8 feet on existing 25- to 35-foot-high levees, designing/constructing seepage berms to control underseepage, and designing/installing up to 500 relief wells. As the Chief of Engineering, Mr. Fleming supervised cost engineering activities and worked closely with the construction division and field offices when he served as Chief of the Geotechnical and Design Branches. He is very familiar with USACE's contracting process, including total cost growth analysis and related cost risk analysis. He is capable of addressing the USACE Safety Assurance Review (SAR) aspect of projects due to his involvement with the development and implementation of the Design Quality Management System & Independent Technical Review Processes in the Vicksburg District. He also served on the Interagency Performance Evaluation Task Force for the New Orleans Hurricane Protection System. Mr. Fleming actively participates in professional engineering and scientific societies and is an American Society of Civil Engineers (ASCE) Fellow, a member of the U.S. Society on Dams, and a member of the Society of American Military Engineers.

Harry Shoudy

Role: Civil Works Planning/Economics
Affiliation: Harry Shoudy Consulting

Mr. Shoudy is the chief executive officer for Harry Shoudy Consulting in Henrico, North Carolina. He earned a B.S. in economics from Central University of Iowa in 1968 and an M.S. in water resources planning from Colorado State University in 1980. He has over 40 years of economic, water resources planning, and policy experience. Mr. Shoudy worked for USACE for 32 years and served in a dual assignment as a chief economist and senior policy advisor before forming his consulting firm in 2003. During his tenure at USACE, he performed and directed economic evaluations for the Buffalo District as the chief of economics and served as chief economist for the South Atlantic Division reviewing economic evaluations. From 1990 to 1992, he was the senior policy advisor to the Board of Engineers for Rivers and Harbors, performing economic and plan formulation reviews for the Board. He then worked for USACE Headquarters from 1992 to 2003, providing project reviews, developing policy, issuing implementation guidance, and providing guidance and training, eventually retiring as senior policy advisor and chief economist.

Mr. Shoudy has over 40 years experience applying Principles and Standards, Principles and Guidelines, and Engineer Regulation (ER) 1105-2-100 from their inception. He is familiar with all USACE flood risk management analysis and benefits calculations and was responsible for the review of flood damage reduction planning studies at the division and Headquarters level. His experience includes participating in numerous project discussions with district staffs regarding

appropriate benefit calculations for their projects and being actively involved in the development of properly calculated benefits. Mr. Shoudy is familiar with the USACE HEC-FDA program and has reviewed numerous flood control reports that have applied HEC-FDA. He also participated in the development and application of a national evaluation model for shore protection projects applying HEC-FDA as a starting point. He is an expert in the understanding, development, and review of National Economic Development (NED) benefits and analysis procedures as they relate to flood risk analysis; the majority of his 37 years of review experience has focused on traditional economic development benefits. In addition, he participated in the development of a national USACE policy related to flood damage reduction national economic benefits.
Mr. Shoudy is a past member of the ASCE.

Michael Kabiling, Ph.D., P.E., C.F.M.

Role: Hydrologic and Hydraulic Engineering
Affiliation: Taylor Engineering, Inc.

Dr. Kabiling is a hydrology/hydraulic engineer with Taylor Engineering Inc. in Jacksonville, Florida. He earned his Ph.D. in hydraulic and coastal engineering from Yokohama National University, Yokohama, Japan, in 1994 and is a licensed P.E. in Florida, Georgia, and South Carolina. He is also a certified floodplain manager. Dr. Kabiling has more than 20 years of work experience in water resources, hydraulic and coastal engineering, and numerical modeling, having conducted more than 65 numerical modeling projects in hydrology, hydrodynamics (dam break, surge, tide, flow, and circulation), waves, water quality, contaminant transport, sediment transport, and surge and flood.

Dr. Kabiling has extensive experience in hydrologic and hydraulic engineering for large public works of both regional and international scope, such as USACE Rio de la Plata Two-Dimensional Flood Analysis, Dorado, Puerto Rico (2008). He has experience modeling water surface profiles for flood risk management projects, including with-project conditions associated with structural features and floodwalls in urban areas. He has a thorough understanding of the dynamics of both open-channel flow systems and enclosed/confined systems. Other representative projects he has worked on include USACE Herbert Hoover Dam Breach Dam-Break Analysis; Illustrative Flood Inundation Maps and Associated Sensitivity and Uncertainty Analyses, Lake Okeechobee, Florida; and the I-73 Bridges over Little Pee Dee River, Horry and Marion Counties, South Carolina.

Dr. Kabiling has additional experience with the modeling of multipurpose alternatives, including ecosystem restoration and non-structural solutions involving flood-proofing for studies such as the San Juan Flood Control Project, Manila, Philippines. He is an expert with standard USACE hydrologic and hydraulic models including HEC-HMS, HEC-RAS, UNET, and TABS and has applied them to numerous engineering/environmental projects throughout his career. His expertise related to detention basins and the effects of best management practices and low-impact development on hydrology is reflected in such projects as the South Florida Water Management District G160 Hydraulic Modeling, Palm Beach County, Florida, and the Rio de la Plata Two-Dimensional Flood Analysis, Dorado, Puerto Rico. Dr. Kabiling is an active member of numerous professional societies, including ASCE, the Association of State Floodplain Managers, the Florida Engineering Society, and the National Society of Professional Engineers.

Steve Stumne, C.W.S

Role: Biology/Ecology
Affiliation: AMEC Environment & Infrastructure Inc.

Mr. Stumne is a senior scientist with AMEC Environment & Infrastructure Inc. in Ballwin, Missouri. He earned a B.S. in biology from Harding University in 1989, an M.S. in environmental science from Southern Illinois University-Edwardsville in 1995, and is a Certified Wetland Specialist in Illinois. He has more than 20 years of professional experience in environmental planning, natural resource investigations, National Environmental Protection Act (NEPA) analysis and documentation, wetland and stream delineation/permitting/mitigation, wetland and prairie restoration, floristic quality assessments, endangered species investigations, reptile and amphibian surveys, sediment and erosion control, and site characterization and remediation.

Mr. Stumne has worked on federal land, state parks, transportation corridors, utility corridors, coal-fired and nuclear power plants, private development projects, and public and private land throughout the Midwest and Great Lakes Region. He has nearly 20 years of experience in NEPA impact assessments, including cumulative effects analysis for multi-objective public works projects with competing trade-offs. His NEPA experience includes numerous studies requiring NEPA evaluation factors, impact assessment, agency and stakeholder correspondence, public meetings, development of NEPA documentation (i.e., environmental assessments, environmental impact statements), and Endangered Species Act (ESA) Section 7 consultation, including the Brown Bridge Dam Removal project in Grand Traverse County, Michigan. Other key experience with the NEPA compliance process and ESA requirements includes the environmental impact statement at Callaway Nuclear Plant in Missouri and PSEG Nuclear Plant in New Jersey in support of Nuclear Regulatory Commission NEPA documentation for new nuclear plant applications.

Additionally, Mr. Stumne has more than 20 years of experience related to ecosystem restoration that includes the development of plans/specifications and field supervision for native prairie restoration, wetland restoration, reforestation, glade restoration, dam removal, and stream and riparian zone restoration for such projects as Taum Sauk Restoration, Proffit Mountain Reforestation, and Point DuSable Eco Park in Missouri. Mr. Stumne is actively involved in professional and scientific societies related to his field of study, including the Society of Wetland Scientists.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012a, 2012b; p. D-4) in the Springfield review documents. The following summarizes the Panel's findings.

The Panel generally agreed that the project is technically sound from an overall hydraulic engineering, structural engineering, geotechnical engineering, civil/cost engineering, and environmental and planning perspective, and that the Springfield Integrated Report provides

adequate detail as to the technical soundness of the proposed solution for the project. However, a few inconsistencies and deficiencies in information made it hard for the Panel to assess the adequacy and acceptability of the data used to select the National Economic Development (NED) Plan, determine risks and uncertainties, and determine costs.

Engineering: Although the assumptions used for the hydraulic modeling are well documented, the hydrologic impact of the without-project assumptions and the model inputs associated with the hydrologic modeling are not fully documented. Therefore, the Panel could not determine whether the associated risks and uncertainties are sufficiently considered. The cost estimate for Plan J is very detailed; however, the review documents present very little detail of actual proposed structures, which affects the Panel's ability to determine if the costs are representative of the engineering plans. In particular, the description of some of the structures to be built and impacts to/from these structures is not clear. In other instances, the description of the proposed work does not match the cost estimates. Inconsistent details provided for bridge replacements and modifications limit the Panel's ability to determine the actual proposed activities and structures (e.g., type and length of bridges being replaced).

Economics/Civil Works Plan Formulation: The economic analysis was performed utilizing accepted models and procedures. However, verifying the adequacy and acceptability of the economic analysis was limited by a lack of documentation that would have normally been provided for studies of this type. Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate. In addition, the reasonableness of the without-project condition assumptions and projections could not be determined, but are essential in estimating the impacts on existing and future hydrology. In the absence of documentation regarding the without-project condition assumptions, effects on hydrology, and benefits claimed, it is more difficult to determine whether the National Economic Development (NED) Plan was properly identified. Regarding the plan formulation, the Panel believes that the screening of alternatives to identify the NED Plan may not have identified maximum net benefits for upper and lower reaches of Jordan Creek because an incremental analysis was not performed for these specific reaches. The Panel also believes that possible minor improvements for the middle reaches may have been overlooked.

Environmental: From a natural resources prospective, this project warrants a straightforward analysis given the degraded nature of the stream. However, several areas in the review documents could be strengthened to make the document more comprehensive. Without additional documentation, the Panel was not able to determine whether impacts to karst geology and to listed species associated with karst features could occur. Second, potential cumulative effects of the project along with the impacts of other actions that have occurred or may occur in the project area have not been considered. Finally, despite being currently listed as endangered throughout all counties in Missouri, there is no discussion of the Indiana bat, relative to its potential habitat in the project area.

Table 3 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report.

Table 3. Overview of 15 Final Panel Comments Identified by the Springfield IEPR Panel

No.	Final Panel Comments
Significance – High	
1	The Panel could not verify (1) impacts on the project's hydrology, (2) benefits, (3) the National Economic Development (NED) Plan, and (4) the benefit/cost ratio (BCR) because the reasonableness of the without-project assumptions and projections could not be determined based on the limited rationale provided.
2	The accuracy and robustness of the hydrologic and hydraulic modeling results could not be determined because the hydrologic impacts of without-project assumptions and the risks and uncertainties associated with hydrologic modeling were not documented.
3	The screening of alternatives to identify the National Economic Development (NED) Plan may not have identified maximum net benefits for the lower and upper reaches of Jordan Creek, and possible minor improvements for the middle reaches were not considered.
Significance – Medium	
4	Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate.
5	The hydrology and hydraulics analyses did not consider potential changes in rainfall frequency and rainfall intensity/duration due to climate change, or increased sedimentation and debris accumulation.
6	The Indiana bat, which is currently listed as endangered throughout all counties in Missouri, has not been discussed relative to its potential habitat in the project area.
7	Impacts to karst geology and cave-dwelling threatened and endangered species have not been considered, and the potential presence of losing stream segments has not been evaluated.
8	The potential cumulative effects of the Jordan Creek flood risk management project in conjunction with the impacts of other actions that have occurred or may occur in the project area have not been considered.
9	The climate information is limited to average rainfall, and it is not possible to relate the historical rainfall data to the data applied in the hydrologic modeling.
10	Descriptions of the Wilsons Creek Railroad Bridge replacement and the modifications required for the Scenic Bridge are inconsistent, which could result in minor changes to the project costs.
Significance – Low	
11	The Macroinvertebrate Stream Condition Indices (MSCI) scores in Table 4-5 do not corroborate the statement that Jordan Creek should support biological communities comparable to those found at the reference site.
12	The alternatives assessment does not provide a quantitative comparison of the alternatives' degree of flood inundation (elevation and coverage) and the duration of the flood inundation.
13	The estimated annual benefits and total construction costs for Plan J are inconsistent between the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) main text and the appendices.

Table 3. Overview of 15 Final Panel Comments Identified by the Springfield IEPR Panel (Con't)

No.	Final Panel Comments
14	National Wetlands Inventory (NWI) mapping alone is not sufficiently accurate to determine that the 0.4-acre wetland to be filled under Plans G and J is isolated.
15	Cost estimate details do not match the descriptions provided in the Engineering Appendix for the proposed retaining walls and outlet structures associated with the detention basins.

6. REFERENCES

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USFWS (2013). Missouri: Federally-Listed Threatened, Endangered, and Candidate Species County Distribution. U.S. Fish and Wildlife Service. Available online at http://www.fws.gov/midwest/endangered/lists/missouri-spp.html. Updated January 3, 2013. Accessed March 7, 2013.

APPENDIX A

Final Panel Comments

on the

Springfield IEPR

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Final Panel Comment 1

The Panel could not verify (1) impacts on the project's hydrology, (2) benefits, (3) the National Economic Development (NED) Plan, and (4) the benefit/cost ratio (BCR) because the reasonableness of the without-project assumptions and projections could not be determined based on the limited rationale provided.

Basis for Comment

Many without-project condition assumptions and projections have been made without providing supporting information to document their reasonableness. The Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) assumes that the following activities will take place under the without-project condition:

1. Areas currently zoned for development will be developed.
2. Improvements will be made to the developed areas in the watershed.
3. Any reasonable activities to be pursued by state and local interests in the absence of a federal project will be undertaken.
4. Property owned by the Springfield School District, Greene County, the State of Missouri, and the U.S. Government will be developed.
5. Some channel improvements will be made by the city during the period of analysis to help alleviate flooding.
6. Thirty-eight regional detention ponds will be added.
7. Existing properties will be redeveloped.

Documentation is not provided in the Springfield Integrated Report to demonstrate and support the reasonableness of these without-project assumptions or projections. For example, specific information on the reasonable activities to be pursued by state and local interests; the locations, types, and magnitude of development projected; channel improvements to be made by the city; the 38 regional detention ponds; and the impacts that each of these activities would have on the hydrology is not provided. In the absence of additional documentation and specific information, the reasonableness of the without-project assumptions cannot be verified and the resulting impacts of a supportable without-project condition on the project's hydrology, benefits, NED Plan, and BCR cannot be identified.

For projected future development, it was estimated that by 2020 the watershed would be developed to the "ultimate development condition." The base year of the project is 2020; therefore, this assumes that no further open land will be available for land use changes during the 50-year period of analysis. Open land development is identified in 5-year increments from 1996 to 2010, with about 50 percent of the development having occurred by 2010 and the rest occurring between 2010 and 2020. More than 15 years of development activity and hydrologic changes have occurred since 1996; however, the supporting documentation, including empirical data to demonstrate the reasonableness of the land development rates and projections, was not discussed. The risk register indicates that there have been structural inventory changes, but no details are provided.

Additional documentation of the land use changes is needed to determine and verify the differences between the without-project hydrology and the with-project hydrology. Hydrologic changes impact benefits, and could also impact the NED Plan and the BCRs for alternative plans.

The Hydrology and Hydraulics (H&H) Appendix of the Springfield Integrated Report modifies the overland flow elements and the estimates of imperviousness to reflect the future conditions. The assumptions for the future without-project condition are critical to the economic analysis. The development assumptions and the impact on the hydrology and hydraulics from the 2003 condition to the "ultimate development condition" are estimated in the Springfield Integrated Report to result in a 10-percent increase in flows and an increase in damages between 50 and 60 percent. With impacts of this magnitude, further documentation is necessary to support the reasonableness of the development projections, changes in hydrologic coefficients, and the estimated future without-project condition.

A sensitivity analysis was performed by using the 2003 hydrology for the base year (rather than the future without-project hydrology) and comparing that to the ultimate conditions hydrology. The result was a reduction of the BCR from 2.7 to 1.7. A risk and uncertainty analysis was not performed for the key variables. A decision was made to not include the planned Mt. Vernon Bridge replacement into the future without-project condition. A sensitivity test of that decision was not performed, so the significance of that decision cannot be demonstrated and documented. By considering current 2013 conditions rather than 2003 conditions, some of the estimated future hydrology impacts may have already occurred. If so, the significant difference between existing and future hydrology in the sensitivity analysis would be reduced, providing additional support for the project.

Significance – High

Development of a reasonable future without-project condition is essential in estimating the impacts on future hydrology, confirming the reasonableness of the benefits for the project and the BCR, and verifying identification of the NED Plan.

Recommendations for Resolution

1. Provide documentation for the future development projections to include location, type of development, and empirical data on development since 1996.
2. Provide support for improvements that will be made to the developed areas and the redevelopment of existing properties based on empirical data or improvement trends.
3. Provide support for the full development of properties owned by the school district, the county, the state, and the federal government by the year 2020.
4. Provide support for, and indicate the type of, channel improvements that will be made by the city during the period of analysis, as well as the addition of 38 detention ponds.
5. Update the sensitivity analysis performed by using current 2013 levels of development and their effect on the hydrology.

Final Panel Comment 2

The accuracy and robustness of the hydrologic and hydraulic modeling results could not be determined because the hydrologic impacts of without-project assumptions and the risks and uncertainties associated with hydrologic modeling were not documented.

Basis for Comment

Although Appendix C, Attachment A (Jordan Creek Feasibility Study Hydrology and Hydraulics [H&H] Report) documents the risks and uncertainties for hydraulic modeling, the Panel did not find adequate discussion and documentation of the hydrologic impacts of without-project assumptions and of the risks and uncertainties associated with the hydrologic modeling. The risks and uncertainties associated with the hydrologic modeling include the estimation of pervious areas, impervious areas, and Curve Number (CN) values, and the selection of reasonable flow velocities. Any inaccuracy or uncertainty in estimating these model inputs can significantly change calculated flooding high-water levels and thereby change benefit/cost ratios (BCRs) of the alternatives. For instance, a sensitivity analysis included in the report dealt only with the impact on the hydrology and hydraulics from the 2003 condition to the "ultimate development condition." However, that sensitivity analysis demonstrated a significant impact with a 10-percent increase in flows and an increase in damages between 50 and 60 percent.

Appendix C, Attachment A (Section 3.2.4 and Appendix HH-A) provides the selected CN values for pervious areas. However, the report does not present the range of applicable CN values and does not document the potential impact of uncertainty in the estimation of CN values on hydrologic modeling results. For the hydrologic modeling of without-project conditions, Appendix C, Attachment A, Section 3.2.5 describes establishment of Manning's roughness coefficients and channel geometry through achievement of reasonable channel flow velocity. The report lacks documentation on the criteria used to determine reasonable channel flow and the methodology for establishing Manning's roughness coefficients and channel geometry.

In Appendix C, Attachment A, Section 4.3.5, the description of the selection process for roughness coefficients assigned to cross sections lacks detail. The report only mentions that the assignment was based on aerial and digital field photos. The report does not describe which value within the range of accepted roughness coefficient values (corresponding to specific land use) was selected for the hydraulic modeling.

Appendix C, Attachment A, Section 4.5 discusses the risk and uncertainty analysis to evaluate changes in hydraulic model results due to increases or decreases in channel roughness. However, the analysis does not consider the uncertainty from debris clogging the waterways.

The analysis described in Appendix C, Attachment A, Section 4.5 appears to sufficiently consider risk and uncertainty associated with the current conditions. However, the Panel did not find risk and uncertainty associated with the future development process.

Significance – High

Although the hydrologic model risks and uncertainties are shared across all the alternatives, changes in hydrologic modeling input and hydrologic considerations can also change hydraulic modeling results and thereby significantly change the BCRs of the alternatives.

Recommendations for Resolution

1. Provide details on how each of the pertinent without-project assumptions modified the hydrology coefficients and flows.
2. Provide documentation regarding risk and uncertainty analyses used in the hydrologic modeling. The documentation should include the effect of larger and smaller impervious/pervious areas or adoption of lower and higher CN values on hydrologic and hydraulic modeling results.
3. Provide documentation to support the selection of reasonable channel flow velocity in the establishment of Manning's roughness coefficients and channel geometry.
4. Provide documentation to support the selection of roughness coefficients for hydraulic modeling. Specify whether the values used were in the low, middle, or high end of the applicable range of roughness coefficients.
5. Provide documentation for the uncertainty associated with debris clogging the waterways.
6. Provide documentation for risk and uncertainty associated with the future development process.

Final Panel Comment 3

The screening of alternatives to identify the National Economic Development (NED) Plan may not have identified maximum net benefits for the lower and upper reaches of Jordan Creek, and possible minor improvements for the middle reaches were not considered.

Basis for Comment

In the formulation of alternatives for the Jordan Creek project, incremental analysis of Reach E1 and upper Reaches E5 and E6 was not performed. Without incrementally analyzing varying levels of protection, it cannot be verified that the plan that maximizes net benefits for each reach was identified and that the overall NED Plan was selected. In addition, minor structural or non-structural improvements in Reaches E2 and E3 may be feasible.

Reach E1: Documentation for the selected level of protection for Reach E1 was not sufficient to demonstrate that the alternative that maximizes net benefits for that reach was identified. Levels of protection considered for Reach E1 should be discussed and documented in the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) to include determination of the NED level of protection for Reach E1. Plans B, C, and E were designed for protection from a 1-percent, 2-percent, and 4-percent probability event, respectively, on a system basis. Based on the annual costs and annual benefits for Plans B, C, and E in Reach E1, documentation should be provided to demonstrate that an incremental analysis of the alternative levels of protection for Reach E1 confirms that the recommended 500-year level of protection for that reach maximizes net benefits. In addition, consideration of a non-structural alternative of elevating inventory may significantly reduce contents damages, which could also impact NED Plan identification for Reach E1.

Reaches E2 and E3: Given the high residual risks associated with the recommended plan, some further improvements could have been evaluated and considered in selective locations in Reaches E2 and E3. However, formulation for the middle reaches was done on a consistent level-of-protection basis. There is no U.S. Army Corps of Engineers (USACE) project planning requirement for a consistent level of protection for all reaches. Unlike the other reaches, the recommended plan resulted in no project improvements for Reaches E2 and E3. The Panel believes that opportunities for varying levels of protection in Reaches E2 and E3 may justify minor structural improvements for those reaches. In fact, the risk register indicates that the City of Springfield now plans to replace the Mt. Vernon Street Bridge. Opportunities such as this bridge replacement could have been evaluated as part of the federal project, if the bridge replacement reduces flood damages. In addition, opportunities for nonstructural considerations may be possible for individual properties. There is no specific USACE planning requirement for a consistent level of non-structural protection or that the government must purchase all buildings on a property. These requirements were applied to this study, but the Panel believes these requirements are too restrictive in the formulation of alternatives and the

identification of the NED Plan.

Reaches E5 and E6: There is no documentation in the report to demonstrate that the detention basins in Reaches E5 and E6 were justified on an incremental basis. The report does state that the detention plan with all five basins provides greater annual net benefits than the North-Branch-only plan and the South-Branch-only plan. However, documentation should be included to demonstrate the incremental feasibility of each of the detention basins, therefore confirming that the alternative that maximizes net benefits for Reaches E5 and E6 was identified.

Significance – High

Further analysis could provide opportunities for considering new alternatives and could result in a modification to the NED Plan.

Recommendations for Resolution

1. Provide additional documentation to demonstrate that the alternative that maximizes net benefits for Reach E1 has been identified.
2. Consider minor structural and nonstructural alternatives for Reaches E2 and E3 or provide documentation in the Springfield Integrated Report to indicate that minor improvements were considered but were not feasible.
3. Conduct an incremental analysis of the detention basins in the upper reaches to demonstrate that net benefits have been maximized.

Final Panel Comment 4

Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate.

Basis for Comment

The Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) does not provide detailed information regarding the specific locations of structures in the various reaches; types of businesses; contents or inventory/storage and values; susceptibility to damage; further pertinent information to describe the physical structures and their contents at risk due to flooding; and contents damages. Given the lack of details on pertinent economic data, the Panel could not verify that the inundation reduction benefits claimed were accurate. In addition, where additional data were collected using the Office of Management and Budget (OMB) approved surveys; those data were not summarized or included in the Springfield Integrated Report. The data needs documented above and the data collected from the surveys should be included in the Springfield Integrated Report to allow the Panel to assess the reasonableness of the economic analysis and inundation reduction benefits claimed.

The Panel is most concerned about Reach E1. While specific information on the physical structures, the types of businesses, and contents is not available for the other reaches, the relationship of average annual damages and structural damages appears reasonable for Reaches E2 through E6. That is not the case for Reach E1. For example, the “total” structural values in Reach E1 are $5,438,000. The “average annual” without-project structural damages are $175,888. The “average annual” without-project total damages are $2,242,650. The contents damages were not identified but it is presumed that contents damages make up the bulk of the difference. Given the magnitude of the damages, where “average annual” total damages ($2,242,650) represent approximately 41 percent of the total structural values in Reach E1 and the “average annual” structural damages ($175,888) are less than 8 percent of the total “average annual” damages, it appears that the bulk of the damages are to contents and not to the structures. It is atypical to have differences of this magnitude, and the Panel does not have sufficient information to determine the underlying reasons. More documentation on the use of the structures and on their contents is needed to support and understand the magnitude of these numbers.

In addition, damages from the 0.1-percent probability flood in Reach E1 are 5.5 times the value of the structures. For the other five reaches, that relationship varies from 0.04 to 0.85 times the value of the structures. Additional documentation and discussion are needed to explain why the magnitude of damages compared to the total value of the structures in Reach E1 is reasonable. Without further documentation, the Panel cannot confirm the damages and inundation benefits claimed.

Although it is stated that a structural inventory and surveys were performed by the U.S. Army Corps of Engineers (USACE), which would traditionally result in a contents-to-

structure relationship, only structure values and total damages are reported. Damages were estimated by the Flood Damage Analysis program developed by the Hydrologic Engineering Center and used nationwide by USACE to estimate project flood damages. Residential content values were dealt with indirectly based on USACE Economics Guidance Memorandum (EGM) 04-01 (USACE, 2003). The curves in EGM 04-01 are for single-family homes with and without basements. The methods to calculate damages and the residential contents values are appropriate, but the process for determining contents values should have been described in the Springfield Integrated Report. In addition, EGM 04-01 requires that feasibility reports must state that generic curves provide reasonable results and are being used in the analysis of flood damages for residential structures.

No similar generic curves for business and commercial contents are endorsed by USACE Headquarters. Content values and depth-damage curves for non-residential properties for Jordan Creek were estimated using non-residential depth-damage curves created for the American River Watershed Project Folsom Dam Modification. While the Springfield Integrated Report indicates that non-residential structures in the Jordan Creek floodplain were assumed to be similar to the prototypical structures used to develop the American River curves, results of the OMB-approved surveys for Jordan Creek should have been analyzed in combination with the American River curves, and documentation should have been provided to demonstrate that an analysis was performed and that the appropriateness of the use of the curves was verified.

Significance – Medium

Further documentation and support are needed to verify the reasonableness of the benefits claimed.

Recommendations for Resolution

1. Provide specific economic information by reach to fully describe the locations of the structures and other pertinent information needed to reasonably allow verification of the economic benefits claimed.
2. Provide documentation to support the reasonableness of the magnitude of damages to contents/inventory in Reach E1.
3. Describe the process for and appropriateness of applying the generic curves for estimating contents damages for residential structures, and state that the generic curves are being used.
4. Support the assumption that the Jordan Creek structures were similar to the prototypical structures used to develop the American River curves; analyze and document the results from the OMB-approved surveys for Jordan Creek in combination with the American River curves; and verify the appropriate use of the curves.

Literature Cited

USACE (2003). Generic Depth-Damage Relationships for Residential Structures with Basements. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C.

Economic Guidance Memorandum (EGM) No. 04-01, USACE CECW-PG, p. 17. October 10. Available at http://planning.usace.army.mil/toolbox/library/EGMs/egm04-01.pdf. Accessed March 6, 2013.

Final Panel Comment 5

The hydrology and hydraulics analyses did not consider potential changes in rainfall frequency and rainfall intensity/duration due to climate change, or increased sedimentation and debris accumulation.

Basis for Comment

The Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) Section 3.3.1.1 (No Action – Future Without-Project Condition) identifies climate change as one of the risks associated with the project assumptions. This risk does not appear to have been addressed in the Springfield Integrated Report, and the Panel did not find documentation to assess the impact of climate change on the project. For the assumed project life of 50 years, climate change could increase the rainfall frequency (e.g., the 4 percent Annual Exceedance Probability rainfall can become 10 percent) and duration/intensity. Because the project area is susceptible to flash flooding, any increase in rainfall frequency, duration, or intensity can result in higher flood levels and longer flood durations, and thereby potentially affect the cost and benefit evaluation for the different alternatives.

Sedimentation and debris will also very likely increase during episodic floods over the 50-year project life. However, sedimentation due to flooding was not discussed in the study. Notably, Section 3.6.2 of the Springfield Integrated Report states, “sedimentation within the channel should be minimal and should not affect the flow capacity of the channel over time” under the Tentatively Selected Plan. However, the Springfield Integrated Report does not provide adequate documentation to support this statement. Both sedimentation and debris accumulation decrease the conveyance of floodways, reduce the storage capacity of detention basins, and cause structures such as bridges, culverts, and flood walls to fail. Project alternatives that rely heavily on detention basins may be more vulnerable to sedimentation, and alternatives that rely heavily on large culverts may be more vulnerable to debris accumulation at waterway entrances/outlets. If sedimentation is severe, additional costs for periodic dredging may be required to maintain the hydraulic efficiency of waterways.

Significance – Medium

The alternatives analysis is incomplete because it does not consider the impacts of climate change, sedimentation, and debris accumulation.

Recommendations for Resolution

1. Provide documentation on risk and uncertainty associated with climate change and assess the impact of climate change in the project, or provide documentation to justify excluding the impacts of climate change on the project.
2. Verify from available climate change models or literature that rainfall characteristics (frequency, intensity, and duration) will not significantly change in the project area within the assumed project life.
3. Provide documentation on risk and uncertainty associated with increased sedimentation and debris accumulation.

Final Panel Comment 6

The Indiana bat, which is currently listed as endangered throughout all counties in Missouri, has not been discussed relative to its potential habitat in the project area.

Basis for Comment

Because the U.S. Fish and Wildlife Service (USFWS) consultation letter to the U.S. Army Corps of Engineers (USACE) (USFWS, 2012) did not mention the Indiana bat, the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) does not evaluate this species. However, the Indiana bat is a federally listed endangered species and, because of continued population decline and the effects of White Nose Syndrome, this species is routinely the subject of various Clean Water Act Section 404 permit conditions, via agency consultation, throughout its range. The USFWS indicates that the current distribution of the Indiana bat includes every county in Missouri, including Greene County (USFWS, 2013). Furthermore, preferred foraging habitat for the Indiana bat includes riparian corridors along small streams. Section 4.6.1 of the Springfield Integrated Report describes small areas of riparian corridors with sporadic tree/shrub cover. These riparian corridors could potentially provide suitable foraging habitat for the Indiana bat.

Significance – Medium

There is no discussion of the Indiana bat, even though the USFWS indicates that the project site is within its range and may include potentially suitable foraging habitat.

Recommendations for Resolution

1. Provide narrative on the Indiana bat to include an evaluation of potentially suitable habitat in the project study area.
2. If the riparian corridors within the study area are not sufficient foraging habitat for the Indiana bat, provide narrative and rationale to eliminate this species from consideration.

Literature Cited

USFWS (2012). Agency Correspondence Letter from the U.S. Fish and Wildlife Service to the U.S. Army Corps of Engineers for the Jordan Creek FRM Study, Springfield, Missouri. June 28, 2012.

USFWS (2013). Missouri: Federally-Listed Threatened, Endangered, and Candidate Species County Distribution. U.S. Fish and Wildlife Service. Available online at http://www.fws.gov/midwest/endangered/lists/missouri-spp.html. Updated January 3, 2013. Accessed March 7, 2013.

Final Panel Comment 7

Impacts to karst geology and cave-dwelling threatened and endangered species have not been considered, and the potential presence of losing stream segments has not been evaluated.

Basis for Comment

Section 4.4.1 of the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) indicates that the geology of the project area is underlain by Mississippian Age limestone and may contain karst features such as sinkholes, losing streams, springs, and caves. Because of the potential for karst features in the vicinity of the project, the Ozark cavefish, a federally endangered species, may also be impacted by the project (Table 4-6). The Springfield Integrated Report does not indicate whether any specific sinkholes or losing stream reaches were identified within the project area. This information is necessary to assess impacts to karst features and to cave-dwelling listed species such as the Ozark cavefish.

Section 5.1.3 of the Springfield Integrated Report suggests that the alternatives and the National Economic Development plan will not have a significant effect on the physiography of the area. However, given the potential for karst features in the region, including the potential for the presence of losing stream segments, significant impacts could occur.

Significance – Medium

Without additional documentation, it is not possible to determine whether impacts to karst geology and to listed species associated with karst features could occur.

Recommendations for Resolution

1. Definitively state in the Springfield Integrated Report whether losing stream segments exist within the study area.
2. In Section 5.1.3 of the Springfield Integrated Report, identify any potential conduits to groundwater (losing stream segments or sinkholes) or indicate that such conduits do not exist. If sinkholes or losing stream segments are present, analyze the project impacts and suggest best management practices to minimize impacts to karst geology during construction.
3. In light of information provided in Section 4.6.2.3 of the Springfield Integrated Report, discuss the potential for impacts to the Ozark cavefish in Section 5.2.4 of the Springfield Integrated Report.

Final Panel Comment 8

The potential cumulative effects of the Jordan Creek flood risk management project in conjunction with the impacts of other actions that have occurred or may occur in the project area have not been considered.

Basis for Comment

The Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA) require that cumulative effects be considered when assessing a project's environmental impacts. Cumulative effects are the impacts on the environment that result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions. The Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) does not analyze the cumulative impacts resulting from other actions or projects in the region.

Significance – Medium

Without considering potential cumulative impacts on resources in the area, a thorough assessment of possible significant impacts on those resources cannot be conducted.

Recommendation for Resolution

1. Consider potential cumulative impacts with other projects in the area, either upstream or downstream, or other large-scale projects that may, in combination with this project, result in significant impacts to regional resources such as karst geology, endangered species, water quality, etc.

Final Panel Comment 9

The climate information is limited to average rainfall, and it is not possible to relate the historical rainfall data to the data applied in the hydrologic modeling.

Basis for Comment

The Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report), Section 4.4, reports two active weather stations—the Springfield Weather Station and the Springfield Regional Airport Weather Station—located near Wilsons and Jordan Creeks in Greene County. Both stations were reported to record daily precipitation, maximum and minimum temperature, snowfall, and snow depth. However, the report provides only the annual average rainfall and temperature over the most recent 30-year period. Appendix C, Attachment A (Jordan Creek Feasibility Study Hydrology and Hydraulics Report), Section 3.3, provides the rainfall data applied in the hydrologic modeling. These sections do not adequately describe the seasonal variation of rainfall and snowfall and do not provide adequate information to relate the local historical rainfall data to the rainfall data applied in the hydrologic modeling. Therefore, the Panel cannot assess the validity of the input rainfall in the hydrologic modeling.

Significance – Medium

Relating the rainfall data applied in the hydrologic modeling to the local historical rainfall provides the means to evaluate the accuracy of the rainfall data for the hydrologic modeling.

Recommendations for Resolution

1. Provide the historical monthly rainfall data to describe seasonal variation of rainfall.
2. Provide estimates of the historical rainfall associated with the 100 percent, 50 percent, 20 percent, 10 percent, and 4 percent Average Exceedance Probability storm events, and compare these to the hydrologic model rainfall input.
3. Provide sufficient documentation to support the use of the rainfall data applied in the hydrologic modeling.

Final Panel Comment 10

Descriptions of the Wilsons Creek Railroad Bridge replacement and the modifications required for the Scenic Bridge are inconsistent, which could result in minor changes to the project costs.

Basis for Comment

Appendix C, Engineering Appendix, Paragraph 6.2.2 (Channelization), discusses in very general terms a proposed solution to replace the Wilsons Creek Railroad Bridge. However, throughout the report, there are inconsistencies regarding what the replacement will be. For example, Section 7.3, Structural Systems, assumes that a Union Pacific Railroad 3-span precast channel bridge (PCB) would replace the Wilsons Creek Railroad Bridge, and plate S-1 shows that the PCB is the most likely replacement. However, plate S-1 shows that the PCB would replace a 220-foot-long existing bridge, while page 8 of Appendix C, Attachment B, Part 2 (Micro-Computer Aided Cost Estimating System [MCACES] Cost Estimate) indicates that a 54-foot-long existing bridge is being removed. In addition, Appendix C paragraph 7.3 refers to a 90-foot-long replacement bridge. Page 13 of the MCACES Cost Estimate shows that the replacement railroad bridge is 117 feet long, which differs from Plate S-1.

Paragraph 6.2.2 of Appendix C states that a “saddle cap” method will be used to replace the Railroad Bridge. It further states that this method will allow the railroad to be out of service only 3 days at a time. The cost estimate shows a 54-foot-long existing bridge will be replaced with a 90-foot-long pre-cast railroad bridge. This will require considerable amounts of excavation, if the existing bridge is indeed 54 feet. It should be documented in Appendix A what proposed work the cost estimate is based on. Paragraph 6.2.2 of Appendix C also states that the Scenic Bridge will most likely undergo modifications as a result of channel excavation under the bridge. While it is understood that the specific modifications to the Scenic Bridge will be identified in detailed designs, the expected modifications and their costs at a feasibility level of detail should be identified. Page 12, Appendix C, attachment b, part 2, states that the modifications to the Scenic Bridge will cost almost $0.5 million; however, the work that will take place has not been described in paragraph 7.3 of Appendix C. A clear explanation of the work proposed for the Scenic Bridge and a sketch showing the proposed work would make the document much easier to understand.

Significance – Medium

Resolution of this comment will not impact project feasibility but will result in report consistency and demonstrate that, while the costs may be minor, all appropriate costs have been included.

Recommendations for Resolution

1. Clarify the length of the replacement Wilsons Creek Railroad Bridge and the plan for replacement by describing the bridge to be replaced and the process to replace it.

2. Describe in greater detail the work associated with the Scenic Bridge modifications. At a minimum, provide a sketch showing the proposed excavation and planned bridge modifications.

Final Panel Comment 11

The Macroinvertebrate Stream Condition Indices (MSCI) scores in Table 4-5 do not corroborate the statement that Jordan Creek should support biological communities comparable to those found at the reference site.

Basis for Comment

Section 4.6.2.2 of the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) (the top of page 71) states that since the instream habitat assessment score for Jordan Creek exceeded the minimal 75-percent total score of the habitat assessment of the biological criteria reference, Jordan Creek should support biological communities comparable to those found in the reference site (Pomme de Terre River). This statement seems contrary to the MSCI scores in Table 4-5. The MSCI scores of 6 for Jordan Creek and 8 for Wilsons Creek are non-sustaining of aquatic life.

Significance – Low

Information in Section 4.6.2.2 of the Springfield Integrated Report appears to be contradictory.

Recommendations for Resolution

1. Provide additional narrative in Section 4.6.2.2 of the Springfield Integrated Report to clarify the apparent discrepancy.
2. Indicate whether the data in Table 4-5 of the Springfield Integrated Report were generated from the same study as the in-stream habitat assessment scores referenced in Missouri Department of Natural Resources (2007).

Literature Cited

Missouri Department of Natural Resources (2007). Springfield Urban Streams, Clear Creek, Jordan Creek, Wilsons Creek and Galloway Creek, Greene County, Missouri. Missouri Department of Natural Resources, Biological Assessment Report.

Final Panel Comment 12

The alternatives assessment does not provide a quantitative comparison of the alternatives' degree of flood inundation (elevation and coverage) and the duration of the flood inundation.

Basis for Comment

Although the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Table 5-1) provides comparisons between project alternatives, it does not provide a quantitative comparison of impacts of alternatives. In particular, Appendix C, Attachment A (Jordan Creek Feasibility Study Hydrology and Hydraulics Report) does not provide sufficient detail to distinguish flood levels for different alternatives.

Significance – Low

The change in flood durations will likely be limited and will likely not change the results of the evaluation of the alternatives; however, the documentation will add to the credibility of the alternative comparisons.

Recommendations for Resolution

1. Quantify the differences in flood levels and flood coverage for the different alternatives and compare the associated impacts.
2. Quantify the potential differences in flooding durations for the different alternatives and compare the associated impacts.

Final Panel Comment 13

The estimated annual benefits and total construction costs for Plan J are inconsistent between the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) main text and the appendices.

Basis for Comment

The Springfield Integrated Report and its appendices are inconsistent with regard to the estimated annual benefits for Plan J. Taking the existing annual damages from the Economic Analysis Appendix (Appendix A), page A-25, minus the estimated annual damages for Plan J, the annual benefits should be $2,902,726. However, page A-40 states that the benefits are $3,029,603, page 44 of the Springfield Integrated Report main text states that the benefits are $3,029,400, and page ES-2 of the Executive Summary states that the benefits are $3,134,400.

In addition, the Springfield Integrated Report is inconsistent with regard to the costs between what is shown in Appendix A (Table 38, Plan J Benefits and Costs, page A-60 under Total Project Costs), the Springfield Integrated Report main text (Paragraph 3.3.4.4, Table 3-5, page 39 under Total Costs), and Appendix C, Attachment B, Part 2 (Micro-Computer Aided Cost Estimating System [MCACES] Cost Estimate) dated December 20, 2012. The MCACES Cost Estimate only addresses Reach E1, which includes Wilsons Creek and the five detention basins, which are located in Reaches E5 and E6. Tables 38 and 3-5 show costs for Reaches E1, E2, E3, E4, E5, and E6, and they all add up to the same amount of approximately $19.5 million on pages 1 and 3 of the MCACES Cost Estimate.

Significance – Low

Resolution of this comment will not impact project feasibility but will result in report consistency.

Recommendations for Resolution

1. Resolve the inconsistencies or explain the differences with regard to the estimated annual benefits for Plan J in the Springfield Integrated Report and the Economic Analysis Appendix.
2. Resolve the inconsistencies or explain the differences between the costs as shown for Plan J in Appendix A, the Springfield Integrated Report main text, and the MCACES Cost Estimate.

Final Panel Comment 14

National Wetlands Inventory (NWI) mapping alone is not sufficiently accurate to determine that the 0.4-acre wetland to be filled under Plans G and J is isolated.

Basis for Comment

Wetland descriptions in the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) are based on NWI mapping (as presented in Section 4.5.4 and Figure 4-3). NWI mapping is a desktop planning tool based on review of aerial imagery and overlay of existing data sources such as digital soil mapping. Because the NWI is produced via desktop review, field verification of the site has not been conducted and there is a possibility that the wetland might not really exist. If it does exist, then in addition to the use of NWI, USACE would need to apply the rationale provided in the EPA and USACE (2008) guidance to determine if it would be jurisdictional.

Section 5.2.2 of the Springfield Integrated Report indicates that under Plans G2 and J, a 0.4-acre isolated wetland in Reach E1 will be filled. The determination that the wetland is isolated should not be made based on NWI mapping alone.

Significance – Low

Sufficient rationale is not provided for the determination that the impacted wetland in Plans G2 and J is isolated.

Recommendation for Resolution

1. Either provide the appropriate field review to verify that the wetland is isolated or provide clarification in Section 5.2.2 of the Springfield Integrated Report that the wetland is *assumed* to be isolated and provide the rationale for making such a determination.

Literature Cited

EPA and USACE. (2008). Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States Memorandum. December 02, 2008.

Final Panel Comment 15

Cost estimate details do not match the descriptions provided in the Engineering Appendix for the proposed retaining walls and outlet structures associated with the detention basins.

Basis for Comment

During review of the Engineering Appendix (Appendix C), the Panel noted costs related to retaining walls and the detention basins. However, the panel members could not find a description within the Jordan Creek Flood Risk Management Study, Springfield, Missouri Draft Feasibility Report and Environmental Assessment (Springfield Integrated Report) that would allow them to compare engineering plans to costs. For example, Paragraph 6.1 of Appendix C mentions a retaining wall that is part of the effort to enlarge the channel between stations 312+00 and 326+15 (i.e., “to construct a trapezoidal channel due to real estate limitations, vertical concrete walls were incorporated”). However, the retaining walls are not mentioned in Paragraph 7.3, Structural Systems. The Micro-Computer Aided Cost Estimating System (MCACES) Cost Estimate (Appendix C, Attachment B, Part 2) does include costs for the retaining walls (a little less than $0.75 million) and describes in detail the work associated with them, but a description of the planned retaining walls is not provided in Appendix C or on the structural systems chart (plate S-2).

In addition, Appendix C, Paragraph 6.2.1, Detention Basins, does not clearly state what structures will be built in the five detention basins. The MCACES Cost Estimate does contain sufficient details to understand what will be built, but there is no way to compare that description to what might have been planned.

Significance – Low

Resolution of this comment will not impact project feasibility but will enhance the Springfield Integrated Report and make it easier to understand.

Recommendations for Resolution

1. In Paragraph 7.3 of Appendix C, Structural Systems, add a description of the type of retaining walls and state that further analyses will be included in the detailed design phase.
2. In Paragraph 6.2.1 of Appendix C, under the heading for each basin, add a sentence or two that describes the proposed structures.

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APPENDIX B

Final Charge to the Independent External Peer Review Panel as Submitted to USACE on December 13, 2012

on the

Springfield IEPR

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Charge Questions and Guidance to the Peer Reviewers
for the
Independent External Peer Review
of the
Jordan Creek-Springfield, Greene County, Missouri
Feasibility Study Report and Environmental Assessment

BACKGROUND

The study area is located within the White River Basin, extending approximately six miles along Jordan Creek. Jordan Creek, including North Branch and South Branch Jordan Creek, at its confluence with Wilsons Creek has a 13.75 square mile drainage basin. The project area is generally centered on the Chestnut Expressway between U.S. Highway 65 to the east and U.S. Highway 160 to the west in the northern half of the city of Springfield, Missouri. The study area includes Jordan Creek, North Branch Jordan Creek, South Branch Jordan Creek, and the upstream portion of Wilson Creek.

Jordan Creek, North Branch Jordan Creek, and South Branch Jordan Creek are classic urban streams throughout most of their length. The upstream reaches consist of grass ditches with small culverts capable of only carrying small frequent storm events. The middle portion of each reach includes concrete and natural channels, some regional detention, large-diameter culverts capable of conveying a storm that has a 10% to 20% chance of happening in any given year and a number of very long tunnel reaches capable of carrying larger flows. The downstream portion of the stream is mostly natural channel with an assortment of conveyance improvements, bridges, culvert structures and grade controls, such as culverts and utility crossings. When storms of a higher frequency happen, the water sheet flows on streets and through buildings moving with it the debris it picks up along the way.

The City of Springfield, the Non-Federal Sponsor (NFS), experiences floods as a result of insufficient flow capacity and urbanization along Jordan Creek. The area along Jordan Creek is heavily urbanized with extensive infrastructure associated with areas of high-density housing, low-density housing, commercial areas, industrial areas, and some open spaces. All of the water that falls in the Jordan Creek and Fassnight basins is taken into account in the study analysis. However, although the entire watershed is being considered, according to EP 1165-2-1 Water Resources Policies and Authorities and ER 1165-2-21 Flood Damage Reduction Measures in Urban Areas, only the benefits downstream of where the discharge is greater than 800 cfs (cubic feet per second) for a 10-percent flood (one chance in ten of being equaled or exceeded in any given year) can be used to justify a project.

The overall objective of the planning study is to improve flood risk management and improve the overall quality of life for the residents of Springfield, Missouri. The Jordan Creek flood risk management feasibility study is one of several USACE pilot projects selected to demonstrate the agency's modernized planning initiative, which is to complete investigations leading to a decision in less time by utilizing a risk-informed evaluation with less detailed information. The risk register will accompany the feasibility study decision document. Although one of the

objectives of IEPR is to evaluate whether sufficient information was available or technical analyses were completed, the IEPR must be completed within the context of the risk-informed decision-making process.

From the preliminary analysis, it was determined that channel modifications and detention basins will make up the bulk of the alternatives. Due to infrastructure and real estate constraints, there were not a lot of options for channel alignment. Formulation of specific alternatives is based on channel effectiveness (benefit outputs) and river reaches. Not many of the measures were eliminated from the initial screening because the team looked at different levels of protection, which may make different measures more efficient than building a larger channel. The tentatively selected plan presents a combination of channel improvements, detention basins, bridges, and potentially some relocations.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment (hereinafter: Springfield IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released 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 1165-2-209; p. D-4) for the Springfield documents. The IEPR will be limited to technical review and will not involve policy review. The IEPR will be conducted by subject matter experts (i.e., IEPR panel members) with extensive experience in civil/cost engineering, hydrology and hydraulic engineering, Civil Works planning/economics, biology/ecology, and structural/geotechnical engineering issues relevant to the project. They will also have experience applying their subject matter expertise to flood risk management.

The Panel will be "charged" with responding to specific technical questions as well as providing a broad technical evaluation of the overall project. Per EC 1165-2-209, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

The following is a list of documents and reference materials that the Panel will be asked to review.

Documents for Review
The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages	Required Disciplines
Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Integrated Environmental Assessment	150	All Disciplines
Risk Register	10	All Disciplines
Design • Hydrologic and Hydraulic Analyses • Civil Design • Geotechnical and Structural Engineering • HTRW • Cost Engineering	400	Civil/Cost Engineering; Hydrology and Hydraulic Engineering; Structural/Geotechnical engineering
Economics	100	Civil Works Planning/Economics
Real Estate	50	Civil Works Planning/Economics

Documents for Reference

- USACE guidance *Civil Works Review Policy*, Change 1 (EC 1165-2-209) dated January 31, 2012
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

SCHEDULE

This draft schedule is based on the February 1, 2013 receipt of the final review documents. The schedule will be revised upon receipt of final review documents.

Task	Action	Days to Complete Action	Due Date
Conduct Peer Review	Battelle sends review documents to IEPR Panel	Within one day of receipt of the documents from USACE	2/4/2013
	Battelle/IEPR Panel kick-off meeting	A few days prior to the documents being ready	1/29/2013
	USACE/Battelle/Panel kick-off meeting	A few days prior to the documents being ready	1/29/2013
	Battelle convenes mid-review teleconference for Panel to ask clarifying questions of USACE	Upon panel members completing 50% of review	2/11/2013
	Panel members complete their individual reviews	Within 20 days of receipt of the documents	2/19/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides Panel merged individual comments and talking points for panel review teleconference	Within 4 days of receipt of individual comments	2/25/2013
	Convene panel review teleconference	Within 5 days of Panel members completing their review	2/26/2013
	Battelle provides Final Panel Comments directive to Panel	Within 1 day of Panel review teleconference	2/27/2013
	Panel members provide draft Final Panel Comments to Battelle	Within 6 days of Panel review teleconference	3/6/2013
	Battelle provides feedback to Panel on draft Final Panel Comments; Panel provides revised draft Final Panel Comments per Battelle feedback (iterative process)	Iterative process, no more than 2 days for each revision	Not Applicable
	Final Panel Comments finalized	Within 7 days of receipt of draft Final Panel Comments	3/15/2013
	Battelle provides Final IEPR Report to Panel for review	Within 2 days Final Panel Comments being finalized	3/19/2013
	Panel provides comments on Final IEPR Report	Within 2 days of receipt of Final IEPR report	3/21/2013
	*Battelle submits Final IEPR Report to USACE	Within 19 days of panel review teleconference	3/26/2013

Task	Action	Days to Complete Action	Due Date
Post-Final Panel Comment Response Process	Battelle inputs Final Panel Comments to DrChecks; Battelle provides Post-Final Panel Comment Response Process template to USACE	Within 2 days of submittal of final report	3/27/2013
	USACE provides draft PDT Evaluator Responses and clarifying questions to Battelle	Within 10 days of receipt of final report	4/2/2013
	Battelle provides the Panel the draft PDT Evaluator Responses and clarifying questions	Within 2 days of receipt of draft PDT Evaluator responses and clarifying questions from USACE PDT	4/4/2013
	Panel members provide Battelle with draft comments on draft PDT Evaluator Responses (i.e., draft BackCheck Responses)	Within 3 days of receipt of draft PDT Evaluator responses from Battelle	4/9/2013
Post-Final Panel Comment Response Process, Continued	Teleconference with Battelle and Panel to discuss draft BackCheck Responses	Within 1 day of receipt of draft BackCheck comments	4/10/2013
	Teleconference between Battelle, Panel, and USACE to discuss Final Panel Comments, draft responses, and clarifying questions	Within 1 day of teleconference with Battelle and panel members	4/11/2013
	USACE inputs final PDT Evaluator Responses in DrChecks	Within 10 days of Final Panel Teleconference	4/18/2013
	Battelle provides PDT Evaluator Responses to Panel	Within 3 days of PDT Evaluator comments being available	4/22/2013
	Panel members provide Battelle with final BackCheck Responses	Within 3 days of receipt of PDT Evaluator comments	4/24/2013
	Battelle inputs the Panel's BackCheck Responses in DrChecks	Within 10 days of notification that USACE responses have been posted in DrChecks	4/25/2013
	*Battelle submits pdf printout of DrChecks project file	Within 1 day of DrChecks closeout	4/26/2013
Civil Works Review Board (CWRB) Preparation & Participation	Panel provides input to preparation of CWRB presentation and participates in meeting	Scheduled by USACE	5/31/2013

CHARGE FOR PEER REVIEW

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

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Springfield 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 1165-2-209; 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 may 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 Independent Technical Review.
2. Please contact the Battelle Project Manager (Lynn McLeod, mcleod@battelle.org) or Battelle Deputy Program Manager (Rachel Sell, sellr@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 Lynn McLeod, mcleod@battelle.org, no later than March 5, 2013, 10 pm ET.

Independent External Peer Review of the

Jordan Creek-Springfield, Greene County, Missouri Feasibility Study Report and Environmental Assessment

Charge Questions and Relevant Sections as Supplied by USACE

General Questions

1. Within the context of risk-informed decision-making, to what extent has it been shown that the project is technically sound?

2. Are the assumptions that underlie the engineering and environmental analyses sound?

3. Within the context of risk-informed decision-making, are the engineering and environmental methods, models and analyses used adequate and acceptable?

4. Were all models used in the analyses used in an appropriate manner with assumptions appropriately documented and explained?

5. Were risk and uncertainty sufficiently considered?

6. Was the process used to select the recommended alternative rational and was the process implemented in a reasonable manner given the project constraints?

7. Does the environmental assessment satisfy the requirements of NEPA? Were adequate considerations given to significant resources by the project?

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

Safety Assurance Review Questions

9. Within the context of risk-informed decision-making, were the methods used to evaluate the condition of the structural features adequate and appropriate given the circumstances?

10. Have the appropriate alternatives been considered and adequately described for this project and do they appear reasonable?

11. Within the context of risk-informed decision-making, do the project features adequately address redundancy, resiliency, or robustness with an emphasis on interfaces between structures, materials, members, and project phases? USACE's *Civil Works Review Policy*, Change 1 (EC 1165-2-209) defines redundancy, resiliency, and robustness in the follow manner:

- Redundancy (the duplication of critical components of a system with the intention of increasing reliability of the system, usually in the case of a backup or failsafe).
- Resiliency (the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use).
- Robustness (the ability of a system to continue to operate correctly across a wide range of operational conditions [the wider the range of conditions, the more robust the system], with minimal damage, alteration, or loss of functionality, and to fail gracefully outside of that range).

12. For the current design, developed using limited detailed information, are the quality and quantity of the surveys, investigations, and engineering sufficient to assess expected risk reduction?

13. Have the hazards that affect the structures been adequately documented and described? If not, is the risk register documented accordingly?

14. Are the models used to assess hazards appropriate?

15. Are the assumptions made for the impacts appropriately documented and explained in the report documentation and/or risk register?

16. Is there sufficient information presented to identify, explain, and comment on the assumptions that underlie the engineering analyses? Has the risk register adequately documented assumptions and corresponding risks associated with limited detailed information associated with the various engineering analyses?

17. Are there any additional analyses or information available or readily obtainable that would affect decisions regarding the structures?

18. Do the physical data and observed data provide adequate information to characterize the structures and their performance? If not, is the risk register documented accordingly?

19. Have all characteristics, conditions, and scenarios leading to potential failure, along with the potential impacts and consequences, been clearly identified and described? Have all pertinent factors, including, but not necessarily limited to population-at-risk, been considered?

20. Does the analysis adequately address the uncertainty given the consequences associated with the potential loss of life for this type of project?

21. From a public safety perspective, are the proposed alternatives reasonably appropriate or are there other alternatives that should be considered?

22. Has anything significant been overlooked in the development of the assessment of the project or the alternatives?

23. Do the alternatives and their associated costs appear reasonable? Do the benefits and consequences appear reasonable?

Study Information

24. Is the purpose of the project adequately defined? If not, why?

25. Has the project need been clearly described?

Problem and Description and Objectives

26. In your opinion, are there any other issues, resources, concerns, or problems that have not been identified and/or addressed?

27. Are the specific objectives and constraints adequately described

Alternatives

28. Have the criteria to eliminate plans from further study been clearly described?

29. Is each of the different alternative plans clearly described?

30. Within the context of risk-informed decision-making, were the assumptions made for use in developing the future with-project conditions for each alternative reasonable?

    a. Were adequate scenarios considered?

    b. Were the assumptions reasonably consistent across the range of alternatives and/or adequately justified where different?

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

32. Have comparative impacts been clearly and adequately described?

33. Comment on the optimization and incremental analysis process for the final array of alternatives.

34. Are the criteria used to evaluate the multi-criteria decision analysis adequate and appropriate? If not, why?

35. Are there any unmitigated environmental impacts not identified and if so, could they impact project designs?

36. Please comment on the likelihood that the recommended alternative will achieve the expected outputs.

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

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

39. Within the context of risk-informed decision-making, have the impacts to the existing infrastructure, utilities, and transportation infrastructure been adequately addressed?

Affected Environment

40. Is the description of the climate in the study area sufficiently detailed and accurate?

41. Is the description of wetland resources in the project area complete and accurate?

42. Is the description of aquatic resources in the project area complete and accurate?

43. Is the description of threatened and endangered species resources in the study area complete and accurate?

44. Is the description of the historical and existing recreational resources in the study area complete and accurate?

45. Is the description of the cultural resources in the study area complete and accurate?

46. Is the description of the historical and existing socioeconomic resources in the study area complete and accurate? Were specific socioeconomic issues not addressed?

Environmental Consequences

47. Have impacts to significant resources been adequately and clearly described?

48. To what extent have the potential impacts of the alternatives on significant resources been addressed and supported?

49. Are the scope and detail of the potential adverse effects that may arise as a result of project implementation sufficiently described and supported?

50. Have impacts from borrow areas been adequately and clearly described?

Cumulative Impacts

51. Are cumulative impacts adequately described and discussed? If not, please explain.

Mitigation

52. Are mitigation measures adequately described and discussed? If not, please explain.

Economics Appendix

53. Were the benefit categories used in the economic analysis adequate to calculate a benefit-to-cost ratio for each of the project alternatives?

54. To what extent are the input parameters, methods, models, and analyses used in the study methodology as documented in the Economics Appendix appropriate and consistent with current best management practices?

55. Were the methods to calculate structure and content values appropriate and adequately described?

56. Was the methodology to assess storm damages and storm damage reduction appropriate and adequately described?

57. Were the methods used to develop the content-to-structure value ratios (CSVRs) appropriate and were the generated results applicable to the study area?

58. Has the report adequately addressed the issue of repetitive flood damages and the subsequent extent of rebuild/repair by property owners as relates to annual damage estimation and have scenarios identified in the report adequately addressed the range of impact to project justification?

59. Were risk and uncertainty sufficiently considered in relation to the future development process?

Hydrology and Hydraulics Appendix

60. 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?

Geotechnical Engineering

61. Is the description of the geomorphic and physiographic setting of the proposed project area accurate and comprehensive?

62. Were the geotechnical analyses adequate and appropriate for the current level of design as presented in the report documentation?

Civil Design

63. Have the design and engineering considerations presented been clearly outlined and will they achieve the project objectives?

64. Are any additional design assumptions necessary to validate the preliminary design of the primary project components?

65. Are the assumptions used to determine the cost of operations and maintenance for the proposed project adequately documented and explained?

Cost

66. To what extent have significant project construction costs been adequately identified and described?

67. Are the costs adequately justified?

Real Estate Plan

68. Comment on the extent to which assumptions and data sources used in the economics analyses are clearly identified and the assumptions are justified and reasonable.

69. Does the Real Estate Plan adequately address all real estate interests (public and private)?

70. Have potential relocations as a result of the project been adequately addressed?

Hazardous, Toxic, and Radioactive Waste

71. Within the context of risk-informed decision-making, comment on the extent to which impacts of the alternatives may have on hazardous, toxic, and radioactive waste issues?

Public Involvement and Correspondence

72. Based on your experience with similar projects, has adequate public, stakeholder, and agency involvement occurred to determine all issues of interest and to ensure that the issues have been adequately addressed to the satisfaction of those interested parties? Should additional public outreach and coordination activities be conducted?

Final Overview Question

73. What is the most important concern you have with the document or its appendices that was not covered in your answers to the questions above?