Final Independent External Peer Review Report
Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study

Prepared by
Battelle Memorial Institute

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

Contract No. W912HQ-15-D-0001
Task Order: 0003

April 25, 2017

BATTELLE
It can be done

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Executive Summary

Project Background and Purpose

Little Colorado River (LCR) at Winslow is a General Investigations study that was undertaken to evaluate structural and non-structural flood risk management measures to reduce the risk of flooding in the City of Winslow and vicinity. Removal of invasive species (tamarisk, saltcedar) was considered as part of larger plans, provided they contributed to the primary objective of flood risk management. The USACE study team did not formulate ecosystem restoration plans, and National Ecosystem Restoration (NER) benefits were not determined for the purpose of plan selection. The non-Federal sponsor for the study is the Navajo County Flood Control District, Navajo County, Arizona.

The overall LCR watershed encompasses an area of approximately 27,051 square miles in northeastern Arizona and northwestern New Mexico. Approximately 80 percent of the watershed is in Arizona and includes parts of Coconino, Navajo, and Apache Counties. The remaining 20 percent of the watershed is in New Mexico and includes parts of San Juan, McKinley, Cibola, and Catron Counties. The drainage basin of the LCR is approximately 245 miles long and 158 miles wide at its widest point. The mainstem of the LCR is entirely in Arizona, has a channel length of 356 miles, and total elevation drop of about 6,300 feet from its headwaters in the White Mountains to its confluence with the Colorado River. The LCR flows in generally a northwest direction and receives runoff from 18 sub-watershed basins and contributing drainage areas with hundreds of miles of small tributary streams. The LCR watershed is bound on the east by the Rio Grande Basin, on the south by the Gila River Basin, and on the north by the San Juan Basin.

The LCR at Winslow study area is located in and near the City of Winslow in western Navajo County, Arizona. The study area encompasses the floodplain of the LCR from the vicinity of the Clear Creek confluence downstream (northwest) to the north end of the existing Winslow Levee system. The study area includes the majority of the City of Winslow, including the Ruby Wash Diversion Levee and the Ruby Wash Levee. The tributaries of Ruby Wash, Clear Creek, Cottonwood Wash, and Salt Creek join the LCR mainstem within the study area.

The City of Winslow is located along both Interstate Highway 40 and the Burlington Northern Santa Fe Railroad along the western border of Navajo County. Winslow is the largest city in Navajo County. The area is supported by tourism, manufacturing, trade, and retail. The 27,000 square mile Navajo Reservation and the 2,410 square mile Hopi Reservation are located to the north. Elsewhere, the surrounding land consists of a patchwork of private and State Trust lands.

As stated previously, the study's purpose was to investigate problems and opportunities and potential alternatives to provide flood risk management for the City of Winslow and vicinity. Potential flood risk management solutions included both structural and non-structural measures. Structural measures

included levee rehabilitation, new levees, channel improvements to increase conveyance capacity, grade control structures, bank stabilization, and on-line or off-line detention facilities. Non-structural floodplain management measures included assisting communities with floodplain management and flood warning systems in areas where needed. In addition, floodproofing, buyout, relocation, and dry flood-proofing were considered.

Independent External Peer Review Process

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study (hereinafter: Little Colorado River at Winslow IEPR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012a). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate this IEPR. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012a) and OMB (2004). This final report presents the Final Panel Comments of the IEPR Panel (the Panel). Details regarding the IEPR (including the process for selecting panel members, the panel members' biographical information and expertise, and the charge submitted to the Panel to guide its review) are presented in appendices.

Based on the technical content of the Little Colorado River at Winslow review documents and the overall scope of the project, Battelle identified potential candidates for the Panel in the following key technical areas: Civil Works planning/economics, biological resources and environmental law compliance, hydrology and hydraulic engineering, geotechnical engineering, and civil/cost engineering. Battelle screened the candidates to identify those most closely meeting the selection criteria and evaluated them for COIs and availability. USACE was given the list of final candidates to confirm that they had no COIs, but Battelle made the final selection of the five-person Panel.

The Panel received electronic versions of the Little Colorado River at Winslow Integrated Feasibility Report/Environmental Impact Statement (IFR/EIS) review documents (1,913 pages in total), along with a charge that solicited comments on specific sections of the documents to be reviewed. Following guidance provided in USACE (2012a) and OMB (2004), USACE prepared the charge questions, which were included in the draft and final Work Plans.

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

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

medium/high significance, two had a medium significance, one had medium/low significance, and two had low significance.

Battelle received public comments from USACE on the Little Colorado River at Winslow project (six emailed comments, four comment cards, seven letters, one voicemail comment, and one public summary totaling approximately 34 pages of comments) and provided them to the IEPR panel members. The panel members were charged with determining if any information or concerns presented in the public comments raised any additional discipline-specific technical concerns with regard to the Little Colorado River at Winslow review documents. After completing its review, the Panel confirmed that no new issues or concerns were identified other than those already covered in the Final Panel Comments.

Results of the Independent External Peer Review

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012a; p. D-4) in the Little Colorado River at Winslow review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the IFR/EIS contains well-written and well-organized information on the engineering, environmental, economic, and plan formulation issues. The IFR/EIS provides a balanced assessment of the economic, engineering, and environmental issues of the overall project; however, the Panel identified several elements of the project where additional analysis are warranted and places where clarification of project findings and objectives need to be documented or revised.

Plan Formulation and Economics: From the plan formulation and economics perspectives, the IFR/EIS is well-assembled and well-written, representing a great deal of hard work, particularly for a project involving existing levee systems, which requires discipline in approach and execution. One particular concern, however, is that the total project and net project benefits may be affected by the addition of freeboard, which is not analyzed to determine if it improved expected project performance relative to the incremental costs of adding it. This issue could be addressed by, for example, providing an explanation in the IFR/EIS why the freeboard is justified in terms of overall performance versus expected costs. Of lesser concern, the Panel believes the IFR/EIS would benefit from identifying the dates of floodplain inventory and explaining why those inventory prices are still representative of current conditions.

Engineering: The engineering panel members commented that, with the extensive existing information available for the project area, the IFR/EIS does an excellent job of consolidating this information into the appendices. The hydraulic modeling efforts for baseline and future conditions have been developed according to industry standards, except that the models are uncalibrated. The geotechnical appendix presents a thorough compilation of available geological data, soil borings, and historic construction/repair details. The cost estimates are fairly thorough and include larger contingencies to cover project uncertainties, however, the basis for the various contingencies is not clearly presented. In addition, the IFR/EIS would benefit from more clarity regarding the long-term management of saltcedar tree growth within the project floodplain.

Of primary concern from a hydraulic engineering standpoint is that there may be inaccuracies in the computed 1% annual chance exceedance (ACE) flow, which may eliminate the need for the proposed project modifications or suggest that the modifications are insufficient to meet project goals. By

developing a synthetic dataset of streamflows based on gauged and locally sourced information, the accuracy of the 1% ACE flow could be recomputed and then compared with the 1% ACE flow used in the IFR/EIS. In addition, a standard calibration of the HEC-RAS model has not been conducted, which may over- or under-compute water levels and flow rates and not produce results comparable to real-world conditions. By calibrating the model to U.S. Geological Survey records, confidence could be provided in the model's ability to reproduce observed conditions.

From a geotechnical standpoint, the Panel does not understand how the cost estimates account for the increased project risk and cost contingences associated with the lack of geotechnical subsurface information. Additional information on how these contingencies were developed would improve Appendix E. Another geotechnical concern is that there is no compilation or synthesis of existing available geotechnical information into Appendix F with respect to the preferred alternative. The Appendix would benefit from a site plan that includes available subsurface data, a summary table that notes assumed geotechnical properties versus laboratory-derived properties or those resulting from in situ testing, and updated analyses reflective of the preferred alternative.

Finally, the IFR/EIS does not clearly describe how the control of invasive saltcedar trees would be incorporated into the operations and maintenance of the levees and channel. The addition of a more detailed discussion on how saltcedar control activities will be managed, including the frequency of such activities and how they will be budgeted, would improve the IFR/EIS.

Environmental: Overall, the environmental analysis covers the major issues and is done well. However, the potential for the occurrence of some special-status species in the project area is not addressed and the conclusion that these species would not be affected is unsupported. The IFR/EIS could be improved by including evidence for the conclusions that certain species are not expected to occur in the project area and evaluating impacts on all special-status species that occur in the project area, including upland species. In addition, the Panel noted that construction activity timing is not clearly described in the IFR/EIS, including descriptions of how environmental impacts during those times can be minimized.

Table ES-1. Overview of Nine Final Panel Comments Identified by the Little Colorado River at Winslow IEPR Panel

No.	Final Panel Comment
Significance – High	
1	The hydrologic analysis does not use all available streamflow and anecdotal data to verify the accuracy of the calculated 1% annual chance exceedance flood.
2	The modeled "baseline conditions" may not be capable of containing the 1% ACE flood because the models used are not calibrated to actual LCR flood events, low and high flow periods, or average flow conditions.
3	The IFR/EIS provides the costs of using three feet of freeboard, but does not consider the benefits that the height over the recommended plan would provide, which has implications for the project benefit-cost analysis.
Significance – Medium/High	
4	It is unclear how the identified "increased project risk and cost contingencies" associated with the lack of geotechnical subsurface information has been accounted for in Appendix E Cost Engineering.
Significance – Medium	
5	Geotechnical analyses of the preferred alternative have not been completed and incorporated into Appendix F.
6	It is not clear how the control of saltcedar trees will be part of the operations and maintenance of the levees and channel.
Significance – Medium/Low	
7	The potential for the occurrence of some special-status species in the project area is not described and little evidence is presented for the conclusion that project activity would not affect the species.
Significance – Low	
8	The timing of channel work activities and their concurrence with monsoon and dry seasons and their potential impact on flannel mouth sucker and other special-status fish species are not clearly described in the IFR/EIS.
9	The dates of floodplain inventory collection have not been identified, and it is not clear why these data are still representative of current conditions.

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Table of Contents

List of Tables

LIST OF ACRONYMS

ACE	annual chance exceedance
ADM	Agency Decision Milestone
ATR	Agency Technical Review
CEQA	California Environmental Quality Act
cfs	cubic feet per second
COI	Conflict of Interest
CWRB	Civil Works Review Board
DrChecks	Design Review and Checking System
EC	Engineer Circular
EM	Engineer Manual
ER	Engineer Regulation
HEC-FDA	Hydrologic Engineering Center's Flood Damage Reduction Analysis
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HEC-SSP	Hydrologic Engineering Center's Statistical Software Package
IEPR	Independent External Peer Review
IFR/EIS	Integrated Feasibility Report/Environmental Impact Statement
IWR	Institute for Water Resources
LCR	Little Colorado River
MCACES	Micro-Computer Aided Cost Estimating System
NDDOA	North Dakota Department of Agriculture
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
O&M	Operations and maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
PED	Preconstruction Engineering and Design
SAR	Safety Assurance Review
SGCN	Species of Greatest Conservation Need
SWPPP	Stormwater Pollution Prevention Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Survey
TSP	Tentatively Selected Plan

1. INTRODUCTION

Little Colorado River (LCR) at Winslow is a General Investigations study that was undertaken to evaluate structural and non-structural flood risk management measures to reduce the risk of flooding in the City of Winslow and vicinity. Removal of invasive species (tamarisk, saltcedar) was considered as part of larger plans provided they contributed to the primary objective of flood risk management. The study team did not formulate ecosystem restoration plans, and National Ecosystem Restoration (NER) benefits were not determined for the purpose of plan selection. The non-Federal sponsor for the study is the Navajo County Flood Control District, Navajo County, Arizona.

The overall LCR watershed encompasses an area of approximately 27,051 square miles in northeastern Arizona and northwestern New Mexico. Approximately 80 percent of the watershed is in Arizona and includes parts of Coconino, Navajo, and Apache Counties. The remaining 20 percent of the watershed is in New Mexico and includes parts of San Juan, McKinley, Cibola, and Catron Counties. The drainage basin of the LCR is approximately 245 miles long and 158 miles wide at its widest point. The mainstem of the LCR is entirely in Arizona, has a channel length of 356 miles, and total elevation drop of about 6,300 feet from its headwaters in the White Mountains to its confluence with the Colorado River. The LCR flows in generally a northwest direction and receives runoff from 18 sub-watershed basins and contributing drainage areas with hundreds of miles of small tributary streams. The LCR watershed is bound on the east by the Rio Grande Basin, on the south by the Gila River Basin, and on the north by the San Juan Basin.

The LCR at Winslow study area is located in and near the City of Winslow in western Navajo County Arizona. The study area encompasses the floodplain of the LCR from the vicinity of the Clear Creek confluence downstream (northwest) to the north end of the existing Winslow Levee system. The study area includes the majority of the City of Winslow, including the Ruby Wash Diversion Levee and the Ruby Wash Levee. The tributaries of Ruby Wash, Clear Creek, Cottonwood Wash, and Salt Creek join the LCR mainstem within the study area.

The City of Winslow is located along both Interstate Highway 40 and the Burlington Northern Santa Fe Railroad along the western border of Navajo County. Winslow is the largest city in Navajo County. The area is supported by tourism, manufacturing, trade, and retail. The 27,000 square mile Navajo Reservation and the 2,410 square mile Hopi Reservation are located to the north. Elsewhere, the surrounding land consists of a patchwork of private and State Trust lands.

As stated previously, the study's purpose was to investigate problems and opportunities and potential alternatives to provide flood risk management for the City of Winslow and vicinity. Potential flood risk management solutions included both structural and non-structural measures. Structural measures included levee rehabilitation, new levees, channel improvements to increase conveyance capacity, grade control structures, bank stabilization, and on-line or off-line detention facilities. Non-structural floodplain management measures included assisting communities with floodplain management and flood warning systems in areas where needed. In addition, floodproofing, buyout, relocation, and dry flood-proofing were considered.

Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analysis. The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management

Feasibility Study (hereinafter: Little Colorado River at Winslow IEPR) in accordance with procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE), Engineer Circular (EC) *Civil Works Review* (EC 1165-2-214) (USACE, 2012a) and the Office of Management and Budget (OMB), *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Supplemental guidance on evaluation for conflicts of interest (COIs) was obtained from the *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports* (The National Academies, 2003).

This final report presents the Final Panel Comments of the IEPR Panel (the Panel) on the existing engineering, economic, environmental, and plan formulation analyses contained in the Little Colorado River at Winslow review documents (Section 4). Appendix A describes in detail how the IEPR was planned and conducted, including the complete schedule followed in executing the IEPR. Appendix B provides biographical information on the IEPR panel members and describes the method Battelle followed to select them. Appendix C presents the final charge to the IEPR panel members for their use during the review; the final charge was submitted to USACE in the final Work Plan according to the schedule listed in Table 1. Appendix D presents the organizational conflict of interest form that Battelle completed and submitted to the Institute for Water Resources (IWR) prior to the award of the Little Colorado River at Winslow IEPR.

2. PURPOSE OF THE IEPR

To ensure that USACE documents are supported by the best scientific and technical information, USACE has implemented a peer review process that uses IEPR to complement the Agency Technical Review (ATR), as described in USACE (2012a).

In general, the purpose of peer review is to strengthen the quality and credibility of the USACE decision documents in support of its Civil Works program. IEPR provides an independent assessment of the engineering, economic, environmental, and plan formulation analyses of the project study. In particular, the IEPR addresses the technical soundness of the project study's assumptions, methods, analyses, and calculations and identifies the need for additional data or analyses to make a good decision regarding implementation of alternatives and recommendations.

In this case, the IEPR of the Little Colorado River at Winslow was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC 1165-2-214). Battelle, a 501(c)(3) organization under the U.S. Internal Revenue Code, has experience conducting IEPRs for USACE.

3. METHODS FOR CONDUCTING THE IEPR

The methods used to conduct the IEPR are briefly described in this section; a detailed description can be found in Appendix A. Table 1 presents the major milestones and deliverables of the Little Colorado River at Winslow IEPR. Due dates for milestones and deliverables are based on the award/effective date listed in Table 1. Note that the actions listed under Task 6 occur after the submission of this report. Battelle anticipates submitting the pdf printout of the USACE's Design Review and Checking System (DrChecks) project file (the final deliverable) on June 27, 2017. The actual date for contract end will depend on the date that all activities for this IEPR, including Civil Works Review Board (CWRB) preparation and participation, are conducted and subsequently completed.

Table 1. Major Milestones and Deliverables of the Little Colorado River at Winslow IEPR

Task	Action	Due Date
1	Award/Effective Date	7/13/2015
	Review documents and public comments available	1/20/2017
2	Battelle submits list of selected panel members	7/29/2015
	Battelle submits revised list of selected panel members with a replacement panel member[a]	1/27/2017
	USACE confirms the revised list of selected panel members has no COI	1/31/2017
3	Battelle convenes kick-off meeting with USACE	7/23/2015
	Battelle conducts updated kick-off meeting with USACE	2/14/2017
	Battelle convenes kick-off meeting with USACE and panel members	2/14/2017
4	Panel members complete their individual reviews	3/15/2017
	Battelle sends public comments to panel members for review	3/23/2017
	Panel members provide draft Final Panel Comments to Battelle	4/6/2017
5	Battelle submits Final IEPR Report to USACE	4/25/2017
6[b]	Battelle convenes Comment Response Teleconference with panel members and USACE	6/5/2017
	Battelle submits pdf printout of DrChecks project file to USACE	6/27/2017
	Agency Decision Milestone (ADM) meeting (estimated date)[c]	October 2017
	Civil Works Review Board (CWRB) Meeting (estimated date)[c]	May 2018
	Contract End/Delivery Date	7/31/2018

[a] *Due to the delay in review document availability, an original panel member was no longer available and had to be replaced.*

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

[c] *The ADM and CWRB meetings were listed in the Performance Work Statement under Task 3, but were relocated in this schedule to reflect the chronological order of activities.*

Battelle identified, screened, and selected five panel members to participate in the IEPR based on their expertise in the following disciplines: Civil Works planning/economics, biological resources and environmental law compliance, hydrology and hydraulic engineering, geotechnical engineering, and civil/cost engineering. The Panel reviewed the Little Colorado River at Winslow documents and produced nine Final Panel Comments in response to 22 charge questions provided by USACE for the review. This charge included two overview questions and one public comment question added by Battelle.

Battelle instructed the Panel to develop the Final Panel Comments using a standardized four-part structure:

1. Comment Statement (succinct summary statement of concern)
2. Basis for Comment (details regarding the concern)

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

Battelle reviewed all Final Panel Comments for accuracy, adherence to USACE guidance (EC 1165-2-214, Appendix D), and completeness prior to determining that they were final and suitable for inclusion in the Final IEPR Report. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Panel's findings are summarized in Section 4.1; the Final Panel Comments are presented in full in Section 4.2.

4. RESULTS OF THE IEPR

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

4.1 Summary of Final Panel Comments

The panel members agreed on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012a; p. D-4) in the Little Colorado River at Winslow review documents. Table ES-1 lists the Final Panel Comment statements by level of significance. The full text of the Final Panel Comments is presented in Section 4.2 of this report. The following summarizes the Panel's findings.

Based on the Panel's review, the IFR/EIS contains well-written and well-organized information on the engineering, environmental, economic, and plan formulation issues. The IFR/EIS provided a balanced assessment of the economic, engineering, and environmental issues of the overall project; however, the Panel identified several elements of the project where additional analysis are warranted and places where clarification of project findings and objectives need to be documented or revised.

Plan Formulation and Economics: From the plan formulation and economics perspectives, the IFR/EIS is well-assembled and well-written, representing a great deal of hard work, particularly for a project involving existing levee systems, which requires discipline in approach and execution. One particular concern, however, is that the total project and net project benefits may be affected by the addition of freeboard, which is not analyzed to determine if it improved expected project performance relative to the incremental costs of adding it. This issue could be addressed by, for example, providing an explanation in the IFR/EIS why the freeboard is justified in terms of overall performance versus expected costs. Of lesser concern, the Panel believes the IFR/EIS would benefit from identifying the dates of floodplain inventory and explaining why those inventory prices are still representative of current conditions.

Engineering: The engineering panel members commented that, with the extensive existing information available for the project area, the IFR/EIS does an excellent job of consolidating this information into the appendices. The hydraulic modeling efforts for baseline and future conditions have been developed according to industry standards, except that the models are uncalibrated. The geotechnical appendix presents a thorough compilation of available geological data, soil borings, and historic construction/repair details. The cost estimates are fairly thorough and include larger contingencies to cover project uncertainties, however, the basis for the various contingencies is not clearly presented. In addition, the

IFR/EIS would benefit from more clarity regarding the long-term management of saltcedar tree growth within the project floodplain.

Of primary concern from a hydraulic engineering standpoint is that there may be inaccuracies in the computed 1% annual chance exceedance (ACE) flow, which may eliminate the need for the proposed project modifications or suggest that the modifications are insufficient to meet project goals. By developing a synthetic dataset of streamflows based on gauged and locally sourced information, the accuracy of the 1% ACE flow could be recomputed and then compared with the 1% ACE flow used in the IFR/EIS. In addition, a standard calibration of the HEC-RAS model has not been conducted, which may over- or under-compute water levels and flow rates and not produce results comparable to real-world conditions. By calibrating the model to U.S. Geological Survey records, confidence could be provided in the model's ability to reproduce observed conditions.

From a geotechnical standpoint, the Panel does not understand how the cost estimates account for the increased project risk and cost contingences associated with the lack of geotechnical subsurface information. Additional information on how these contingencies were developed would improve Appendix E. Another geotechnical concern is that there is no compilation or synthesis of existing available geotechnical information into Appendix F with respect to the preferred alternative. The Appendix would benefit from a site plan that includes available subsurface data, a summary table that notes assumed geotechnical properties versus laboratory-derived properties or those resulting from in situ testing, and updated analyses reflective of the preferred alternative.

Finally, the IFR/EIS does not clearly describe how the control of invasive saltcedar trees would be incorporated into the operations and maintenance of the levees and channel. The addition of a more detailed discussion on how saltcedar control activities will be managed, including the frequency of such activities and how they will be budgeted, would improve the IFR/EIS.

Environmental: Overall, the environmental analysis covers the major issues and is done well. However, the potential for the occurrence of some special-status species in the project area is not addressed and the conclusion that these species would not be affected is unsupported. The IFR/EIS could be improved by including evidence for the conclusions that certain species are not expected to occur in the project area and evaluating impacts on all special-status species that occur in the project area, including upland species. In addition, the Panel noted that construction activity timing is not clearly described in the IFR/EIS, including descriptions of how environmental impacts during those times can be minimized.

4.2 Final Panel Comments

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

Final Panel Comment 1

The hydrologic analysis does not use all available streamflow and anecdotal data to verify the accuracy of the calculated 1% annual chance exceedance flood.

Basis for Comment

Appendix A Hydrology (including Climate Change) presents peak water-year streamflow data for the Little Colorado River (LCR) at Grand Falls and Holbrook. These data are found in the input files to the Hydrologic Engineering Center's Statistical Software Package (HEC-SSP) to compute the 1% annual chance exceedance (ACE) flood. However, this dataset is incomplete; there are many years for which data are not provided, ostensibly because gauged flow records are not available for these periods. For example, the data for the LCR at Holbrook (combined with data from nearby Joseph City) do not include peak flows for the years 1906-1922 and 1924-1949. Similarly, for the LCR at Grand Falls, data are missing for 1924-1925, 1961-1969, 1973-1989, and 1995-present. Data from these missing years could alter the computation of the 1% ACE event. Including even anecdotal data for these missing years (e g., documented accounts of observed flood events for which flows could be estimated) would likely alter the 1% ACE computation.

It is also of note that the data from which the 1% ACE flow was calculated for the LCR at Winslow excluded the estimated 70,000-75,000 cubic foot per second (cfs) flood flow event that occurred at Winslow on January 8, 1993. Neither the upstream gauge (Joseph City) nor the downstream gauge (Grand Falls) recorded flows greater than 9,000 cfs on this date. Inclusion of this large flow event in the 1% ACE flow calculation would certainly alter the computed flow. Neither the upstream nor the downstream gauges recorded large flows on or around January 8, 1993, although both gauges recorded the highest ever peak flows during a similar storm/runoff event on September 19, 1923. The general “agreement” of peak flows in 1923 suggests the LCR at that time conveyed flood flows downstream from the Winslow area. In contrast, the available flow data for January 8, 1993 do not suggest that a flood flow at Winslow was conveyed downstream to Grand Falls, or that it was even partially conveyed from upstream at Joseph City. This calls into question the validity of interpolating 1% ACE flows for the Winslow area based on computed 1% ACE flows for Joseph City and Grand Falls.

In addition, the HEC-SSP program identified the peak flows from September 19, 1923 as outliers that are significantly higher than all other annual peak flows within their respective datasets. If the accuracy of these flow measurements cannot be readily determined and verified, the outliers may have to be excluded. Excluding the outliers should reduce the computed 1% ACE flow, possibly to the extent that the current levee configuration could contain the flow without project modifications other than repairs (to avoid/minimizing risk of piping failures). A revised 1% ACE calculation could also reveal that the ACE calculation does not impact the proposed project modifications either. The impact of revising the 1% ACE flow cannot be known until the revision is complete.

Significance – High

Potential inaccuracies in the computed 1% ACE flow lead to uncertainties in the current levee configuration and may eliminate the need for the proposed project modifications, or may suggest that the proposed project modifications may not be sufficient to meet project goals.

Recommendation for Resolution

1. Explain why the January 8, 1993 high flow observed at the LCR at Winslow was not captured in upstream or downstream gauged flows, and therefore not used in calculating the 1% ACE flow for the Winslow location.
2. Demonstrate the impact of including the January 8, 1993 high flow observed at Winslow on the computed 1% ACE flow by inserting drainage-area adjusted flows into the Grand Falls and Holbrook/Joseph City datasets.
3. Create a synthetic dataset of streamflows for the LCR at Winslow, based on Winslow gauged data and locally sourced information.
    a. Develop regression/correlation equations between the LCR gauge at Winslow and the gauges upstream and downstream (including gauges at Carmen, Grand Falls, Joseph City, and Holbrook).
    b. Use gauged data at Winslow when possible, including the estimated flow on January 8, 1993. When gauged data at Winslow are not available, use values derived from the regression/correlation equations. For periods during which no data are available, use available literature or locally sourced anecdotes to approximate flows.
4. Re-compute the 1% ACE flow using the synthetic dataset.
5. Revise Appendices A and B as needed to include a re-assessment of the 1% ACE flood and associated floodplain.
    a. Re-assess the number of structures within the 1% ACE floodplain for which Federal Emergency Management Agency flood insurance would be required.

Final Panel Comment 2

The modeled "baseline conditions" may not be capable of containing the 1% ACE flood because the models used are not calibrated to actual LCR flood events, low and high flow periods, or average flow conditions.

Basis for Comment

According to Appendix B, Section 5.3.7 (p. 19), the Hydrologic Engineering Center's River Analysis System (HEC-RAS) model used to simulate baseline/with-project conditions was calibrated by adjusting Manning's n-values, but observed water surface elevation data were not available. Standard methods for calibrating HEC-RAS models include comparing observed and modeled water surface elevations during a range of flows: low, average, and high. This type of standard calibration was not performed for the HEC-RAS model for this project, limiting confidence in the model results. Similarly, the Flow-2D model of the LCR floodplain was never calibrated by comparing modeled and observed water levels for specific flow events.

Appendix B (p. 19) states that the January 8, 1993 Winslow flood event modeled and observed floodplains were compared as a qualitative means of establishing model credibility. However, qualitative comparison is not a sufficiently rigorous method for establishing the ability of a model to reproduce observed conditions.

Uncalibrated models may (or may not) have inherent tendencies to over- or under-compute observed water levels and flow rates, potentially by a large degree. Only with calibrated models can confidence in the model results be satisfactorily obtained.

Significance – High

Uncalibrated models do not necessarily yield results comparable to real-world conditions, and therefore should not be used in designing flood mitigation alternatives or in assessing the adequacy of existing flood mitigation infrastructure.

Recommendation for Resolution

1. Calibrate the baseline HEC-RAS model against measured flow and water surface elevation pairs collected by the U.S. Geological Survey (USGS) when they perform rating-curve measurements at the LCR at Winslow gauge. Based on USGS records, they have flow and stage measurements over a range of flow levels, from 10 cfs to 18,600 cfs (from 12/30/2004). Even though these potential calibration flows are all below the computed 1% ACE flow, matching observed and computed water levels over this low flow range would provide confidence in the model's ability to reproduce observed conditions.
2. As part of re-calibration efforts, consider the use of standard goodness-of-fit statistics (e.g., coefficient of determination, nash-sutcliffe efficiency) to gauge degree of model calibration.

Final Panel Comment 3

The IFR/EIS provides the costs of using three feet of freeboard, but does not consider the benefits that the height over the recommended plan would provide, which has implications for the project benefit-cost analysis.

Basis for Comment

Adding freeboard to a proposed levee system is likely to provide protection above the target level of conveyance, in this case, the 100-year storm event. The purpose of adding freeboard is to reduce or eliminate residual risk, which in turn provides protection over and above the 100-year storm. However, the IFR/EIS does not analyze this increased protection.

Current USACE policy and existing technical approaches to evaluating levee performance do not allow for the use of freeboard to eliminate residual risk or improve a levee system's ability to withstand a given flood event. The freeboard is not being added to improve expected performance relative to the incremental costs of adding it.

Engineer Regulation (ER) 1105-2-100, 3-3,(2)(b) (USACE 2000) states:

> "Projects are analyzed and described in terms of their expected performance, not in terms of levels of protection. Contingencies are acknowledged and residual risk is not routinely reduced by overbuilding or by inclusions of freeboard. The regulation identifies key variables that must be explicitly incorporated into the risk-based analysis. At a minimum, the stage damage function for economic studies (with special emphasis on first floor elevation, and content and structure values for urban studies), discharge associated with exceedance frequency for hydrologic studies, and conveyance roughness and cross-section geometry for hydraulic studies must be incorporated in the risk-based analysis. ER 1105-2-101 further requires a probabilistic display of benefits and eliminates freeboard to account for hydraulic uncertainty."

Appendix E of ER 1105-2-100, Section E-18 (p. E-87) repeats the policy above with more details on how a levee system is to be analyzed and how deviations from the National Economic Development (NED) plan are to be documented. Section E-18 explicitly discourages use of freeboard as "unaffordable." Engineer Manual (EM) 1110-2-1619 (USACE 1996) goes into even greater detail as to why the addition of arbitrary additional factors such as freeboard do not reduce uncertainty in performance.

From an economics and plan formulation perspective, adding additional height to a proposed levee system without including benefits attributable to the increased height affects total project and net project benefits. It is possible that the additional 3 feet of freeboard proposed in the IFR/EIS, which is intended to improve the likelihood that the recommended plan conveys the 100-year event, provides measurable protection against less frequent events, such as the 250- and 500-year events. Technical practice calls for this additional protection to be estimated and included in the risk-based performance evaluation described in the guidance.

Adding freeboard also has cost-sharing implications. An NED levee that includes features unnecessary for recommendation as the NED plan is considered a deviation that should be a non-Federal expense.

Significance – High
The freeboard as described in the IFR/EIS and its appendices has a very high likelihood of having cost implications in the benefit-cost analysis, yet the IFR/EIS provides no analysis to demonstrate that it serves to reduce uncertainty or that it is necessary from a cost perspective.
Recommendation for Resolution
1. Integrate more of the guidance recommended in ER 1105-2-100, ER 1105-2-101 and EM 1110-2-1619 to substantiate the use of freeboard. 2. Explain why 3 feet of freeboard is justified in terms of overall performance. 3. Provide documentation of the analyses used to demonstrate performance with and without freeboard of varying heights. 4. Analyze the additional height in terms of expected benefits vs. expected costs, add it as a non-Federal expense, or remove it as a feature altogether. 5. Include any additional protection provided by the freeboard in the benefit analysis. 6. Show the costs of freeboard as a non-Federal expense if the freeboard is unnecessary for the recommended plan.

Literature Cited:

USACE (2006). Planning: Risk-Based Analysis for Flood Damage Reduction Studies. ER 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 6.

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

USACE (1996). Engineering and Design: Risk-Based Analysis for Flood Damage Reduction Studies. EM 1110-2-1619. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. August 1.

Final Panel Comment 4

It is unclear how the identified "increased project risk and cost contingencies" associated with the lack of geotechnical subsurface information has been accounted for in Appendix E Cost Engineering.

Basis for Comment

Appendix F, Geotechnical, states (p. 27):

> "It should be reiterated that, except for the seismic refraction and limited boring from the as-built plans and bridge plans, there is very little geotechnical information currently available for the subsurface. As part of the accelerated "SMART Planning" directive, subsurface investigations have been delayed to future phases of the project. As a result, the study will carry increased project risk and cost contingencies going forward, until such investigation is performed."

Appendix E presents contingencies in the Preliminary Feasibility Cost Estimate – Draft table (p. 50), where the same 36.61% contingency is given for three different categories: "Preconstruction Engineering and Design (PED) – 15%," "Levees & Floodwalls," and "Construction Management (S&A) – 6.7%." Other elements, such as Relocations – Utilities, have a larger contingency of 40.86%. Note 6 to the above table states, "PED was developed from judgment and experience." Additional information has not been provided on how these contingencies were developed and whether they relate to the lack of geotechnical subsurface information, or what factors went into their calculation.

Significance – Medium/High

The overall project cost may be underestimated because the uncertainty associated with the incomplete geotechnical characterization has been underestimated in Appendix E.

Recommendation for Resolution

1. Clarify and confirm how the contingencies associated with the elevated geotechnical uncertainty in Appendix E were developed.

Final Panel Comment 5

Geotechnical analyses of the preferred alternative have not been completed and incorporated into Appendix F.

Basis for Comment

As noted in the IFR/EIS, the SMART Planning process has precluded completion of basic site characterization activities and subsequent analyses of the geotechnical engineering aspects of the project. Appendix F Geotechnical Appendix states (p. 56):

> "Additional subsurface exploration should be conducted during the design phase to the level of detail necessary to perform design, minimize unnecessary assumptions, and to conform with the general requirements of EM1110-2-1913. Geotechnical data is currently one, if not the greatest data gap on the project; therefore, a significant investigation effort should be anticipated moving forward. It is recommended that future investigation include detailed investigation of both the levee foundation and the existing levee (if necessary). It is expected that the scope of the investigation would generally include borings, test trenches/pits, index testing on bulk samples, strength, and permeability testing of both in-situ and remolded, as well as field testing for permeability. Cone Penetration Testing (CPT) may also be a useful method for determining foundation properties and defining the foundation stratigraphy."

Appendix F further states (p. 27): "… As part of the accelerated "SMART Planning" directive, subsurface investigations have been delayed to future phases of the project."

While subsurface investigations have been delayed to future phases of the project, there are opportunities to compile and synthesize existing information and update past analyses to reflect the configuration of the identified preferred alternative. For example:

- Appendix F discusses numerous previous geotechnical subsurface campaigns (i.e., ADWR 1980; Dames & Moore 1980; Western Technologies 1982, 1993; Kleinfelder West 2009; Advanced Geoscience 2013), however, there is no integrated figure showing the preferred alternative with an overlay of available subsurface information.
- No formal documented geotechnical analyses for the preferred alternative are presented. Past analyses, such as USACE 2012b, note the lack of site-specific data and use assumed values. For example (USACE 2012b, p. 15):

  > "Engineering test data in the area of RWDL 495 was sparse; therefore a wide uncertainty was used to incorporate a wider possible range of performance. The engineering properties selected are supported by literature and consistent with explorations of the levee outside of the RWDL 495 area."

  Also (USACE 2012b, p. 27):

  > "Winslow Station 51500 has four relevant conditions: a bentonite seepage cutoff, a sand levee fill, a clay blanket, and foundation sands. These layers are taken from geotechnical exploration stick logs from a 1990s Dames and Moore exploration and shown on the as-built plans. Engineering lab tests were not available at Winslow Station 51500, so literature was used to support the parameters shown in Table 7."

  Analyses informing a constructed work should be based on site-specific data/studies.

- Seepage, slope stability, and erosion analyses performed by USACE (2012b) evaluated levees with a cutoff wall. Because this project envisions using a toe drain, the model analyses from 2011 and 2012 could be re-analyzed to ascertain performance associated with the preferred alternative.

Significance – Medium

The lack of both geotechnical information for the preferred alternative and updated geotechnical analyses for the preferred alternative prevents a full evaluation of the geotechnical methods, models, assumptions, and analyses.

Recommendation for Resolution

1. Prepare a site plan that presents the preferred alternative alignment along with all available subsurface data (for example, similar to Plates 3-8 in the 2009 Kleinfelder report (PDF pp. 481-486).
2. Provide a summary table in Appendix F of the soil units and associated engineering properties, noting which properties are assumed and which are based on site-specific geotechnical laboratory and/or in situ testing.
3. Re-analyze seepage, slope stability, and erosion to reflect the configuration of the preferred alternative and present in Appendix F.

Literature Cited:

USACE (2012b). Geotechnical Evaluation of Levee Fragility: Winslow Levee and Ruby Wash Diversion Levee, LCR at Winslow Feasibility Study, Winslow, AZ. U.S. Army Corps of Engineers, Geotechnical Branches in Los Angeles District and San Francisco District. May 23.

Final Panel Comment 6

It is not clear how the control of saltcedar trees will be part of the operations and maintenance of the levees and channel.

Basis for Comment

One of the components of the tentatively selected plan (TSP) is the removal of dense vegetation within the current channel limits in the vicinity of the BNSF railroad bridge. The vegetation, which includes fast-growing saltcedar/Tamarisk (*Tamarix*), reduces the conveyance in the channel leading to higher Manning n values. The dense vegetation may also produce sedimentation in the same areas. The combination of higher Manning n values and sediment deposition results in higher flooding potential in the study area.

Saltcedar is an invasive species introduced to the United States in the 1800s and has now spread across the Western United States (USDA 2017). In the study area, it grows in dense patches and will have to be removed. According to the North Dakota Department of Agriculture (NDDOA 2003), a mature tree can develop roots to a depth of 50 feet. Saltcedar is also difficult and expensive to remove and generally returns unless completely killed with chemical applications followed by manual tree removal. If it is simply mowed in place, it is likely to return and possibly grow even more quickly (Sudbrock 1993). Small, established seedlings can grow up to a foot per month in early spring (Sudbrock 1993). A possible secondary problem is that a mature tree can also transpire up to 200 gallons of water per day, possibly affecting area wildlife.

Operations and maintenance (O&M) of the levees and channel will be influenced by saltcedar control activities. It is therefore critical that saltcedar be continually controlled by a designated entity, such as the local sponsor, otherwise, the flood mitigation benefits of the proposed project will degrade over time. Section ES-44 part (i) of the IFR/EIS indicates that the local sponsor has responsibility for all O&M activities for the project. However, there is limited evidence provided in the IFR/EIS that effective saltcedar control has occurred over time as part of the existing flood mitigation project. Thus, there appears to be a moderate risk that saltcedar control will not be a priority for the new project either.

Currently, Section ES-44 part (e) of the IFR/EIS requires the local sponsor to prepare a Flood Plain Management Plan within one year of signing a Project Cooperation Agreement. The Panel assumes that saltcedar control will be an important component of the plan. However, the current IFR/EIS could benefit from the inclusion of further discussion on the saltcedar control strategy. In addition, the cost implications of the saltcedar control strategy should be reviewed as a more detailed control strategy is developed.

Significance – Medium

The future success of the project is dependent upon controlling saltcedar regrowth, which can contribute to future flooding, and some risk exists that required saltcedar control will not occur as needed.

Recommendation for Resolution

1. Provide a more detailed discussion for the control of saltcedar in the levees and channels critical to project function in the IFR/EIS.
2. As part of the additional narrative added to the IFR/EIS, provide further details regarding the O&M frequency necessary for saltcedar control activities in order to maintain the projected TSP flood mitigation benefits.

3. Revise the O&M costs as required to ensure that sufficient saltcedar control is accounted for in the budget.

Literature Cited:

NDDOA (2003). Saltcedar: A New Threat to North Dakota's Rivers, Streams and Wildlife. North Dakota Department of Agriculture (NDDOA) Noxious Weeds Section. Available online at: http://www.co.morton.nd.us/vertical/sites/%7B90CBB59C-38EA-4D41-861A-81C9DEBD6022%7D/uploads/%7B49DC44A8-ACC7-4906-823E-C51C24413867%7D.PDF

Sudbrock, A. (1993). Tamarisk Control. I. Fighting Back: An overview of the invasion, and a low-impact way of fighting it. Restoration and Management Notes 11: 31-34.

USDA (2017). Species Profile – Saltcedar. U.S. Department of Agriculture, National Agricultural Library, National Invasive Species Information Center. Available online at: https://www.invasivespeciesinfo.gov/plants/saltcedar.shtml

Final Panel Comment 7

The potential for the occurrence of some special-status species in the project area is not described and little evidence is presented for the conclusion that project activity would not affect the species.

Basis for Comment

Section 4.5.3, Affected Environment for Wildlife, states that an estimated 59 Species of Greatest Conservation Need (SGCN) may occur within the Colorado Plateau ecoregion (p. 4-14), but provides little or no explanation as to why they are not likely to occur within the project area. Specifically:

- Section ES 14 (p. 4-14) states that several SGCN fish species (e.g., bluehead sucker, Zuni bluehead sucker, Little Colorado River spinedace) are not likely to inhabit the project area, but, to support this conclusion, refers only to an informal survey conducted in 2014. However, no details are provided about the survey methods, including level of effort or replication. These species are known to occur elsewhere in the LCR and presumably could move into the project area.
- Section ES 15 (p. 4-14) states that no species-specific surveys were conducted, and "although many amphibian and reptile species were predicted to occur in the area by HabiMap, they were not observed during the site visit." Informal surveys may not be reliable methods for accurately assessing whether sensitive amphibians and reptiles are likely to occur in a project area.
- Section ES 16 (p. 4-15) states that an active bird community exists within the riparian vegetation located adjacent to the LCR and lists some examples, some of which are SGCN or Federally protected (e.g., American peregrine falcon, common nighthawk, ferruginous hawk, golden eagle, northern goshawk, sage thrasher, Swainson's thrush, western burrowing owl, yellow warbler, and yellow-breasted chat). However, these species are not discussed further and no impact evaluation is presented. Also, the consideration of sensitive bird species in the project area (e.g., southwestern willow flycatcher, yellow-billed cuckoo) focuses only on the riparian-associated species and may overlook SGCN that could occur in uplands (e.g., burrowing owl in the borrow and disposal areas or staging, stockpiling, and access sites).
- Section ES 17 (p. 4-15) lists mammals that are known to occur within or near the project area. All the mammals listed are considered SGCN, except the big free-tailed bat (*Nyctinomops macrotis*), but they are not discussed further in the IFR/EIS and no evaluation of impacts is provided.
- No information is provided about the potential for special-status plant species to occur within the project area, beyond the description of vegetation types.

Appendix I includes a list of special-status species in Navajo County, Arizona (PDF p. 5). Some of the species are Federally protected and some are considered SGCN by the State of Arizona. Some of the species included in Appendix I are not discussed in the Environmental Setting or Environmental Consequences sections of the report (e.g., California condor, Mexican spotted owl, Gila trout, Navajo sedge, Peebles Navajo cactus, Welsh's milkweed, black-foot ferret, gray wolf, Mexican gray wolf, New Mexico meadow jumping mouse, northern Mexican gartersnake). The potential of these species to occur in the project area is not discussed and the report does not address whether the project would affect these species.

The assumption in the Environmental Consequences section that wildlife species are mobile and would move out of the construction area (see, for example, p. 5-50) does not consider if breeding sites for the sensitive species are present within the project area and the possible impacts of construction on young or eggs that cannot move out of the area, or if adults refuse to abandon breeding sites or young.

Significance – Medium/Low

The missing information about potential occurrence of special-status species in the project area could result in undisclosed adverse effects on special-status species, notably SGCN.

Recommendation for Resolution

1. Clarify or describe the potential for all SGCN and Federally listed species to occur within the project area.
2. Provide evidence to support a conclusion that the species is not likely to occur in the project area.
3. Evaluate impacts on all special-status species that may occur in the project area, including upland species that could occur in the borrow and disposal areas or staging, stockpiling, or access sites.

Final Panel Comment 8

The timing of channel work activities and their concurrence with monsoon and dry seasons and their potential impact on flannel mouth sucker and other special-status fish species are not clearly described in the IFR/EIS.

Basis for Comment

The IFR/EIS describes channel work as occurring during the dry season and outside the monsoon season when minimal flows would be present in the Little Colorado River (e.g., p. 5-28 and other places). However, the definition of the dry season is not clear. The Affected Environment section for water quality states (p. 4-8) that the winter-spring snowmelt season is November 1- May 31 and the summer-fall monsoon season is June 1 to October 31. These seasons span the entire calendar year. The IFR/EIS does not provide a definition of the dry season or quantify a low flow condition, when channel work would occur. If channel work occurs during rain events or when river flows are present in the work area, erosion of soils or release of contaminants into the river may occur. Water in the work area could result in increased turbidity from erosion, mobilized contaminants, or otherwise negatively affect water quality, which could adversely affect flannel mouth sucker and other special status fish species.

Significance – Low

Because definitions of dry and low flow condition are not provided in the IFR/EIS, it is not clear when the channel work would occur and therefore, the feasibility of minimizing impacts on water quality and flannel mouth sucker and other special-status fish species is difficult to ascertain.

Recommendation for Resolution

1. Provide definitions of dry season, low flow, or minimal flow condition in the IFR/EIS.
2. Explain timing of channel work and the feasibility of completing channel work when minimal flows are present or during the dry season.
3. If not feasible to complete channel work when minimal flows are present or during the dry season, describe measures to avoid adverse impacts on water quality and special-status fish species, including flannel mouth sucker.

Final Panel Comment 9

The dates of floodplain inventory collection have not been identified, and it is not clear why these data are still representative of current conditions.

Basis for Comment

Policy and sound planning practice call for using a reasonably current assessment of floodplain inventory. The Planning Guidance Notebook (USACE 2000) calls for a floodplain inventory to be no older than three fiscal years prior to the development of the flood risk reduction planning report's price and development level. The IFR/EIS does not provide information on when the floodplain inventory was collected. If the inventory was older than three years in fiscal year 2014, the inventory should be reevaluated rather than updated using price level indices.

Significance – Low

While this matter is unlikely to change the recommended plan or affect the ranking of alternatives, the provided floodplain inventory prices may not be accurate or representative of current conditions, affecting the technical completeness and understanding of the IFR/EIS.

Recommendation for Resolution

1. State the year in which floodplain data were collected.
2. Ensure that the data used in the 2014 report are no more than three years old.
3. If the data are over three years old, reevaluate floodplain conditions and update price levels.

Literature Cited:

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

5. REFERENCES

NDDOA (2003). Saltcedar: A New Threat to North Dakota's Rivers, Streams and Wildlife. North Dakota Department of Agriculture (NDDOA) Noxious Weeds Section. Available online at: http://www.co.morton.nd.us/vertical/sites/%7B90CBB59C-38EA-4D41-861A-81C9DEBD6022%7D/uploads/%7B49DC44A8-ACC7-4906-823E-C51C24413867%7D.PDF

OMB (2004). Final Information Quality Bulletin for Peer Review. Executive Office of the President, Office of Management and Budget, Washington, D.C. Memorandum M-05-03. December 16.

Sudbrock, A. (1993). Tamarisk Control. I. Fighting Back: An overview of the invasion, and a low-impact way of fighting it. Restoration and Management Notes 11: 31-34.

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

USACE (2012b). Geotechnical Evaluation of Levee Fragility: Winslow Levee and Ruby Wash Diversion Levee, LCR at Winslow Feasibility Study, Winslow, AZ. U.S. Army Corps of Engineers, Geotechnical Branches in Los Angeles District and San Francisco District. May 23.

USACE (2006). Planning: Risk-Based Analysis for Flood Damage Reduction Studies. Engineer Regulation (ER) 1105-2-101. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. January 6.

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

USACE (1996). Engineering and Design: Risk-Based Analysis for Flood Damage Reduction Studies. Engineer Manual (EM) 1110-2-1619. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. August 1.

USDA (2017). Species Profile – Saltcedar. U.S. Department of Agriculture, National Agricultural Library, National Invasive Species Information Center. Available online at: https://www.invasivespeciesinfo.gov/plants/saltcedar.shtml

APPENDIX A

IEPR Process for the Little Colorado River at Winslow Project

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

Table A-1 presents the schedule followed in executing the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study Independent External Peer Review (hereinafter: Little Colorado River at Winslow IEPR). Due dates for milestones and deliverables are based on the award/effective date listed in Table A-1. The review documents were provided by U.S. Army Corps of Engineers (USACE) on January 20, 2017 approximately 18 months after the award/effective date. Note that the actions listed under Task 6 occur after the submission of this report and are described in more detail at the end of this Appendix.

Table A-1. Little Colorado River at Winslow Complete IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	7/13/2015
	Review documents available	1/20/2017
	Public comments available	1/20/2017
	Battelle submits draft Work Plan[a]	7/22/2015
	Battelle submits revised draft Work Plan[a]	6/21/2016
	Battelle submits final Work Plan[a]	3/2/2017
2	Battelle requests input from USACE on the conflict of interest (COI) questionnaire	7/15/2015
	USACE provides comments on COI questionnaire	7/17/2015
	Battelle submits list of selected panel members[a]	7/29/2015
	USACE confirms the panel members have no COI	7/29/2015
	Battelle completes subcontracts for panel members	8/7/2015
	Battelle submits revised list of selected panel members with a replacement panel member[a]	1/27/2017
	USACE confirms the revised list of selected panel members has no COI	1/31/2017
	Battelle completes subcontract for replacement panel member and extends the subcontracts for other panel members	2/7/2017
	Subcontractors complete mandatory Operations Security (OPSEC) training	3/9/2017
3	Battelle convenes kick-off meeting with USACE	7/23/2015
	Battelle conducts updated kick-off meeting with USACE	2/14/2017
	Battelle sends review documents to panel members	2/14/2017
	Battelle convenes kick-off meeting with panel members	2/14/2017
	Battelle convenes kick-off meeting with USACE and panel members	2/14/2017
	Battelle convenes mid-review teleconference with USACE and panel members	Not held

Table A-1. Little Colorado River at Winslow Complete IEPR Schedule (continued)

Task	Action	Due Date
4	Panel members complete their individual reviews	3/15/2017
	Battelle provides talking points for Panel Review Teleconference to panel members	3/28/2017
	Battelle convenes Panel Review Teleconference	3/29/2017
	Battelle provides Final Panel Comment templates and instructions to panel members	3/30/2017
	Panel members provide draft Final Panel Comments to Battelle	4/6/2017
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	4/07/2017 - 4/16/2017
	Panel finalizes Final Panel Comments	4/17/2017
	Battelle receives public comments from USACE	1/20/2017
	Battelle sends public comments to Panel for review	3/23/2017
	Panel members complete their review of public comments	3/29/2017
	Battelle and Panel review Panel's responses to public comments	3/30/2017
	Panel drafts Final Panel Comment, if necessary	3/31/2017
	Panel finalizes Final Panel Comment regarding public comments	4/4/2017
5	Battelle provides Final IEPR Report to panel members for review	4/19/2017
	Panel members provide comments on Final IEPR Report	4/21/2017
	Battelle submits Final IEPR Report to USACE[a]	4/25/2017
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance	5/2/2017
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	5/3/2017
	Battelle convenes teleconference with USACE to review the Comment Response process	5/3/2017
	Battelle convenes teleconference with Panel to review the Comment Response process	5/3/2017
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	5/24/2017
	Battelle provides draft PDT Evaluator Responses to panel members	5/26/2017
	Panel members provide draft BackCheck Responses to Battelle	6/1/2017
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	6/2/2017
	Battelle convenes Comment Response Teleconference with panel members and USACE	6/5/2017
	USACE inputs final PDT Evaluator Responses to DrChecks	6/12/2017
	Battelle provides final PDT Evaluator Responses to panel members	6/14/2017
	Panel members provide final BackCheck Responses to Battelle	6/19/2017

Table A-1. Little Colorado River at Winslow Complete IEPR Schedule (continued)

Task	Action	Due Date
	Battelle inputs the Panel's final BackCheck Responses in DrChecks	6/26/2017
	Battelle submits pdf printout of DrChecks project file[a]	6/27/2017
	Agency Decision Milestone (ADM) meeting (estimated date)[c]	October 2017
	Civil Works Review Board (CWRB) meeting (estimated date)[c]	May 2018
	Contract End/Delivery Date	7/31/2018

[a] *Deliverable.*

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

[c] *The ADM and CWRB meetings were listed in the Performance Work Statement under Task 3 but were relocated in this schedule to reflect the chronological order of activities.*

At the beginning of the period of performance for the Little Colorado River at Winslow IEPR, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., terminology to use, access to DrChecks, etc.). Any revisions to the schedule were submitted as part of the final Work Plan. The final charge consisted of 22 charge questions provided by USACE, two overview questions and one public comment question added by Battelle (all questions were included in the draft and final Work Plans), and general guidance for the Panel on the conduct of the peer review (provided in Appendix C of this final report).

Prior to beginning their review and after their subcontracts were finalized, all the members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge, as well as the review documents and reference/supplemental materials listed in Table A-2 below.

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

Review Documents	No. of Review Pages
Integrated Feasibility Report/Environmental Impact Statement	380
Appendix A Hydrology	554
Appendix B Hydraulics	353
Appendix C Economics	77
Appendix D Design	42
Appendix E Cost Engineering	54
Appendix F Geotechnical (including Appendices A and B)	182
Appendix G HTRW	41

Review Documents	No. of Review Pages
Appendix H Real Estate	54
Appendix I Environmental	89
Appendix J Clean Water Act 404(b)(1) Evaluation	53
Public Comments[a]	34
Total # of pages *to be reviewed*	**1,913**
Reference/Supplemental Information	
Appendix F Geotechnical (Attachments 1-7 to Appendix B)	691
Risk Register	13
Decision Management Plan (Decision Log)	6
Total # of pages *for information only*	**710**

[a] *USACE submitted public comments to Battelle according to the schedule in Table A-1, who in turn submitted the comments to the IEPR Panel for review.*

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

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

The Panel did not have any clarifying questions for USACE during the course of their review. Therefore, Battelle and the PCX determined that a mid-review teleconference was not necessary with USACE.

A.2 Review of Individual Comments

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

A.3 IEPR Panel Teleconference

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

Comment with the Panel, including the associated level of significance, and confirmed the lead author for each comment.

A.4 Preparation of Final Panel Comments

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

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

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

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

    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)
    3. Significance (high, medium/high, medium, medium/low, and low; see description below)
    4. Recommendation(s) for Resolution (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:

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

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

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

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

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

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

Battelle reviewed and edited the Final Panel Comments for clarity, consistency with the comment statement, and adherence to guidance on the Panel's overall charge, which included ensuring that there were no comments regarding either the appropriateness of the selected alternative or USACE policy. At the end of this process, nine Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The full text of the Final Panel Comments is presented in Section 4.2 of the main report.

A.5 Conduct of the Public Comment Review

Following the schedule in Table A-1, Battelle received 19 PDF files (six emailed comments, four comment cards, seven letters, one voicemail comment, and one public summary) totaling approximately 34 pages of comments from USACE. Battelle sent the public comments to the panel members in addition to the following charge question:

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

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

A.6 Final IEPR Report

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

A.7 Comment Response Process

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

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APPENDIX B

Identification and Selection of IEPR Panel Members for the Little Colorado River at Winslow Project

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B.1 Panel Identification

The candidates for the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study (hereinafter: Little Colorado River at Winslow IEPR) Panel were evaluated based on their technical expertise in the following key areas: Civil Works planning/economics, biological resources and environmental law compliance, hydrology and hydraulic engineering, geotechnical engineering, and civil/cost engineering. These areas correspond to the technical content of the review documents and overall scope of the Little Colorado River at Winslow project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle evaluated these candidate panel members in terms of their technical expertise and potential conflicts of interest (COIs). Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected five experts for the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

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

> "…when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

1. Previous and/or current involvement by you or your firm[1] in the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
2. Previous and/or current involvement by you or your firm[1] in flood risk management studies in the Little Colorado River Watershed region located in northeast Arizona and western New Mexico.
3. Previous and/or current involvement by you or your firm[1] in projects related to the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.

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

4. Previous and/or current involvement by you or your firm[1] in the conceptual or actual design, construction, or operation and maintenance (O&M) of any projects related to the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
5. Current employment by the U.S. Army Corps of Engineers (USACE).
6. Previous and/or current involvement with paid or unpaid expert testimony related to Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
7. Previous and/or current employment or affiliation with members of the cooperating agencies, local sponsors, stakeholders or any of the following cooperating Federal, State, County, local and regional agencies, environmental organizations, and interested groups (for pay or pro bono) including the Navajo County Flood Control District, U.S. Fish and Wildlife Service, and/or Arizona Game and Fish Department.
8. Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, children or relations associated with the Little Colorado River Watershed region located in northeast Arizona and western New Mexico.
9. Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, ERDC, etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Los Angeles District.
10. Previous or current involvement with the development or testing of models that will be used for, or in support of the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study, including HEC-FDA, HEC-RAS, FLO-2D, HEC-FFA, Seep/W, Slope/W, IWR-Planning Suite, RECONS, and/or MCACES or MII.
11. Current firm[1] involvement with other USACE projects, specifically those projects/contracts that are with the Los Angeles 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 Los Angeles District. Please explain.
12. Any previous employment by USACE as a direct employee, notably if employment was with the Los Angeles District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
13. Any previous employment by USACE as a contractor (either as an individual or through your firm[1]) within the last 10 years, notably if those projects/contracts are with the Los Angeles District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
14. Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning water supply/water rights-related studies and include the client/agency and duration of review (approximate dates).
15. Pending, current, or future financial interests in USACE contracts or awards related to Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
16. A significant portion (i.e., greater than 50%) of personal or firm[1] revenues within the last 3 years came from USACE contracts.

17. A significant portion (i.e., greater than 50%) of personal or firm[1] revenues within the last 3 years from contracts with the Navajo County Flood Control District.
18. Any publicly documented statement (including, for example, advocating for or discouraging against) related to Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
19. Participation in relevant prior and/or current Federal studies relevant to the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
20. Previous and/or current participation in prior non-Federal studies relevant to this project, this area of the country, and/or Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study.
21. Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project?

Providing a positive response to a COI screening question did not automatically preclude a candidate from serving on the Panel. For example, participation in previous USACE technical peer review committees and other technical review panel experience was included as a COI screening question. A positive response to this question could be considered a benefit.

B.2 Panel Selection

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. Table B-1 provides information on each panel member's affiliation, location, education, and overall years of experience. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. Because there was a delay in the availability in the review documents, one panel member, who was originally proposed on the IEPR Panel, was no longer available. Battelle submitted a revised list of selected panel members with the replacement panel member. USACE was given the list of candidate panel members, but Battelle selected the final Panel.

Table B-1. Little Colorado River at Winslow IEPR Panel: Summary of Panel Members

Name	Affiliation	Location	Education	P.E.	Exp (yrs)
Civil Works Planning/Economics					
David Luckie	Independent consultant	Mobile, AL	B.S., Economics and Finance	N/A	28
Biological Resources and Environmental Law Compliance					
Linda Leeman	Ascent Environmental, Inc.	Sacramento, CA	M.S., Natural Resources, Wildlife	N/A	19
Hydrology and Hydraulic Engineering					
Jordan Furnans	LRE Water, LLC	Round Rock, TX	Ph.D., Civil Engineering	Yes	17
Geotechnical Engineering					
Rune Storesund	Independent consultant	Kensington, CA	D.Eng., Civil Systems Engineering	Yes	16
Civil/Cost Engineering					
Chris Brown	Independent consultant	Jacksonville, FL	Ph.D., Civil Engineering/Hydrology	Yes	25

Table B-2 presents an overview of the credentials of the five members of the Panel and their qualifications in relation to the technical evaluation criteria. More detailed biographical information regarding each panel member and his or her area of technical expertise is given in Section B.3.

Table B-2. Little Colorado River at Winslow IEPR Panel: Technical Criteria and Areas of Expertise

Technical Criterion	Luckie	Leeman	Furnans	Storesund	Brown
Civil Works Planning/Economics					
Minimum of 15 years of demonstrated experience in economics	X				
Minimum of 15 years of expertise in flood risk management analysis and benefit calculations, including some experience evaluating both structural and nonstructural measures.	X				
Direct experience working for or with USACE	X				
Very familiar with USACE plan formulation process, procedures, and standards as it relates to flood risk management.	X				
A minimum of five years of experience directly dealing with the USACE six-step planning process, which is governed by ER 1105-2-100, Planning Guidance Notebook	X				
Familiar with USACE flood risk management analysis and economic benefit calculations, including use of standard USACE computer programs including Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA).	X				
Familiarity with the Institute for Water Resources (IWR) planning suite and the USACE RECONS model which assesses regional economic development (RED).	X				
Active participation in related professional societies	X				
Bachelor's degree or higher in economics	X				
Biological Resources and Environmental Law Compliance					
Minimum 15 years of experience directly related to water resource environmental evaluation or review and National Environmental Policy Act (NEPA) compliance.		X			
Familiar with the habitat, fish and wildlife species, and tribal cultures and archeology that may be affected by the project alternatives in this study area.		X			
Expertise in compliance with additional environmental laws, policies, and regulations, including:					
Fish and Wildlife Coordination Act		X			
Endangered Species Act		X			
Section 106 of the National Historic Preservation Act		X			
State and Federal laws/executive orders pertaining to American Indian Tribes		X			
M.S. degree or higher in a related field.		X			
Hydrology and Hydraulic Engineering					

Technical Criterion	Luckie	Leeman	Furnans	Storesund	Brown
Registered professional engineer with a minimum of 15 years of experience in hydrologic and hydraulic engineering			X		
Familiar with:					
floodplain mapping			X		
hydrologic statistics			X		
sediment transport analysis			X		
channel stability analysis			X		
risk and uncertainty analysis			X		
Knowledgeable of Southwest riverine hydrology.			X		
Familiar with:					
HEC River Analysis System (RAS)			X		
FLO-2D			X		
Capable of addressing the USACE Safety Assurance Review (SAR) aspects of all projects.			X		
Active participation in related professional societies			X		
Geotechnical Engineering					
Minimum 15 years of experience in geotechnical engineering and geomorphology.				X	
Demonstrated experience in performing geotechnical evaluation and geo-civil design for riverine projects in the Southwest.				X	
Familiar with:					
Sampling and laboratory testing				X	
Embankment stability and seepage analyses				X	
Levee probability failure				X	
Capable of addressing the USACE SAR aspects of all projects.				X	
Active participation in related professional engineering and scientific societies				X	
M.S. degree or higher in engineering				X	
Civil/Cost Engineering					
Minimum 15 years of experience in civil engineering					X
Experience in:					
Designing grading plans and levees.					X
Levee stability.					X
Levee and bank protection removal or modification.					X
Competent in cost estimating for construction using the second generation of Micro-Computer Aided Cost Estimating System (MCACES/MII)					X
Capable of addressing the USACE SAR aspects of all projects.					X
Working knowledge of construction costs					X

Technical Criterion	Luckie	Leeman	Furnans	Storesund	Brown
Active participation in related professional engineering and scientific societies.					X

B.3 Panel Member Qualifications

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

David Luckie

Role: Civil Works Planning/Economics
Affiliation: Independent consultant

Mr. Luckie is an independent consultant with nearly three decades of experience in public works, water resource planning, and economic analysis. He earned his B.S. in economics and finance from the University of South Alabama in 1986. He has performed work for USACE, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and numerous non-Federal and private sector clients.

Over the last 27 years, Mr. Luckie has been involved in numerous flood risk management studies. Two examples of such studies are the Village Creek Watershed Study in Birmingham, Alabama, which was a multipurpose project that included structural, non-structural, environmental, and recreation outputs, and the Charting Buffalo Study, a non-Federal evaluation of the benefits of creating green space through a combination of structural and non-structural management measures. Other recent relevant experience includes the Hunting Bayou General Reevaluation and Integrated Environmental Assessment and the White Oak Section 211(f) Flood Risk Management Study in Houston, Texas.

From 1988 through 2006, he served as a Regional Economist with the U.S. Army Corps of Engineers, Mobile District, Planning and Environmental Division. Since 2006, Mr. Luckie has worked with USACE on a variety of public works projects as a Project Delivery Team (PDT) Leader or reviewer. He has a long and intimate familiarity of USACE plan formulation from his positions as a PDT lead planner, project economist, and reviewer of planning studies prepared by others or subordinates.

Mr. Luckie is highly experienced in the Six-Step Planning Process, having used it throughout his nearly three-decade career. He has used the process to solve a variety of issues, including problems unrelated to public works and water resources. He is also well-versed in the Planning Guidance Notebook (ER 1105-2-100), including its appendices, and other policy guidance related to flood risk management and risk analysis.

Mr. Luckie has been using Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA) since its inception in the 1990s. He has also performed, reviewed, or trouble-shot scores of HEC-FDA analyses for Federal, non-Federal, and private sector clients. In addition, he has mentored interns and junior economists in USACE methodologies for flood risk management, requiring them to calculate without- and with-project condition damages, either by hand or with a Microsoft Excel spreadsheet, before allowing them to use HEC-FDA. He is also very familiar with the USACE Regional Economic System

(RECONS) model and the estimation of Regional Economic Development benefits, and has used it for both Federal and non-Federal project proponents since its inception.

Mr. Luckie serves on the Economics and Finance Advisory Board for his alma mater, the University of South Alabama. The Board helps the university's Mitchell College of Business faculty develop curricula relevant to today's skill-set needs for graduating economists. He is also a scheduled speaker for the student groups, the Financial Management Association, and the Economics Society of South Alabama.

Mr. Luckie has experience serving on IEPRs for flood risk management projects, including the Mill Creek, Davidson County, Feasibility Report and the Dallas Floodway Feasibility Report and Environmental Impact Statement (EIS), Dallas, Texas.

Linda Leeman

Role: Biological Resources and Environmental Law Compliance
Affiliation: Ascent Environmental, Inc.

Ms. Leeman, a principal and Natural Resource Practice leader with Ascent Environmental, has 18 years of experience conducting environmental review and compliance under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) for water resource, flood control, and flood management projects. She earned her M.S. in natural resources from Humboldt State University in 2000 and is a certified wildlife biologist.

Ms. Leeman has worked extensively within the western United States and Central America. She has extensive experience with CEQA, NEPA, and the Federal and California Endangered Species Acts (ESA) compliance for projects throughout northern and central California. Although her primary experience is in California, she has worked in Arizona as an independent contractor for the Arizona Game and Fish Department and is familiar with the natural resources in Arizona. Since 2000, she has prepared numerous impact analyses for biological resources and prepared documents in accordance with CEQA and NEPA requirements. These impact analyses include cumulative effects analyses, compliance with other environmental regulations, and public outreach and comment periods.

Several water resource projects that she worked on triggered the Fish and Wildlife Coordination Act and relied on Habitat Evaluation Procedures (HEP) for the analysis. An example project is the Orestimba Creek Flood Control Project in Stanislaus County, California. She has extensive experience with ESA, developing compliance strategies through Section 7 of the ESA, not-likely-to-affect analyses, Biological Assessments, and conservation strategies. For example, she has been involved in the San Joaquin River Restoration Program Environmental Impact Report (EIR)/EIS and ESA compliance for the U.S. Bureau of Reclamation, the Calaveras Dam Project EIR and ESA compliance for the San Francisco Public Utilities Commission, and the Putah Creek Watershed Management Action Plan for the Creek Coordinating Committee.

Through permitting of projects under the Clean Water Act, she has worked with cultural resource specialists and assisted USACE with Section 106 compliance, consulting with the State Historic Preservation Officer and tribal representatives. Ms. Leeman has also worked on several projects as the lead biologist for environmental compliance in coordination with archeologists for protection of cultural

resources. Examples include construction monitoring (and discovery of American Indian burials and sensitive cultural artifacts) of the Level II Infill Correctional Facility Project and the Natomas Levee Improvement Program, as well as surveys for cultural resources at Beale Air Force Base.

Ms. Leeman has experience serving on IEPRs for flood risk management projects, including the Berryessa Creek, California, General Reevaluation Study (GRS) Draft General Reevaluation Report and EIS/EIR and the Sutter Basin Pilot Feasibility Study, California: Draft Feasibility Report and EIS/EIR.

Jordan Furnans, Ph.D., P.E., P.G., CFM

Role: Hydrology and Hydraulic Engineer
Affiliation: LRE Water, LLC

Dr. Furnans, a vice president and manager with LRE Water, LLC, has 17 years of experience studying and working in hydrologic and hydraulic engineering. He is a licensed professional engineer in Texas, New Mexico, Oklahoma, Colorado, Washington, Indiana, Illinois, Michigan, and Florida. He is also a licensed professional geologist in Texas, as well as a certified floodplain manager (CFM). Dr. Furnans holds a BSE in civil engineering from Princeton University, and both an MSE in environmental and water resources engineering and a Ph.D. in civil engineering from the University of Texas at Austin.

As a certified floodplain manager, Dr. Furnans has the necessary training and experience to assess FEMA floodplain requirements and help clients evaluate and manage their flood-preparedness. He has used Hydrologic Engineering Center's River Analysis System (HEC-RAS) to define floodplains, and filed Letter of Map Revisions (LOMRs) with the Federal Emergency Management Agency (FEMA) upon reviewing changes to floodplains made by clients. He is well-versed in ArcGIS applications, and uses GIS daily in all his projects.

The majority of his professional work in Texas has involved hydrologic statistical analyses of streamgauge records. This has involved time-series analyses to determine heterogeneity in annual, monthly, and daily flow data. He has performed statistical analyses for all U.S. Geological Survey gauges in Texas, quantifying and spatially mapping streamflow trends. He has also used baseflow analysis techniques to assess trends in inflows to the Highland Lakes (upstream of Austin, Texas), and served as an expert witness in legal cases before the Texas State office of Administrative Hearings, where he testified regarding his statistical analyses of streamflows, trends in precipitation, and reservoir inflows.

Dr. Furnans has studied the physical bases for sediment transport models, and performed field data collection efforts to determine both bed load transport and suspended sediment transport (in Texas and Oklahoma). He also modeled sediment transport using EFDC, SED2D, and custom-designed streamflow-power relationships. The majority of his channel stability analyses have involved scour calculations around bridge piers, where he has used empirical equations and hydrodynamic models to calculate hydraulic forces on each pier. He has performed geomorphic assessments of stream alteration patterns in the Sabine and San Antonio Rivers (Texas), and assessed how high flow pulses are likely to damage and shape riverine landforms. .

Dr. Furnans has used Monte-Carlo type analyses, coupled with statistical analyses on inflow parameters, to assess uncertainty in water availability and hydrodynamic models in Florida and Texas. He has also helped Texas clients assess water supply risks associated with the vagaries of streamflow patterns in the

Brazos River Basin, Texas. He used statistical techniques and Monte-Carlo analyses to assess uncertainty in water reliability calculations using State of Texas Watershed Assessment Models.

Dr. Furnans has focused most of his professional work in assessing Texas hydrology, performing analyses on every major river system across the state. He has also managed gain/loss studies on the Rio Grande River upstream of Albuquerque, New Mexico, and assessed the likely impacts of delayed or earlier onset annual snowmelt on river water availability for Albuquerque.

Dr. Furnans is proficient with the HEC-RAS model, having used it to determine floodplains and minimum flows and levels for Florida streams, and in designing canal improvements for water providers in Texas. All of the modeling has been under steady-flow conditions. He is currently developing a model of about 20 miles of water canals in Fort Bend County, Texas, including over 20 bridge crossings and inline gate structures. He has studied the physical basis for flood wave routing simulated in Flo-2D, and used similar flood routing models, including the Interconnected Channel and Pond Routing model (for the City of Bonita Springs, Florida) and HEC-RAS 2D (non-project specific training efforts).

In addition, he has addressed USACE's Safety Assurance Review (SAR) on previous IEPRs, including the Integrated Draft General Reevaluation Report and draft Supplemental Environmental Impact Statement for the Hunting Bayou Flood Risk Management Study in 2013.

Dr. Furnans is a member of the American Society of Civil Engineers, the Texas Floodplain Management Association, and the Texas Water Conservation Association. He recently presented a paper at the Environmental and Water Resources Institute World Environmental Congress in Austin, Texas.

Rune Storesund, D. Eng., P.E., G.E., QSD/QSP

Role: Geotechnical Engineer
Affiliation: Independent consultant

Dr. Storesund is the Executive Director of the University of California-Berkeley (UC Berkeley) Center for Catastrophic Risk Management, a group of academic researchers and practitioners who pursue transdisciplinary solutions to avoid and mitigate the aftereffects of catastrophic events. He also has a private civil engineering consultant. He has more than 16 years of planning, design, engineering, and construction experience working on a variety of projects throughout California, the United States, and internationally. He earned a D.Eng. (2009) in Civil Engineering (Civil Systems focus) and an M.S. (2002) in Civil Engineering (Geotechnical Engineering), both from UC Berkeley. His D.Eng. degree focused heavily on geotechnical engineering, geomorphology, and risk identification, analysis, and evaluation. He provides consulting services in all aspects of civil, geotechnical, water resources, ecological, restoration, and sustainability engineering projects. His expertise focuses on the application of reliability and risk-based approaches to engineering projects (with a specialization in environmental restoration and flood control projects) in order to effectively manage project uncertainties. He has participated in all aspects of engineering projects, from preliminary reviews, to detailed analyses, to construction observations and post-project monitoring. He is also the President of Storesund Engineering LLC, a Class A General Contractor

Dr. Storesund's work on four USACE projects—the N1 Levee, N2 Levee, Pacheco Levee, and Panhandle Berm Levee—demonstrates his extensive experience evaluating static and dynamic slope stability, seepage through earthen embankments, and settlement of earthen embankments. He also evaluated seepage through and settlement of earthen embankments for the USACE MRGO Levee project and gained additional expertise on settlement through his work on the USACE Bulge Levee project.

Furthermore, Dr. Storesund gained experience evaluating underseepage through foundations of levee embankments through his work on the N1 Levee, N2 Levee, Bulge Levee, Pacheco Levee, Panhandle Berm, MRGO Levee, Amber Knolls Reservoir, Platt Reservoir, Grape Creek Reservoir, and Red Hills Reservoir projects. He has evaluated underseepage under floodwalls on three other USACE projects (the IHNC floodwalls, 17th Street Floodwall, and London Avenue Floodwall); evaluated underseepage under closure structures on the USACE Bayou Bienvenue Closure Structure, Bayou Dupre Closure Structure, and Hamilton Panhandle Control Structure projects; and evaluated underseepage of other pertinent features of flood protection systems such as outlet structures, overflow structures, and spillway structures. Dr. Storesund has worked on a number of projects in Arizona, including Chino Bandito, Chandler, Arizona.

Dr. Storesund has participated in numerous projects related to USACE geotechnical practices. For more than 10 years, he directly participated in engineering design, specification development, DrChecks, and Micro-Computer Aided Cost Estimating System (MCACES/MII) cost evaluations. Most recently, he served as the geotechnical engineer of record for the Hamilton Wetland Restoration project in Novato, California (2004 through 2014). Other USACE flood protection projects he has worked on include the West Sacramento Flood Control Project; the Las Gallinas Coastal Inundation Study; the Upper Penitencia Creek Flood Improvement Project; the San Lorenzo Flood Control Project; and the USACE Upper Napa River Flood Protection Project.

Dr. Storesund has extensive experience with SARs, having recently participated in the SAR for the USACE Princeville IEPR. In addition, in the aftermath of Hurricane Katrina, which hit the greater New Orleans area in 2005, he participated in an American Society of Civil Engineers assessment that served as the basis for the Guiding Principles for conducting USACE SARs. He has been active in advancing risk-informed decision making for critical infrastructure identification and management of uncertainties. His 'systems' synthesis perspective is unique among his peers, and he has routinely evaluated the application of redundancy, resiliency, and robustness.

Dr. Storesund is a registered P.E. in California, Louisiana, Hawaii, and Washington State and a registered Geotechnical Engineer (G.E.) in California. He also is a Qualified Stormwater Pollution Prevention Plan (SWPPP) Practitioner (QSP) and Qualified SWPPP Developer (QSD).

Chris Brown, Ph.D., P.E.

Role: Civil/Cost Engineer
Affiliation: Independent consultant

Dr. Brown is an associate professor at the University of North Florida teaching civil engineering, fluid mechanics, hydraulics, senior design, foundation engineering, and engineering geology. He earned his Ph.D. in civil engineering in 2005 from the University of Florida and is a licensed, practicing professional

engineer in Florida and Pennsylvania focusing on water resources and geotechnical engineering. Dr. Brown has 24 years of civil engineering experience including design, construction, inspection, and teaching, working with and for USACE (Philadelphia District, 1991 to 1999, Jacksonville District, 1999 to 2006), as well as municipal governments and private engineering firms.

Dr. Brown has worked on levee project design in Florida, Puerto Rico, Delaware, New Jersey, and Pennsylvania. He has also developed grading plans for earth works and landfills. He has evaluated levee stability (slope stability, seepage, erosion, and settlement), and served on the original USACE ad hoc national levee assessment team. In addition, he has designed levee and bank protection schemes in multiple states involving riprap, gabions, articulated mats, and various geosynthetic materials. Dr. Brown also helped devise the scope of work for levee overtopping studies in the Southeastern United States after Hurricane Katrina.

Dr. Brown is very competent in cost estimating for construction using MCACES and has acted as cost-estimating IEPR reviewer on some of the largest USACE Civil Works projects, including the most expensive lock and dam replacement in USACE history. He is very familiar with construction costing, material costs, labor costs, and overhead. Dr. Brown teaches construction cost estimating and contracting as part of the senior civil engineering capstone course series at the University of North Florida.

He is also fully capable of addressing relevant SAR issues and has fulfilled this requirement for at least four other IEPR projects, including the Olmsted Locks and Dam 52 and 53 Replacement Project Post Authorization Change Report and the Dallas Floodway Feasibility Report and EIS, Dallas, Texas.

Dr. Brown is active in the Society of American Military Engineers (SAME) and the American Water Resources Association, and is the faculty advisor to the University of North Florida SAME student chapter.

APPENDIX C

Final Charge for the Little Colorado River at Winslow IEPR

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Charge Questions and Guidance to the Panel Members for the Independent External Peer Review (IEPR) of the Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study

This is the final Charge to the Panel for the Little Colorado River at Winslow IEPR. This final Charge was submitted to USACE as part of the final Work Plan, originally submitted on March 2, 2017.

BACKGROUND

Little Colorado River at Winslow is a General Investigations study that was undertaken to evaluate structural and non-structural flood risk management (FRM) measures to reduce the risk of flooding in the City of Winslow and vicinity. Removal of invasive species (tamarisk, saltcedar) was considered as part of larger plans provided they contributed to the primary objective of flood risk management. The study team did not formulate ecosystem restoration plans, and National Ecosystem Restoration (NER) benefits were not determined for the purpose of plan selection. The non-Federal sponsor for the study is the Navajo County Flood Control District, Navajo County, Arizona.

The overall Little Colorado River watershed encompasses an area of approximately 27,051 square miles in northeastern Arizona and northwestern New Mexico. Approximately 80 percent of the watershed is in Arizona and includes parts of Coconino, Navajo, and Apache Counties. The remaining 20 percent of the watershed is in New Mexico and includes parts of San Juan, McKinley, Cibola, and Catron Counties. The drainage basin of the Little Colorado River is approximately 245 miles long and 158 miles wide at its widest point. The mainstem of the Little Colorado River is entirely in Arizona, has a channel length of 356 miles, and total elevation drop of about 6,300 feet from its headwaters in the White Mountains to its confluence with the Colorado River. The Little Colorado River flows in generally a northwest direction and receives runoff from 18 sub-watershed basins and contributing drainage areas with hundreds of miles of small tributary streams. The Little Colorado River Watershed is bound on the east by the Rio Grande Basin, on the south by the Gila River Basin, and on the north by the San Juan Basin. The Little Colorado River joins the Colorado River in the Grand Canyon on the northwest edge of the Basin.

The Little Colorado River at Winslow study area is located in the middle Little Colorado River Sub-Watershed, in and near the City of Winslow in western Navajo County Arizona. The study area encompasses the floodplain of the Little Colorado River from the vicinity of the Clear Creek confluence downstream (northwest) to the north end of the existing Winslow Levee system. The study area includes the majority of the City of Winslow, including the Ruby Wash Diversion Levee (RWDL) and the Ruby Wash Levee. The tributaries of Ruby Wash, Clear Creek, Cottonwood Wash, and Salt Creek join the Little Colorado River Mainstem within the study area.

The City of Winslow is located along both Interstate Highway 40 and the Burlington Northern Santa Fe Railroad along the western border of Navajo County. Winslow is the largest city in Navajo County. The area is supported by tourism, manufacturing, trade, and retail. The 27,000 square mile Navajo Reservation and the 2,410 square mile Hopi Reservation are located to the north. Elsewhere, the surrounding land consists of a patchwork of private and State Trust lands.

As stated previously, the study purpose was to investigate problems and opportunities and potential alternatives to provide flood risk management (FRM) for the City of Winslow and vicinity. Potential FRM solutions included both structural and non-structural measures. Structural measures included levee rehabilitation, new levees, channel improvements to increase conveyance capacity, grade control

structures, bank stabilization, and on-line or off-line detention facilities. Non-structural floodplain management measures included assisting communities with floodplain management and flood warning systems in areas where needed. In addition, floodproofing, buyout, relocation, and dry flood-proofing were considered.

The Little Colorado River at Winslow FRM Study Team has conducted the feasibility study following the Corps Planning process defined in Engineer Regulation 1105-2-100 (Planning Guidance Notebook) and the USACE SMART Planning initiative, which incorporates risk-informed evaluation with less detailed information to reach decision points more efficiently, and includes greater Vertical Team coordination throughout the study.

OBJECTIVES

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

Peer review is one of the important procedures used to ensure that the quality of published information meets the standards of the scientific and technical community. Peer review typically evaluates the clarity of hypotheses, validity of the research design, quality of data collection procedures, robustness of the methods employed, appropriateness of the methods for the hypotheses being tested, extent to which the conclusions follow from the analysis, and strengths and limitations of the overall product.

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Little Colorado River at Winslow 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 works planning/economy, biological resources and environmental law compliance, hydrology and hydraulic engineering, geotechnical engineering, and civil/cost 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 1165-2-214, Appendix D, review panels should identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods. Review panels should be able to evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable. Reviews should focus on assumptions, data, methods, and models. The panel members may offer their opinions as to whether there are sufficient analyses upon which to base a recommendation.

DOCUMENTS PROVIDED

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

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	No. of Pages	Required Disciplines
Integrated Feasibility Report/Environmental Impact Statement	380	All Disciplines
Appendix A Hydrology	554	H&H Engineering
Appendix B Hydraulics	353	H&H Engineering
Appendix C Economics	77	Civil Works Planner/Economics
Appendix D Design	42	Geotechnical Engineering; Civil/Cost Engineering; H&H Engineering
Appendix E Cost Engineering	54	Civil Works Planner/Economics; Civil/Cost Engineering
Appendix F Geotechnical (Appendices A and B)	182	Geotechnical Engineering
Appendix G HTRW	41	Biological Resources and Environmental Law Compliance
Appendix H Real Estate	54	Civil Works Planner/Economics; Biological Resources and Environmental Law Compliance
Appendix I Environmental	89	Biological Resources and Environmental Law Compliance
Appendix J Clean Water Act 404(b)(1) Evaluation	53	Biological Resources and Environmental Law Compliance
Public Comments*	34	All Disciplines
Appendix F Geotechnical (Attachments 1-7 to Appendix B)**	691	
Risk Register**	13	All Disciplines
Decision Management Plan (Decision Log)**	6	All Disciplines
Total Page Count	2,623	

**Page count for public comments is approximate*

***Supporting documentation only. Not included in the total page count.*

Documents for Reference

- USACE guidance *Civil Works Review,* (EC 1165-2-214, December 15, 2012)
- Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004)
- Foundations of SMART Planning
- SMART Planning Bulletin (PB 2013-03)

- SMART – Planning Overview
- Planning Modernization Fact Sheet.

SCHEDULE

This draft schedule is based on the January 20, 2017 receipt of the final review documents. Note that dates presented in the schedule below could change due to document, panel member and/or USACE availability.

Task	Action	Due Date Working Days
Conduct Peer Review	Subcontractors complete mandatory Operations Security (OPSEC) training	3/9/2017
	Battelle sends review documents to panel members	2/14/2017
	Battelle convenes kick-off meeting with panel members	2/14/2017
	Battelle convenes kick-off meeting with USACE and panel members	2/14/2017
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	TBD
	Panel members complete their individual reviews	3/15/2017
Prepare Final Panel Comments and Final IEPR Report	Battelle provides talking points to panel members for Panel Review Teleconference	3/23/2017
	Battelle convenes Panel Review Teleconference	3/29/2017
	Battelle provides Final Panel Comment templates and instructions to panel members	3/30/2017
	Panel members provide draft Final Panel Comments to Battelle	4/6/2017
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	4/07/2017 - 4/16/2017
	Panel finalizes Final Panel Comments	4/17/2017
	Battelle sends public comments to Panel	3/23/2017
	Panel members complete their review of public comments	3/29/2017
	Panel drafts Final Panel Comment, if necessary	3/31/2017
	Panel finalizes Final Panel Comment regarding public comments	4/4/2017
	Battelle provides Final IEPR Report to panel members for review	4/19/2017
	Panel members provide comments on Final IEPR Report	4/21/2017
	Battelle submits Final IEPR Report to USACE*	4/25/2017
	USACE Planning Center of Expertise (PCX) provides decision on Final IEPR Report acceptance	5/2/2017
Comment/ Response Process	Battelle inputs Final Panel Comments to Design Review and Checking System (DrChecks) and provides Final Panel Comment response template to USACE	5/3/2017
	Battelle convenes teleconference with Panel to review Comment Response process	5/3/2017

Task	Action	Due Date Working Days
	USACE Project Delivery Team (PDT) provides draft Evaluator Responses to USACE PCX for review	5/17/2017
	USACE PCX reviews draft Evaluator Responses and works with USACE PDT regarding clarifications to responses, if needed	5/23/2017
	USACE PCX provides draft PDT Evaluator Responses to Battelle	5/24/2017
	Battelle provides draft PDT Evaluator Responses to panel members	5/26/2017
	Panel members provide draft BackCheck Responses to Battelle	6/1/2017
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	6/2/2017
	Battelle convenes Comment Response Teleconference with panel members and USACE	6/5/2017
	USACE inputs final PDT Evaluator Responses to DrChecks	6/12/2017
	Battelle provides final PDT Evaluator Responses to panel members	6/14/2017
	Panel members provide final BackCheck Responses to Battelle	6/19/2017
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	6/26/2017
	Battelle submits pdf printout of DrChecks project file*	6/27/2017
Agency Decision Milestone (ADM)	Panel prepares and/or reviews slides for ADM	TBD
	ADM Meeting	October 2017
Civil Works Review Board (CWRB)	Panel prepares and/or reviews slides for CWRB	TBD
	CWRB Meeting	May 2018

CHARGE FOR PEER REVIEW

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

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the Little Colorado River at Winslow documents. Please focus your review on the review materials assigned to your discipline/area of expertise and technical knowledge. Even though there are some sections with no questions associated with them, that does not mean that you cannot comment on them. Please feel free to make any relevant and appropriate comment on any of the sections and appendices you were asked to review. In addition, please note the following guidance. Note that the Panel will be asked to provide an overall statement related to 2 and 3 below per USACE guidance (EC 1165-2-214; Appendix D).

1. Your response to the charge questions should not be limited to a "yes" or "no." Please provide complete answers to fully explain your response.
2. Assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, and any biological opinions of the project study.
3. Assess the adequacy and acceptability of the economic analyses, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, and models used in evaluating economic or environmental impacts of the proposed project.
4. If appropriate, offer opinions as to whether there are sufficient analyses upon which to base a recommendation.
5. Identify, explain, and comment upon assumptions that underlie all the analyses, as well as evaluate the soundness of models, surveys, investigations, and methods.
6. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.
7. Please focus the review on assumptions, data, methods, and models.

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

1. If desired, panel members can contact one another. However, panel members **should not** contact anyone who is or was involved in the project, prepared the subject documents, or was part of the USACE Agency Technical Review (ATR).
2. Please contact the Battelle Project Manager (Corey Wisneski, wisneskic@battelle.org) or Program Manager (Rachel Sell (sellr@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle Program Manager, Rachel Sell (sellr@battelle.org) immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Corey Wisneski, wisneskic@battelle.org, no later than March 15, 2017, 10 pm ET.

Independent External Peer Review

of the

Little Colorado River at Winslow, Navajo County, Arizona Flood Risk Management Feasibility Study

Charge Questions and Relevant Sections as Supplied by USACE

Broad Evaluation Charge Questions

1. Is the need for and intent of the decision document clearly described?
2. Does the decision document adequately address the stated need and intent?

Decision Documents

3. Assess the adequacy and acceptability of the Project evaluation data used in the study analyses.
4. Assess the adequacy and acceptability of the Economic, environmental, and engineering assumptions that underlie the study analyses.
5. Assess the adequacy and acceptability of the Economic, environmental, and engineering methodologies, analyses, and projections.
6. Assess the adequacy and acceptability of the Models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives.
7. Assess the adequacy and acceptability of the Methods for integrating risk and uncertainty.
8. Assess the adequacy and acceptability of the Formulation of alternative plans and the range of alternative plans considered.
9. Assess the adequacy and acceptability of the Quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans.
10. Assess the adequacy and acceptability of the Overall assessment of significant environmental impacts and any biological analyses.
11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable.
12. Assess the considered and tentatively selected alternatives from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

Tentatively Selected Plan (TSP)

13. Assess whether the models used to assess life safety hazards are appropriate.
14. Assess whether the assumptions made for the life safety hazards are appropriate.
15. Assess whether the quality and quantity of the surveys, investigations, and engineering are sufficient for a concept design considering the life safety hazards and to support the models and assumptions made for determining the hazards.

16. Assess whether the analysis adequately address the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project.
17. From a public safety perspective, assess whether the proposed alternative is reasonably appropriate or are there other alternatives that should be considered.

Specific Technical and Scientific Charge Questions

18. Given the limited study-specific geotechnical information, are the assumptions made regarding construction material sources, salvage, re-use, transport and disposal of materials reasonable and appropriate to support evaluation of and selection among alternative plans?
19. Given the uncertainties regarding geotechnical data, levee and channel design, material availability/transport and environmental commitments, are the cost contingencies and conceptual cost estimates for the alternative plans reasonable and adequate for differentiating among plans? Have the uncertainties been adequately defined, and the cost risks associated with those uncertainties appropriately identified, to reasonably support future development of a detailed cost estimate for the selected plan?
20. Assess the sustainability of the proposed project in consideration of floodplain geomorphology, levee placement, river channelization, and the anticipated operation and maintenance costs.
21. Does the decision document provide adequate and reasonable scientific and technical information to differentiate among different alternative plans and support selection of a recommended plan?
22. Does the decision document reasonably identify and discuss impacts to critical facilities, flood warning time, evacuation routes, depth/velocity of flooding and water temperature as they relate to life safety considerations with the selected plan?

Battelle Summary Charge Questions to the Panel Members[1]

Summary Questions

23. Please identify the most critical concerns (up to five) you have with the project and/or review documents. These concerns can be (but do not need to be) new ideas or issues that have not been raised previously.

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

Public Comment Questions

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

[1] Questions 23 through 25 are Battelle supplied questions and should not be construed or considered part of the list of USACE-supplied questions. These questions were delineated in a separate appendix in the final Work Plan submitted to USACE.

APPENDIX D

Conflict of Interest Form

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Conflicts of Interest Questionnaire

Independent External Peer Review

Little Colorado River (Winslow, AZ) IEPR

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

NAME OF FIRM: **Battelle Memorial Institute**
REPRESENTATIVE'S NAME: **LaDonna James**
TELEPHONE: **614-424-5543**
ADDRESS: **505 King Avenue, Columbus, OH 43210**
EMAIL ADDRESS: jamesl@battelle.org

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

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

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

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

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

LaDonna James — YOUR SIGNATURE

June 18, 2015 — DATE

BATTELLE

It can be done