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November 8, 2013

Final Independent External Peer Review Report Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement

Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Ecosystem Restoration Planning Center of Expertise
Rock Island District, Mississippi Valley Division

Contract No. W912HQ-10-D-0002
Task Order: 0048

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Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement

by

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505 King Avenue
Columbus, OH 43201

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Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement

EXECUTIVE SUMMARY

Project Background and Purpose

The baseline study area initially considered during the planning process included 32 miles of the River within the City of Los Angeles, within a half mile of each bank. It begins at the origin of the Los Angeles River, which is the confluence of Bell Creek and Arroyo Calabasas in the northwest San Fernando Valley at Owensmouth Boulevard, and ends near the City of Vernon in the downtown Los Angeles area. Through initial investigation of constraints in the baseline study area and the identification of where ecosystem restoration might best be accomplished, the planning process defined the focused study area as the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach, which extends from the Headworks downstream to First Avenue.

This study area includes the Glendale Narrows, which is the only portion of the Los Angeles River that does not have a hardened bed (bottom of the river channel), and contains several distinctive sites and connections including the Headworks, Pollywog Park, Bette Davis Park, the Burbank Western Channel and Glendale River Walk, Griffith Park, Ferraro Fields, Verdugo Wash, Atwater Village, Taylor Yard and the Rio de Los Angeles State Park, the "Cornfields" (Los Angeles State Historic Park), Arroyo Seco, Elysian Park, "Piggyback Yard" (also known as "Los Angeles Transportation Center" as well as "Mission Yard"), and downtown Los Angeles. These sites provide key opportunities for restoration and enhanced connectivity.

The study was authorized by Senate Committee on Public Works Resolution and approved on June 25, 1969. Section 4018 of the Water Resources Development Act (WRDA) of 2007 provided authorization for a "feasibility study for environmental ecosystem restoration, flood control, recreation, and other aspects of Los Angeles River revitalization that is consistent with the goals of the Los Angeles River Revitalization Master Plan published by the city of Los Angeles…." The implementation guidance for this section identified that the scope and substance of the study under the Senate resolution is identical to the study mandated by section 4018 and directed that the ongoing study incorporate the section 4018 study. The feasibility study incorporates, where applicable, conceptual elements from the City's Los Angeles River Revitalization Master Plan (LARRMP). The City of Los Angeles, Bureau of Engineering is serving as non-Federal sponsor. The study is cost shared with the non-Federal sponsor.

The feasibility study provides an interim response to the study authority, and the study efforts will determine the feasibility of ecosystem restoration of the Los Angeles River and surrounding environment. There is no sponsor available to investigate flood risk management at this time.

The primary purpose of the proposed project and alternatives considered in the study is to restore 11 miles of the Los Angeles River from approximately Griffith Park to downtown Los Angeles. The project will be reestablishing riparian strand, freshwater marsh, and aquatic habitat communities and reconnecting the Los Angeles River to major tributaries, its historic floodplain, and the regional habitat zones of the Santa Monica, San Gabriel, and Verdugo Mountains while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem within this 11-mile reach of the Los Angeles River. This reach will be referred to as the study area or ARBOR Reach for the purposes of this project.

Independent External Peer Review Process

The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Los Angeles River Ecosystem Restoration Feasibility Study (hereinafter LA River IEPR). The decision document being reviewed is an Integrated Feasibility Study, Environmental Impact Statement, and Environmental Impact Report—known as a draft Integrated Feasibility Report (IFR). As a 501(c)(3) non-profit science and technology organization, Battelle is independent, is free from conflicts of interest (COIs), and meets the requirements for an Outside Eligible Organization (OEO) per guidance described in USACE (2012). Battelle has experience in establishing and administering peer review panels for USACE and was engaged to coordinate the IEPR of the Los Angeles River draft IFR. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. The IEPR was external to the agency and conducted following USACE and Office of Management and Budget (OMB) guidance described in USACE (2012) and OMB (2004). This final report describes the IEPR process, describes the panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel (the Panel).

Based on the technical content of the LA River review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: arid region riverine system ecology, socioeconomics, hydrologic and hydraulic (H&H) modeling, and geotechnical engineering. Four panel members were selected for the IEPR. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel.

The Panel received an electronic version of the 1,418-page LA River review documents, along with a charge that solicited comments on specific sections of the documents to be reviewed. USACE prepared the charge questions following guidance provided in USACE (2012) and OMB (2004), which were included in the draft and final Work Plans.

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

IEPR panel members reviewed the LA River documents individually. The panel members then met via teleconference with Battelle to review key technical comments, discuss charge questions

for which there were conflicting responses, and reach agreement on the Final Panel Comments to be provided to USACE. Each Final Panel Comment was documented using a four-part format consisting of: (1) a comment statement; (2) the basis for the comment; (3) the significance of the comment (high, medium, or low); and (4) recommendations on how to resolve the comment. Overall, 17 Final Panel Comments were identified and documented. Of these, four were identified as having high significance, 11 had medium significance, and two had low significance.

Results of the Independent External Peer Review

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

The Panel agreed that the LA River review documents and appendices are well written and provide a very comprehensive description of background information. The evaluation of the different alternatives is quite complete and presents a sound comparison. The Panel recognizes that the LA River Ecosystem Restoration Feasibility Study represents a high-quality effort to restore the riverine ecosystem within the ARBOR Reach that is clearly the result of a long and detailed study, with high local and regional importance. While the Panel deemed the report well-written with robust documentation in many areas, it identified areas where additional documentation and clarification is warranted.

Ecology – The Panel found the Combined Habitat Assessment Protocol (CHAP) habitat analysis to be very impressive. Using the CHAP methodology, a comprehensive analysis of current conditions, future conditions without remediation, and an evaluation of the alternatives have been conducted in a reasonable and defensible fashion. Assumptions are clearly laid out with respect to what the restoration would mean to the type and amount of habitat; however, an assessment of monitoring needs, maintenance activities, and adaptive management strategies to assess the extent to which the project has achieved or not achieved the goals and objectives of the project is not well described. Post-project monitoring and maintenance actions to evaluate how successfully the project met the project objectives could be documented in the IFR to address this.

In addition, risk and uncertainty associated with various aspects of the project have not been clearly identified and communicated, particularly regarding the hydrologic and ecological restoration components. The Panel noted that there was little consideration of the risks and risk mitigation that could affect the success of the restoration, such as adverse weather, disease, invasive species, stresses from the surrounding urban environment, and human disturbance. A thorough evaluation and comparison of the array of alternatives is not complete without considering associated risks and uncertainties. The Panel believes this issue can be addressed by conducting a hydrologic risk and uncertainty analysis of the predicted flooding following completion of the project; evaluating the risk to, and uncertainty of, the future success of ecological restoration activities, including effects of failures of plantings, disease, disturbance

from invasive species, human activities, stresses created by surrounding urbanization, and future climate change; and potentially revising cost estimates to account for higher than expected long-term operations and maintenance (O&M) costs to achieve stated restoration goals.

Hydrologic and Hydraulic Modeling – USACE has accomplished an extensive amount of H&H modeling work and has documented this work in a comprehensive manner. This project presents a unique goal to restore a major river system in the midst of a highly developed urban setting; the H&H data, tools, and analyses initiated for this project provide an effective means to achieve this goal. However, the Panel believes that creation of a fully viable and technically sound project requires that flood risk management, which is the primary purpose and (historic) function of the Los Angeles River channel, be considered an explicit objective as part of the ecosystem restoration project. The flood risk management capacity of the Los Angeles River channel, which is significantly compromised by existing channel vegetation and sediment, could prove severely problematic to ecological restoration as envisioned in the IFR. While not clearly acknowledged or discussed in the IFR (other than in Appendix E), it seems to the Panel that this leaves open the possibility that existing vegetation and sediment may be removed, and that removal could be extensive, which may conflict with project objectives for ecosystem restoration and may potentially affect the selected alternative. The Panel believes this concern can be addressed by integrating flood risk management into the existing list of planning objectives and reconciling the discussion of flood risk management in the IFR with a much more cautious and provisional discussion in Appendix E of channel vegetation and potential ecological restoration elements on channel flow conveyance capacity and associated flood risk.

The hydrologic analyses and hydraulic modeling are focused on design storms and flood event conditions to assess conveyance capacity, but do not consider the more frequent seasonal flows and low flows to understand how the restored river system can be sustained over time. The Panel found no discussion of the perennial effluent base flow in terms of how it will impose a different hydrologic condition on the river system – when compared to the historic ephemeral flow condition. The likelihood that the restored conditions of the Tentatively Selected Plan (TSP) channel and floodplain can be sustained is uncertain because not enough data, analyses, and results have been presented for the perennial base flow and seasonal hydrology. The Panel believes this can be addressed by discussing the fundamental change from an ephemeral to perennial hydrologic condition and how this change may affect the ability to restore the physical functions and ecological habitats that were historically present in the Los Angeles River system, reviewing project hydrology considerations, and expanding the discussion in Appendix E on how the models were applied to achieve planning objectives and why other models, such as HEC-EFM, were not applied in this project to better understand ecosystem responses to changes in the flow regime of the river and/or connected wetlands.

Geotechnical Engineering – From a geotechnical engineering perspective, the Panel generally agreed with the geotechnical considerations and design constraints identified in Appendix D and the related risks identified in the Abbreviated Risk Analysis (ARA) of Appendix C. The Panel was concerned that the proposed replacement of grouted rip-rap and reinforced concrete on affected channel slopes by geosynthetic High Performance Turf Reinforcement Mat (HPTRM) has not been analyzed or fully qualified for structural and geotechnical stability during extreme flood conditions. While the design flow velocities generally exceed the 12 fps maximum for planting,

the Panel notes that there appears to be no maximum permissible velocity for channel sections where a geosynthetic HPTRM will be used to replace the hard armoring of grouted rip-rap and reinforced concrete on channel slopes. Replacement of hard armoring by HPTRM will be a major element of the ecological restoration. The Panel believes this concern can be addressed by clarifying the ability of HPTRM to resist potentially high flow velocities and prevent or minimize structural and geotechnical instability and damage to the channel, including physical elements of the ecological restoration, during flood events and confirm that the TSP can be implemented in such a way as to achieve ecological objectives while preventing unacceptable performance in areas where HPTRM is used to replace grouted rip-rap and reinforced concrete on channel slopes.

Socioeconomics – The Panel found that the economic analysis was conducted in a reasonable process for National Ecosystem Restoration (NER) performed using the certified Institute for Water Resources (IWR) Planning Suite (IWR Plan), utilizing standard recreational benefit evaluation methods, and economic impact models for Regional Economic Development (RED). The economics framework adopts reasonable methodologies because IWR Plan is used to implement the Cost Effectiveness and Incremental Cost Analysis (CE/ICA) evaluation.

Of concern, however, is that the cost schedule risk analysis does not adequately account for uncertainties in capital and O&M costs, especially related to long-term restoration success. A more comprehensive (and quantitative) evaluation and documentation of capital and long-term O&M costs for ecosystem restoration elements is warranted because the risks could potentially affect the selected alternative. The Panel believes this issue can be addressed by providing a more comprehensive discussion of the methods and assumptions applied in an Abbreviated Risk Analysis (ARA) method, explaining why an ARA method was used, and conducting a separate risk analysis of O&M costs, especially the costs of long-term adaptive management of restored ecosystem services.

Table ES-1. Overview of 17 Final Panel Comments Identified by the LA River IEPR Panel

No.	Final Panel Comment
	Significance – High
1	Flood risk management has not been effectively integrated with the objectives of the ecological restoration project, yet is a primary purpose and function of the Los Angeles River.
2	The cost schedule risk analysis does not adequately account for uncertainties in capital and O&M costs, especially related to long-term restoration success.
3	The hydrologic analyses and hydraulic modeling are focused on design storms and flood event conditions to assess conveyance capacity, but do not consider the more frequent seasonal flows and low flows to understand how the restored river system can be sustained over time.
4	The proposed replacement of grouted rip-rap and reinforced concrete on affected channel slopes by geosynthetic HPTRM has not been analyzed or fully qualified for structural and geotechnical stability during extreme flood conditions.
	Significance – Medium
5	Risk and uncertainty associated with various aspects of the project have not been clearly identified and communicated, particularly regarding the hydrologic and ecological restoration components.
6	Post-project monitoring, maintenance, and adaptive management, while necessary for success of the TSP, are not well described in the IFR.
7	The interaction between the restored landcapes and the wider ecosystem has not been fully considered.
8	Conflicts and issues related to cleanup of HTRW chemicals and CERCLA hazardous waste may emerge during plan implementation as cleanup issues and costs manifest, affecting the TSP.
9	The water budget discussion in Appendix E characterizes water budget parameters, but these parameters have not been applied in a water budget analysis.
10	Groundwater conditions specific to the project reaches have not been fully described and data are lacking, especially on groundwater/surface water exchanges.
11	The Integrated Feasibility Report and Appendices do not provide an analysis of sediment processes, which is a component of a planning objective for the restoration project.
12	It is not clear whether the Tentatively Selected Plan is consistent with the goals of the Los Angeles River Revitalization Master Plan, as directed by WRDA 2007.
13	Cost estimates for the eight specific reaches comprising the ARBOR Reach have not been identified for each of the four final alternatives and the TSP in particular.
14	Future without project conditions related to operation and maintenance, population growth, climate change and hydrology are not adequately described.
15	The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or supporting data are not provided.
	Significance – Low
16	Reach cross sections for the Tentatively Selected Plan have not been presented in a consistent and clear way.
17	The reasonableness of key drivers in estimating recreational benefits has not been substantiated with local data.

Table of Contents

Executive Summary i
1. Introduction 1
2. Purpose Of The IEPR 2
3. Methods 2
3.1 Planning and Schedule 3
3.2 Identification and Selection of IEPR Panel Members 5
3.3 Conduct of the IEPR 7
3.4 Review of Individual Comments 8
3.5 IEPR Panel Teleconference 8
3.6 Preparation of Final Panel Comments 9
4. Panel Description 10
5. Summary Of Final Panel Comments 16
6. References 21

Appendix A. Final Panel Comments on the LA River IEPR
Appendix B. Final Charge to the Independent External Peer Review Panel on the LA River

List of Tables

Table ES-1. Overview of 17 Final Panel Comments Identified by the LA River IEPR Panel vi
Table 1. LA River IEPR Schedule 3
Table 2. LA River IEPR Panel: Technical Criteria and Areas of Expertise 11
Table 3. Overview of 17 Final Panel Comments Identified by the LA River IEPR Panel 19

LIST OF ACRONYMS

ACE	Annual Chance Exceedance
ANGTS	Alaska Natural Gas Transportation System
ARA	Abbreviated Risk Analysis
ARBOR	Area with Restoration Benefits and Opportunities for Revitalization
ATR	Agency Technical Review
CAFG	California Fish and Game Department
CE/ICA	Cost effectiveness and Incremental Cost Analysis
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFM	Certified Floodplain Manager
CHAP	Combined Habitat Assessment Protocol
COI	Conflict of Interest
CVFED	Central Valley Floodplain Evaluation and Delineation
CVFPP	California Central Valley Flood Protection Plan
CVFSCS	California Central Valley Flood System Conservation Strategies
CVP	Central Valley Project
CX	cross sections
DrChecks	Design Review and Checking System
DWR	Department of Water Resources
EC	Engineer Circular
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
H&H	Hydrologic and Hydraulic Modeling
HPTRM	High Performance Turf Refinement Mat
HSDRRS	Hurricane and Storm Damage Risk Reduction System
HTRW	hazardous, toxic, or radioactive waste
IEPR	Independent External Peer Review
IFR	Integrated Feasibility Report
IWR	Institute for Water Resources
LARRMP	Los Angeles River Revitalization Master Plan
NOAA	National Oceanic and Atmospheric Administration

NER	National Ecosystem Restoration
NTP	Notice to Proceed
OEO	Outside Eligible Organization
O&M	Operations and Maintenance
OMB	Office of Management and Budget
PDT	Project Delivery Team
RED	Regional Economic Development
SAR	Safety Assurance Review
SWP	State Water Project
TAPS	Trans-Alaska Pipeline System
TSP	Tentatively Selected Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WRDA	Water Resources Development Act

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1. INTRODUCTION

The baseline study area initially considered during the planning process included 32 miles of the River within the City of Los Angeles, within a half mile of each bank. It begins at the origin of the Los Angeles River, which is the confluence of Bell Creek and Arroyo Calabasas in the northwest San Fernando Valley at Owensmouth Boulevard, and ends near the City of Vernon in the downtown Los Angeles area. Through initial investigation of constraints in the baseline study area and the identification of where ecosystem restoration might best be accomplished, the planning process defined the focused study area as the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach, which extends from the Headworks downstream to First Avenue.

This study area includes the Glendale Narrows, which is the only portion of the Los Angeles River that does not have a hardened bed (bottom of the river channel), and contains several distinctive sites and connections including the Headworks, Pollywog Park, Bette Davis Park, the Burbank Western Channel and Glendale River Walk, Griffith Park, Ferraro Fields, Verdugo Wash, Atwater Village, Taylor Yard and the Rio de Los Angeles State Park, the "Cornfields" (Los Angeles State Historic Park), Arroyo Seco, Elysian Park, "Piggyback Yard" (also known as "Los Angeles Transportation Center" as well as "Mission Yard"), and downtown Los Angeles. These sites provide key opportunities for restoration and enhanced connectivity.

The study was authorized by Senate Committee on Public Works Resolution and approved on June 25, 1969. Section 4018 of the Water Resources Development Act (WRDA) of 2007 provided authorization for a "feasibility study for environmental ecosystem restoration, flood control, recreation, and other aspects of Los Angeles River revitalization that is consistent with the goals of the Los Angeles River Revitalization Master Plan published by the city of Los Angeles…." The implementation guidance for this section identified that the scope and substance of the study under the Senate resolution is identical to the study mandated by section 4018 and directed that the ongoing study incorporate the section 4018 study. The feasibility study incorporates, where applicable, conceptual elements from the City's Los Angeles River Revitalization Master Plan (LARRMP). The City of Los Angeles, Bureau of Engineering is serving as non-Federal sponsor. The study is cost shared with the non-Federal sponsor.

The feasibility study provides an interim response to the study authority, and the study efforts will determine the feasibility of ecosystem restoration of the Los Angeles River and surrounding environment. There is no sponsor available to investigate flood risk management at this time.

The primary purpose of the proposed project and alternatives considered in the study is to restore 11 miles of the Los Angeles River from approximately Griffith Park to downtown Los Angeles. The project will be reestablishing riparian strand, freshwater marsh, and aquatic habitat communities and reconnecting the Los Angeles River to major tributaries, its historic floodplain, and the regional habitat zones of the Santa Monica, San Gabriel, and Verdugo Mountains while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem within this 11-mile reach of the

Los Angeles River. This reach will be referred to as the study area or ARBOR Reach for the purposes of this project.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Los Angeles River Ecosystem Restoration Feasibility Study (hereinafter LA River) Integrated Feasibility Report (IFR) 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, 2012) and Office of Management and Budget (OMB) bulletin *Final Information Quality Bulletin for Peer Review* (OMB, 2004). Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses.

This final report details the IEPR process, describes the IEPR panel members and their selection, and summarizes the Final Panel Comments of the IEPR Panel on the existing environmental, economic, and engineering analyses contained in the LA River review documents. The full text of the Final Panel Comments is presented in Appendix A.

2. PURPOSE OF THE IEPR

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

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

In this case, the IEPR of the LA River 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

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

3.1 Planning and Schedule

At the beginning of the Period of Performance, Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan. In addition, 53 charge questions were provided by USACE and included in the draft and final Work Plans. The final charge also included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of August 28, 2013. The review documents were provided by USACE on September 18, 2013. Note that the work items listed in Task 6 occur after the submission of this report. Battelle will enter the 17 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 closure, as a final deliverable and record of the IEPR results.

Table 1. LA River IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	8/28/2013
	Review documents available	9/18/2013
	Battelle submits draft Work Plan[a]	9/23/2013
	USACE provides comments on draft Work Plan	9/26/2013
	Battelle submits final Work Plan[a]	9/27/2013
2	Battelle requests input from USACE on the COI questionnaire	9/6/2013
	USACE provides comments on COI questionnaire	9/10/2013
	Battelle submits list of selected panel members[a]	9/11/2013
	USACE confirms the panel members have no COI	9/18/2013
	Battelle completes subcontracts for panel members	9/23/2013
3	Battelle convenes kick-off meeting with USACE	9/11/2013
	Battelle sends review documents to panel members	9/24/2013
	Battelle convenes kick-off meeting with panel members	9/24/2013
	Battelle convenes kick-off meeting with USACE and panel members	9/24/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	10/10/2013

Table1. LA River IEPR Schedule (continued)

Task	Action	Due Date
4	Panel members complete their individual reviews	10/16/2013
	Battelle provides panel members with talking points for Panel Review Teleconference	10/18/2013
	Battelle convenes Panel Review Teleconference	10/21/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	10/23/2013
	Panel members provide draft Final Panel Comments to Battelle	10/28/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	10/29 to 11/1/2013
	Battelle finalizes Final Panel Comments	11/4/2013
5	Battelle provides Final IEPR Report to panel members for review	11/6/2013
	Panel members provide comments on Final IEPR Report	11/7/2013
	Battelle submits Final IEPR Report to USACE[a]	11/8/2013
6[b]	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	11/12/2013
	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	11/12/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process	11/12/2013
	USACE provides draft PDT Evaluator Responses to Battelle	11/22/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	11/26/2013
	Panel members provide Battelle with draft BackCheck Responses	12/3/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	12/4/2013
	Battelle convenes Comment-Response Teleconference with panel members and USACE	12/5/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	12/19/2013
	Battelle provides final PDT Evaluator Responses to panel members	12/20/2013
	Panel members provide Battelle with final BackCheck Responses	12/31/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	1/3/2014
	Battelle submits pdf printout of DrChecks project file[a]	1/6/2014
	Contract End/Delivery Date	8/28/2014

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

3.2 Identification and Selection of IEPR Panel Members

The candidates for the Panel were evaluated based on their technical expertise in the following key areas: arid region riverine system ecology, socioeconomics, hydrologic and hydraulic (H&H) modeling, and geotechnical engineering. These areas correspond to the technical content of the LA River IEPR and overall scope of the LA River 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 COIs. Of these candidates, Battelle chose the most qualified individuals, confirmed their interest and availability, and ultimately selected four experts for the final Panel.

The four selected reviewers constituted the final Panel. The remaining candidates were not proposed for a variety of reasons, including lack of availability, disclosed COIs, or lack of the precise technical expertise required.

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

- Previous and/or current involvement by you or your firm[2] in the Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/Environmental Impact Statement (EIS).
- Previous and/or current involvement by you or your firm[2] in ecosystem restoration studies in the Los Angeles River Watershed including the Los Angeles County drainage area, the Los Angeles River, and its tributaries.
- Previous and/or current involvement by you or your firm[2] in the Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS related projects.
- Previous and/or current involvement by you or your firm[2] in the conceptual or actual design, construction, or operations and maintenance (O&M) of any projects in the Los

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

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

Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS, or related projects.

- Current employment by USACE.
- Previous and/or current involvement with paid or unpaid expert testimony related to Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS.
- Previous and/or current employment or affiliation (for pay or pro bono) with members of the non-Federal Sponsor: City of Los Angeles, Bureau of Engineering or with cooperating agencies or local sponsors: U.S. Fish and Wildlife Service (USFWS), the Regional Water Quality Board, the California Fish and Game Department (CAFG), the California Coastal Conservancy, or the Audubon Society, Friends of the LA River.
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to Los Angeles River Watershed including the Los Angeles County drainage area, the Los Angeles River and its tributaries.
- 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.
- Previous or current involvement with the development or testing of models that will be used for, or in support of, the Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS project.
- Current firm[2] 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.
- 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.
- Any previous employment by USACE as a contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Los Angeles District. If yes, provide title/description, dates employed, and place of employment (district, division, Headquarters, ERDC, etc.), and position/role.
- Previous experience conducting technical peer reviews. If yes, please highlight and discuss any technical reviews concerning ecosystem restoration, and include the client/agency and duration of review (approximate dates).
- Pending, current, or future financial interests in Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last three years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last three years from contracts with the non-Federal sponsor (City of Los Angeles - Bureau of Engineering).

- Any publicly documented statement (including, for example, advocating for or discouraging against) related to Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS.
- Participation in relevant prior and/or current Federal studies relevant to this project and/or Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS.
- Previous and/or current participation in prior non-Federal studies relevant to this project and/or Los Angeles River Ecosystem Restoration Feasibility Study, Draft IFR/EIS.
- 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?

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. One of the four final reviewers is affiliated with an academic institution and the remaining reviewers are affiliated with consulting companies. Battelle established subcontracts with the panel members when they indicated their willingness to participate and confirmed the absence of COIs through a signed COI form. USACE was given the list of candidate panel members, but Battelle made the final selection of the Panel. Section 4 of this report provides names and biographical information on the panel members.

3.3 Conduct of the IEPR

Prior to beginning their review and within one day of their subcontracts being finalized, all members of the Panel attended a kick-off meeting via teleconference planned and facilitated by Battelle in order to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel. Battelle planned and facilitated a second kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meetings, the IEPR Panel received an electronic version of the final charge as well as the LA River review documents and reference materials listed below. The documents and files in bold font were provided for review; the other documents were provided for reference or supplemental information only.

- **Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement, September 2013 (505 pages)**
- **Appendix A: Design (150 pages)**
- **Appendix B: Economics (164 pages)**
- **Appendix C: Cost (169 pages)**
- **Appendix D: Geotechnical (97 pages)**
- **Appendix E: Hydrology and Hydraulics (131 pages)**
- **Appendix F: Air Quality (29 pages)**
- **Appendix G: Habitat Evaluation (Combined Habitat Assessment Protocols) (161 pages)**
- **Appendix H: Supplemental Baseline Conditions Information (12 pages)**
- Appendix I: Value Engineering

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

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

- App E Hydro, p. 46/131. Section 20.2 - Memorandum for CESPL-ED, Subject: Vegetation in Los Angeles River Channel, April 2001
- App E Hydro, p. 53/131. Section 22.5 - Memorandum dated June 2012 between FEMA and USACE entitled "Federal Emergency Management Agency (FEMA)/U.S. Army Corps of Engineers (USACE), Joint Actions on Planning for Flood Risk Management Projects"
- The Reach cross sections (CX) for the Tentatively Selected Plan (TSP), Alternative 13, extracted from the HEC-RAS models.

About half way through the review of the LA River IEPR documents, a teleconference was held with USACE, the Panel, and Battelle so that USACE could answer any questions the Panel had concerning either the review documents or the project. Prior to this teleconference, Battelle submitted 37 panel member questions to USACE. USACE was able to provide responses to all but two questions during the teleconference. The remaining panel member questions that required additional coordination within USACE were addressed by USACE by October 17, 2013.

3.4 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a charge question response table provided by Battelle. At the end of the review period, the Panel produced 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. On the basis of the review, Battelle summarized the individual comments into a preliminary list of 21 overall comments and discussion points. Each panel member's individual comments were shared with the full Panel in a merged individual comments table.

3.5 IEPR Panel Teleconference

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

missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

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

At the end of these discussions, the Panel identified 15 comments and discussion points that should be brought forward as Final Panel Comments.

3.6 Preparation of Final Panel Comments

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

- Lead Responsibility: For each Final Panel Comment, one Panel member was identified as the lead author responsible for coordinating the development of the Final Panel Comment and submitting it to Battelle. Battelle modified lead assignments at the direction of the Panel. To assist each lead in the development of the Final Panel Comments, Battelle distributed the merged individual comments table, a summary detailing each draft final comment statement, an example Final Panel Comment following the four-part structure described below, and templates for the preparation of each Final Panel Comment.
- Directive to the Lead: Each lead was encouraged to communicate directly with the other panel member as needed and to contribute to a particular Final Panel Comment. If a significant comment was identified that was not covered by one of the original Final Panel Comments, the appropriate lead was instructed to draft a new Final Panel Comment.
- Format for Final Panel Comments: Each Final Panel Comment was presented as part of a four-part structure:
    1. Comment Statement (succinct summary statement of concern)
    2. Basis for Comment (details regarding the concern)
    3. Significance (high, medium, low; see description below)
    4. Recommendation(s) for Resolution (see description below).
- Criteria for Significance: The following were used as criteria for assigning a significance level to each Final Panel Comment:
    1. High: Describes a fundamental problem with the project that could affect the recommendation, success, or justification of the project. Comments rated as high indicate that the Panel analyzed or assessed the methods, models, and/or analyses and determined that there is a "showstopper" issue.

2. Medium: Affects the completeness of the report in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium indicate that the Panel does not have sufficient information to analyze or assess the methods, models, or analyses.
3. Low: Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information (tables, figures, equations, discussions) that was mislabeled or incorrect or data or report sections that were not clearly described or presented.

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

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. During the Final Panel Comment development process, the Panel determined that one of the Final Panel Comments no longer met the criteria for a high, medium, or low level significance; however, the Panel submitted three additional Final Panel Comments for consideration after the panel review teleconference that met the criteria for a high, medium, or low level significance. At the end of this process, 17 Final Panel Comments were prepared and assembled. There was no direct communication between the Panel and USACE during the preparation of the Final Panel Comments. The Final Panel Comments are presented in Appendix A of this report.

4. PANEL DESCRIPTION

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

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

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

Technical Criterion	Wilcox	Behr	Coulton	Vita
Arid Region Riverine Systems Ecology[3]				
Restoration ecologist with a minimum of 10 years of demonstrated experience in riparian ecology in arid coastal regions	X			
Experience in the Los Angeles region (preferred but not required)				
Familiar with quantification of restoration benefits	X			
Experience working in urban stream settings	X			
M.S. degree or higher in a related field	X			
Socioeconomics				
Able to evaluate the appropriateness of cost effectiveness and incremental cost analysis (CE/ICA), as applied to dollar costs and ecosystem restoration benefits		X		
Familiar with USACE tool for CE/ICA, IWR-Planning Suite		X		
Experienced in National Ecosystem Restoration analysis procedures		X		
Degree in Economics or related field		X		
Hydrologic and Hydraulic (H&H) Modeling				
Minimum 10 years of demonstrated experience in hydraulic engineering with an emphasis on large public works projects, associated with ecosystem restoration design			X	
Familiar with standard USACE H&H computer models, including experience with HEC-RAS with expertise in river engineering and channel restoration [4]			X	
Experienced in both computer simulation and physical modeling of large river systems			X	
Registered professional engineer			X	
M.S. degree or higher in engineering			X	
Geotechnical Engineering				
Minimum 10 years of experience in geotechnical engineering with extensive background in large river processes in complex systems and geotechnical theory and practice				X

[3] Screening criteria were not originally provided in the Performance Work Statement (PWS) for this discipline; however, USACE provided these technical criteria on August 8, 2013 as part of their responses to Battelle's clarifying questions submitted during the proposal phase.

[4] USACE clarified (as part of the August 8, 2013 response) that H&H modeling should include HEC-RAS with expertise in river engineering and channel restoration.

Table 2. LA River IEPR Panel: Technical Criteria and Areas of Expertise (continued)

Technical Criterion	Wilcox	Behr	Coulton	Vita
Knowledgeable in large river engineering projects				X
Knowledgeable in geomorphology				X
Knowledgeable in sediment transport				X
Knowledgeable in the design of secondary channels in large river systems				X
Knowledgeable in the design and construction of engineered structures in large rivers				X
Knowledgeable in the design and construction of foundations				X
Knowledgeable in the design and construction of earthworks				X
Experienced in the design and construction of pavement subgrades required for the construction of low-head dams				X
Familiar with large, complex Civil Works projects with high public and interagency interests				X
Registered professional engineer				X
M.S. degree or higher in engineering				X

Bradford Wilcox, Ph.D.

Role: Arid region riverine systems ecology expertise.
Affiliation: Texas A&M University

Dr.Wilcox is a Professor in the Department of Ecosystem Science and Management at Texas A&M University. He earned a Ph.D. in watershed management and hydrology from New Mexico State University in 1986. He has more than 28 years of experience in the area of semiarid watershed management, ecohydrology, and restoration. He is an internationally recognized expert in the hydrology of semiarid landscapes and rivers including the implications of, and strategies for, restoration of these landscapes.

Dr. Wilcox is knowledgeable in restoration ecology through his work in academia, government research, and National Laboratories. He has led a number of national and international studies doing comparative analysis of different semiarid landscapes notably those in the coastal California region. While with the Los Alamos National Laboratory, he was responsible for several multimillion-dollar restoration projects of semiarid landscapes. He has worked in the semiarid coastal areas of South Texas and extensively throughout the western U.S., including Idaho, New Mexico, and Wyoming. During his time as a government researcher with the USDA agricultural research service, he was stationed at the Northwest Watershed Research Center, which has a heavy focus on hydrology of semiarid mountain climates.

Dr. Wilcox is familiar with the methodologies for quantifying restoration benefits. He has served on numerous national panels evaluating the benefits of restoration including several USACE IEPR Panels. He is familiar with many aspects of watershed management including the regulatory framework, planning, restoration, and river form and function. He has developed a research and teaching program aimed at understanding riparian systems and how river management affects the water quantity, quality and river attributes of these systems.

His expertise includes understanding the implications of land cover change, including urbanization, to the hydrology of semiarid landscapes. He teaches courses, both graduate and undergraduate, with a heavy emphasis on restoration and ecohydrology of both arid and semiarid landscapes and rivers. He incorporates sections on urban hydrology and the impacts of urbanization into these courses. Additionally, he served on an IEPR Panel that focused on urban streams in a coastal area of semiarid Texas. He has published more than 75 peer-reviewed publications, including articles in Arid Land Research and Management and Journal of Arid Environments. Many of his publications focus on the hydrology of rivers. He is a member of the American Geophysical Union, Ecological Society of America, and the Society for Range Management.

Christopher Behr

Role: Socioeconomics expertise.
Affiliation: HDR Inc.

Mr. Behr is an economist with an engineering background working for HDR Engineering Inc. in Silver Spring, Maryland. He earned his M.S. in natural resource economics from the University of Wisconsin in 1994 and his M.S. in civil and environmental engineering in 2001 from Cornell University. He has 19 years of experience evaluating infrastructure investments and assessing environmental impacts, especially in the water and wastewater sector. He brings a diverse set of analytical tools such as cost-benefit analyses, cost-risk analyses, environmental valuation, and statistics to his projects.

He is experienced in evaluating the appropriateness of CE/ICA as applied to dollar cost and ecosystem restoration benefits, and is familiar with the Institute for Water Resources (IWR)-Planning Suite. He has provided guidance and quality control on CE/ICA for USACE Portland District on such projects as Abernathy Creek Ecosystem Restoration, Oregon and the Dairy Creek Ecosystem Restoration, Oregon. The first project evaluated different measures for suitability in the restoration of a tidal estuary on the Abernathy Creek. The analysis evaluated the benefits from habitat restoration using USACE habitat suitability indices against project costs. The second project evaluated different measures for suitability in the restoration of a riparian habitat on the Dairy Creek and, similarly, evaluated the benefits from habitat restoration using USACE habitat suitability indices against project costs.

Mr. Behr has experience with high visibility, large, complex Civil Works projects as an economist, including his participation in the USACE Hurricane System Protection-Phase II project, New Orleans District. He managed a team to assess the cost of planned construction

activities for rebuilding the New Orleans Hurricane System Protection. This work included a market analysis of construction components and a cost and schedule risk assessment. The final results incorporated uncertainties due to risks and price forecasts. For the Metropolitan Water District of Southern California, Mr. Behr served as the principal economist and conducted a market and risk analysis of a new water supply. The new canal would divert water from the Sacramento River to the State Water Project and Central Valley Project. The analysis combined an assessment of escalation of key construction components and cost and schedule risk assessment.

Mr. Behr is familiar with the National Ecosystem Restoration (NER) analysis procedures, having reviewed project methods for assessing ecosystem impacts and incorporating results into decision-making metrics. On the Yakima River Basin Study and Integrated Water Resource Management Plan, he was the principal economist and provided guidance on a National Elevation Dataset model to estimate the value of water management improvement on the Yakima River.

Kevin Coulton, P.E., CFM

Role: H&H modeling experience and expertise.
Affiliation: cbec, inc.

Mr. Coulton is a water resources engineer with cbec, inc. and has more than 28 years of experience in hydraulic engineering with many of those years focused on ecosystem restoration planning and design. His experience includes riverine and coastal flood studies in the Pacific Northwest for the Federal Emergency Management Agency (FEMA) and state and local governments in California, Washington, Oregon, Idaho and Montana. He earned his M.S. in civil/hydraulic engineering from Washington State University. He is a registered professional engineer in the states of California, Idaho, Montana, Oregon and Washington and a Certified Floodplain Manager (CFM).

Mr. Coulton has experience in hydraulic engineering associated with ecosystem restoration planning and design through projects for the California Department of Water Resources (DWR) including: the California Central Valley Flood System Conservation Strategies (CVFSCS): Methodology to Assess Floodway Elevation Lowering and Levee Setback Actions; FloodSAFE California Central Valley Flood Protection Plan (CVFPP): Floodplain Restoration Opportunity Analysis; and through other projects such as Natural Floodway Investigations for the Washington State Department of Ecology; Grant Creek Environmental Restoration/Flood Control project for Missoula County, Montana; Edgewater Park Side-Channel Restoration Design project for the City of Mt. Vernon, Washington; and the Williamson River Delta Restoration Planning and Concept Design for The Nature Conservancy.

Mr. Coulton has significant experience with standard USACE H&H computer models including HEC-RAS, HEC-1, HEC-HMS, HEC-2, SWMM, TR-55, TR-20, WSPRO, HSPF, FLO-2D, MIKE-11, BEACH modeling packages, as well as ESRI's Geographic Information Systems (GIS) software, which he used to analyze the entire U.S. to assess national flood risk. He understands the modeling techniques for the HEC-FDA program and has performed benefit-cost

analyses for FEMA that use similar data and techniques such as stage-discharge functions, stage-damage functions, and damage categories. Mr. Coulton managed and reviewed the development of HEC-HMS models to assess flood peak flows to the Rio Santa Catarina, Mexico. He also developed an HEC-HMS model to assess runoff in the 5 Mile Creek watershed near Boise, Idaho. Mr. Coulton understands the modeling techniques used in HEC-5 and HEC-RES-SIM, and he has used the HEC-3 model to simulate the operation of reservoir systems. He also developed a HEC-RAS model to evaluate flooding and sediment transport on Grant Creek in Missoula, Montana, and managed the development of a HEC-RAS model of the Feather River during the California DWR Central Valley Floodplain Evaluation and Delineation (CVFED) program. Mr. Coulton understands the modeling techniques used for applying the UNET model, such as unsteady flow, bridge hydraulics, submerged flow, and storage areas. Mr. Coulton was responsible for managing the development of FLO-2D models for the Feather River, Honcut Creek, Yuba River North, Bear River, Yankee Slough, and Coon Creek during the California DWR CVFED program. In addition, as part of an Environmental Impact Statement, he managed the development of a FLO-2D model to assess flood inundation in downtown Los Angeles from the failure of a 10 million gallon cooling tank.

Mr. Coulton has experience in physical modeling of large river systems. He has applied numerical models and/or managed the modeling of the Sacramento and San Joaquin Rivers in California, the Willamette River in Oregon, and the Flathead River in Montana. In addition, his graduate schoolwork involved physical modeling of open channel flow, field work related to stream restoration and fish passage, and coursework on fluid dynamics and open channel hydraulics. He has published in several peer-reviewed publications focused on topics such as ecosystem restoration, river restoration, and floodplain management. Mr. Coulton is a member of the Association of State Floodplain Managers, Northwest Regional Floodplain Managers Association, and American Society of Civil Engineers.

Charles Vita, Ph.D., P.E., G.E.

Role: Geotechnical engineering experience and expertise.
Affiliation: AECOM

Dr. Vita is Senior Technical Advisor with AECOM. He has 40 years of professional geotechnical engineering experience, with an extensive background in large river processes in complex systems and in geotechnical theory and practice. He earned a Ph.D. in civil engineering from the University of Washington in 1985, and a B.S. (1972) and M.S. (1973) in civil engineering from the University of California Berkeley; he is a registered Professional Civil Engineer in California, Alaska, and Washington State and a registered Geotechnical Engineer in California. He is also familiar with conducting safety assurance reviews (SAR) for IEPRs.

Dr. Vita is knowledgeable in large river engineering projects from his experience working on the Coeur d'Alene River Basin Project, the Sacramento River (California Levee Evaluation Project), and the Puyallup River. As principal engineer for the Coeur d'Alene River Basin Project, he provided comprehensive engineering support to EPA for the 1,500-square-mile basin-wide cleanup of historical mining sites. Mixed mining waste and sediments affected various media, including soil, groundwater, surface water, and sediments, in the river basin as well as adjacent

floodplains, lakes, and wetlands. He served as a principal engineer on the California Urban Levee Evaluation project team responsible for developing and implementing a major levee geotechnical evaluation program. He authored sections of the guidance document for geotechnical analyses, including integration with slope stability analyses and problematic foundations soils included interbedded sands and silts and soft to very soft clays. For the Puyallup River (Washington state) project, Dr. Vita provided geotechnical support to the National Oceanic and Atmospheric Administration (NOAA) on the 3,500-ft long ring levee that is part of their Sha Dadx Habitat Restoration Project. As part of the Pearson Field Airport Surface Water Drainage Evaluation (in Vancouver, Washington), Dr. Vita evaluated the need and applicability of flood mitigation using engineered surface water drainage controls. Based on available hydrologic data, he estimated the probability of the Columbia River rising to an elevation that could adversely impact airport operations by flooding.

He has extensive knowledge in geomorphology based on his doctoral research, general geotechnical practice and project experience including the Alaska Natural Gas Transportation System (ANGTS), Coeur d'Alene River Basin Project, and also from the California Levee Evaluation program. He has additional experience and knowledge in sediment transport and design of secondary channels in large river systems from serving as principal engineer on the Coeur d'Alene River Basin Project, the Puyallup River ring levee, and the Trans-Alaska Pipeline System (TAPS) Project, along with various forensic engineering projects.

Dr. Vita is familiar with geotechnical practices associated with the design and construction of engineered structures in large rivers, foundations, and earthworks from 40 years of geotechnical engineering practice on projects such as the Coeur d'Alene River Basin Project, California Levee Evaluation Program, and his early experience at the Los Angeles County Flood Control District. He is knowledgeable in the design and construction of pavement subgrades required for the construction of low-head dams based on focused research and knowledge of pavement design and dam-levee hydraulic principles.

Dr. Vita is familiar with large, complex Civil Works projects with high public and interagency interests based on his experience on the Bremerton Naval Complex Projects, TAPS, ANGTS, and the Coeur d'Alene River Basin Project. He has provided peer review support on the greater New Orleans Hurricane and Storm Damage Risk Reduction System (HSDRRS) Design Guidelines, the Morganza to the Gulf Project, New Orleans to Venice Project, and provided detailed geotechnical review for the New Orleans East Levee Improvement Program. He also served as an independent expert technical reviewer for the Coastal Ecosystem Restoration Project as part of a multidisciplinary team of engineers, wetland ecologists, and resource economists. Issues he focused on included effects of relative sea level rise, adequacy and limitations of hydraulic modeling, geotechnical stability of cuts and dredge fills of very soft sediments, and adequacy of the cost risk analysis.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one other on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the LA River IEPR review document. Table 3 lists the Final

Panel Comments statements by level of significance. The full text of the Final Panel Comments is presented in Appendix A of this report. The following summarizes the Panel's findings.

The Panel agreed that the LA River review documents and appendices are well written and provide a very comprehensive description of background information. The evaluation of the different alternatives is quite complete and presents a sound comparison. The Panel recognizes that the LA River Ecosystem Restoration Feasibility Study represents a high-quality effort to restore the riverine ecosystem within the ARBOR Reach that is clearly the result of a long and detailed study, with high local and regional importance. While the Panel deemed the report well-written with robust documentation in many areas, it identified areas where additional documentation and clarification is warranted.

Ecology – The Panel found the Combined Habitat Assessment Protocol (CHAP) habitat analysis to be very impressive. Using the CHAP methodology, a comprehensive analysis of current conditions, future conditions without remediation, and an evaluation of the alternatives have been conducted in a reasonable and defensible fashion. Assumptions are clearly laid out with respect to what the restoration would mean to the type and amount of habitat; however, an assessment of monitoring needs, maintenance activities, and adaptive management strategies to assess the extent to which the project has achieved or not achieved the goals and objectives of the project is not well described. Post-project monitoring and maintenance actions to evaluate how successfully the project met the project objectives could be documented in the IFR to address this.

In addition, risk and uncertainty associated with various aspects of the project have not been clearly identified and communicated, particularly regarding the hydrologic and ecological restoration components. The Panel noted that there was little consideration of the risks and risk mitigation that could affect the success of the restoration, such as adverse weather, disease, invasive species, stresses from the surrounding urban environment, and human disturbance. A thorough evaluation and comparison of the array of alternatives is not complete without considering associated risks and uncertainties. The Panel believes this issue can be addressed by conducting a hydrologic risk and uncertainty analysis of the predicted flooding following completion of the project; evaluating the risk to, and uncertainty of, the future success of ecological restoration activities, including effects of failures of plantings, disease, disturbance from invasive species, human activities, stresses created by surrounding urbanization, and future climate change; and potentially revising cost estimates to account for higher than expected long-term operations and maintenance (O&M) costs to achieve stated restoration goals.

Hydrologic and Hydraulic Modeling – USACE has accomplished an extensive amount of H&H modeling work and has documented this work in a comprehensive manner. This project presents a unique goal to restore a major river system in the midst of a highly developed urban setting; the H&H data, tools, and analyses initiated for this project provide an effective means to achieve this goal. However, the Panel believes that creation of a fully viable and technically sound project requires that flood risk management, which is the primary purpose and (historic) function of the Los Angeles River channel, be considered an explicit objective as part of the ecosystem restoration project. The flood risk management capacity of the Los Angeles River channel, which is significantly compromised by existing channel vegetation and sediment, could

prove severely problematic to ecological restoration as envisioned in the IFR. While not clearly acknowledged or discussed in the IFR (other than in Appendix E), it seems to the Panel that this leaves open the possibility that existing vegetation and sediment may be removed, and that removal could be extensive, which may conflict with project objectives for ecosystem restoration and may potentially affect the selected alternative. The Panel believes this concern can be addressed by integrating flood risk management into the existing list of planning objectives and reconciling the discussion of flood risk management in the IFR with a much more cautious and provisional discussion in Appendix E of channel vegetation and potential ecological restoration elements on channel flow conveyance capacity and associated flood risk.

The hydrologic analyses and hydraulic modeling are focused on design storms and flood event conditions to assess conveyance capacity, but do not consider the more frequent seasonal flows and low flows to understand how the restored river system can be sustained over time. The Panel found no discussion of the perennial effluent base flow in terms of how it will impose a different hydrologic condition on the river system – when compared to the historic ephemeral flow condition. The likelihood that the restored conditions of the Tentatively Selected Plan (TSP) channel and floodplain can be sustained is uncertain because not enough data, analyses, and results have been presented for the perennial base flow and seasonal hydrology. The Panel believes this can be addressed by discussing the fundamental change from an ephemeral to perennial hydrologic condition and how this change may affect the ability to restore the physical functions and ecological habitats that were historically present in the Los Angeles River system, reviewing project hydrology considerations, and expanding the discussion in Appendix E on how the models were applied to achieve planning objectives and why other models, such as HEC-EFM, were not applied in this project to better understand ecosystem responses to changes in the flow regime of the river and/or connected wetlands.

Geotechnical Engineering – From a geotechnical engineering perspective, the Panel generally agreed with the geotechnical considerations and design constraints identified in Appendix D and the related risks identified in the Abbreviated Risk Analysis (ARA) of Appendix C. The Panel was concerned that the proposed replacement of grouted rip-rap and reinforced concrete on affected channel slopes by geosynthetic High Performance Turf Refinement Mat (HPTRM) has not been analyzed or fully qualified for structural and geotechnical stability during extreme flood conditions. While the design flow velocities generally exceed the 12 fps maximum for planting, the Panel notes that there appears to be no maximum permissible velocity for channel sections where a geosynthetic HPTRM will be used to replace the hard armoring of grouted rip-rap and reinforced concrete on channel slopes. Replacement of hard armoring by HPTRM will be a major element of the ecological restoration. The Panel believes this concern can be addressed by clarifying the ability of HPTRM to resist potentially high flow velocities and prevent or minimize structural and geotechnical instability and damage to the channel, including physical elements of the ecological restoration, during flood events and confirm that the TSP can be implemented in such a way as to achieve ecological objectives while preventing unacceptable performance in areas where HPTRM is used to replace grouted rip-rap and reinforced concrete on channel slopes.

Socioeconomics – The Panel found that the economic analysis was conducted in a reasonable process for National Ecosystem Restoration (NER) performed using the certified Institute for

Water Resources (IWR) Planning Suite (IWR Plan), utilizing standard recreational benefit evaluation methods, and economic impact models for Regional Economic Development (RED). The economics framework adopts reasonable methodologies because IWR Plan is used to implement the Cost Effectiveness and Incremental Cost Analysis (CE/ICA) evaluation.

Of concern, however, is that the cost schedule risk analysis does not adequately account for uncertainties in capital and O&M costs, especially related to long-term restoration success. A more comprehensive (and quantitative) evaluation and documentation of capital and long-term O&M costs for ecosystem restoration elements is warranted because the risks could potentially affect the selected alternative. The Panel believes this issue can be addressed by providing a more comprehensive discussion of the methods and assumptions applied in an Abbreviated Risk Analysis (ARA) method, explaining why an ARA method was used, and conducting a separate risk analysis of O&M costs, especially the costs of long-term adaptive management of restored ecosystem services.

Table 3. Overview of 17 Final Panel Comments Identified by the LA River IEPR Panel

No.	Final Panel Comment
	Significance – High
1	Flood risk management has not been effectively integrated with the objectives of the ecological restoration project, yet is a primary purpose and function of the Los Angeles River.
2	The cost schedule risk analysis does not adequately account for uncertainties in capital and O&M costs, especially related to long-term restoration success.
3	The hydrologic analyses and hydraulic modeling are focused on design storms and flood event conditions to assess conveyance capacity, but do not consider the more frequent seasonal flows and low flows to understand how the restored river system can be sustained over time.
4	The proposed replacement of grouted rip-rap and reinforced concrete on affected channel slopes by geosynthetic HPTRM has not been analyzed or fully qualified for structural and geotechnical stability during extreme flood conditions.
	Significance – Medium
5	Risk and uncertainty associated with various aspects of the project have not been clearly identified and communicated, particularly regarding the hydrologic and ecological restoration components.
6	Post-project monitoring, maintenance, and adaptive management, while necessary for success of the TSP, are not well described in the IFR.
7	The interaction between the restored landcapes and the wider ecosystem has not been fully considered.
8	Conflicts and issues related to cleanup of HTRW chemicals and CERCLA hazardous waste may emerge during plan implementation as cleanup issues and costs manifest, affecting the TSP.
9	The water budget discussion in Appendix E characterizes water budget parameters, but these parameters have not been applied in a water budget analysis.
10	Groundwater conditions specific to the project reaches have not been fully described and data are lacking, especially on groundwater/surface water exchanges.

Table 3. Overview of 17 Final Panel Comments Identified by the LA River IEPR Panel (continued)

No.	Final Panel Comment
11	The Integrated Feasibility Report and Appendices do not provide an analysis of sediment processes, which is a component of a planning objective for the restoration project.
12	It is not clear whether the Tentatively Selected Plan is consistent with the goals of the Los Angeles River Revitalization Master Plan, as directed by WRDA 2007.
13	Cost estimates for the eight specific reaches comprising the ARBOR Reach have not been identified for each of the four final alternatives and the TSP in particular.
14	Future without project conditions related to operation and maintenance, population growth, climate change and hydrology are not adequately described.
15	The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or supporting data are not provided.
Significance – Low	
16	Reach cross sections for the Tentatively Selected Plan have not been presented in a consistent and clear way.
17	The reasonableness of key drivers in estimating recreational benefits has not been substantiated with local data.

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APPENDIX A

Final Panel Comments

on the

LA River IEPR

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Final Panel Comment 1

Flood risk management has not been effectively integrated with the objectives of the ecological restoration project, yet is a primary purpose and function of the Los Angeles River.

Basis for Comment

The Panel believes that creation of a fully viable and technically sound project requires that flood risk management, which is the primary purpose and function of the Los Angeles River channel, be considered an explicit objective as part of this ecosystem restoration project. The Panel notes that Appendix E Hydrology and Hydraulics, Section 1 states that "any ecosystem project evaluated in this study must not negatively impact the flood risk management function of the system," however, Section 22.5 (Point 1) states that "flood risk management is not within the scope of the current Ecosystem Restoration Feasibility Study" because, per the Integrated Feasibility Report (IFR), Section 1.2.4, "there is no sponsor available to investigate flood risk management at this time."

The flood risk management capacity of the Los Angeles River channel, which is significantly compromised by existing channel vegetation and sediment, could prove severely problematic to the ecological restoration as envisioned in the IFR. The Tentatively Selected Plan (TSP) has been formulated to not increase *existing* flood risk by not increasing maximum water surface elevations or creating excessive maximum water velocities within the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach. However, the current level of flood protection is only about 11% Annual Chance Exceedance (ACE), or a 9-year event (Appendix E, p. 40, Point 3), a reduction from a 4% ACE, or 25-year event, due to the present level of vegetation and sediment. Appendix E states that "the proposed restoration features (new structures and vegetation put in place under the proposed project) will be designed to minimize impacts to conveyance capacity" and that "existing vegetation and sediment not associated with the restoration features will also be considered."

While not clearly acknowledged or discussed in the IFR (other than as indicated in Appendix E), it seems to the Panel that this leaves open the possibility that existing vegetation and sediment may be removed, and that removal could be extensive, which may conflict with project expectations and may potentially affect the selected alternative. Moreover, because so much of the hydraulic and geotechnical design has been deferred into the future (as stated in Appendix E and Appendix G), there is a risk that the level of flood protection actually achievable in the ARBOR under the TSP may later prove unacceptable from a flood risk standpoint.

There appears to be a potential latent need, which is presently undocumented in the IFR, to increase the level of future flood protection (i.e., reduce risk) during implementation of the TSP – providing that increased level of flood risk management could impact the TSP, and vice versa. The potential cost and ecological impact of providing an increased level of flood risk management are not considered in the IFR, and an assessment of periodic flood damage to the restoration features also seems to be lacking in the IFR. Also, the IFR does not address how any of the alternatives, including the TSP, would provide robustness, resilience, and redundancy consistent with the potential threat to public safety inherent in the project.

Significance – High

The major issue and challenge facing the project is acceptably resolving the conflicts and tradeoffs between the Los Angeles River's flood management objective (its primary and historic

function) and the objectives of the ecological restoration.

Recommendations for Resolution

1. Consider integrating flood risk management into the existing list of planning objectives. Reconcile the discussion and framing of flood risk management in the IFR with the much more cautious and provisional discussion in Appendix E of channel vegetation and potential ecological restoration elements on channel flow conveyance capacity and associated flood risk.
2. Acknowledge and discuss in the IFR that the de facto level of flood risk may not prove acceptable and will have to be decreased, which could complicate the current project as formulated and potentially change the TSP and affect project cost and schedule.
3. Explain in the IFR how the TSP could (or could not) accommodate an increased level of flood protection (decreased flood risk) in the ARBOR Reach.
4. Explain in the IFR how the alternatives, including the TSP, would provide robustness, resilience, and redundancy consistent with the potential threat to public safety inherent in the project.
5. Clarify the intent to identify a sponsor to investigate flood risk management in the future for this project.

Final Panel Comment 2

The cost schedule risk analysis does not adequately account for uncertainties in capital and O&M costs, especially related to long-term restoration success.

Basis for Comment

An Abbreviated Risk Analysis (ARA) was completed for the total project capital cost; its findings are documented in Attachment 7 of the Cost Appendix. The ARA identifies a series of risks that could affect capital costs and qualitatively scores each feature of work in terms of the likelihood that it would occur and the impact if it did occur. Through this process, a risk-adjusted contingency was developed and applied to estimated total capital costs. The contingencies range from 13.44% to over 47.10% for different cost items (Cost Appendix, p. 7-2).

Since capital construction costs, for even the lowest cost alternative of channel works alone exceed $50M, a more quantitative and detailed analysis of risks is warranted. This finding is consistent with USACE guidelines that define ARA to be “an acceptable method in addressing the regulations for risk based analysis for Total Project Costs under $40 million.” (USACE, 2013). The Panel finds that the estimated contingencies from the ARA may be too low. According to USACE (2009), a “rule of thumb is that for a feasibility level estimate, a healthy contingency at 80% confidence should land between 20% and 30%, or between 30% and 40% for a controversial, high-risk (and easy to document and defend) project.” The Panel also finds that a more detailed quantitative analysis is warranted because of the high-risk nature of much of the work (e.g., construction occurs in a flood channel) and because the constructed systems are altogether new to the site and must be integrated with existing systems.

In addition, annual operations and maintenance (O&M) costs have been developed as a percentage of capital construction costs; the percentages range from 0.25% to 2.5% for different cost items. These construction items are likely to be only partially reflective of the full O&M costs necessary to achieve restoration. While the estimated risk-based contingencies are incorporated into annual O&M costs, O&M costs for long-term adaptive management and maintenance of restored ecosystem habitats are not identified separately. Given that habitat restoration is targeted for a highly degraded environment, O&M costs could be substantially greater than conventional estimates. Therefore, it is not clear if the current estimated O&M costs are sufficient; more research on actual case studies may be required. O&M costs are assumed to be a percentage of construction costs, which entail their own independent risks. Given the highly degraded baseline conditions, annual O&M costs to maintain the habitat functions over the long term could be substantially higher.

Ultimately, the Panel found little documentation to assess the adequacy of the methods and assumptions employed in the ARA on construction costs. While the Panel recognizes that many relevant risks for construction costs have been reasonably identified and recorded in a risk register, no information is provided to assess how risks translate into quantitative cost contingences. A much more substantive discussion of risk and uncertainty (over a range of issues) should be included in the final Integrated Feasibility Report (IFR). The IFR could incorporate the information on key risks from the risk register and discuss risk and uncertainty in the main text of the IFR.

An example of the implication of this issue: Project groups 10, 13, 16, and 20 are determined in part by their relative cost-effectiveness. One or more of them could prove to be more expensive than estimated after a detailed risk analysis, and would then be shifted to another project group.

Without a risk analysis, it is difficult to know the likelihood of this occurring, and overall the robustness of the projects selected to be part of a group.

Significance – High

A more comprehensive (and quantitative) evaluation and documentation of capital and long-term O&M costs for ecosystem restoration elements is warranted because the risks could potentially affect the selected alternative.

Recommendations for Resolution

1. Provide a more comprehensive discussion of the methods and assumptions applied in an ARA method; explain why an ARA method was used, in contradiction to USACE guidelines.
2. Conduct a separate risk analysis of O&M costs, especially the costs of long-term adaptive management of restored ecosystem services. Justify assumptions using research on costs conducted elsewhere.
3. Articulate assumptions related to O&M costs of ensuring habitat function. Clarify whether a cost estimate based on a percentage of capital costs is sufficient.
4. Implementing a more comprehensive and quantitative analysis of cost and schedule risks according to USACE (2009) guidelines. This analysis should jointly account for risks in the cost of restoring services and the risk of achieving these services.

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USACE (2013). Walla Walla District Cost Engineering Mission. Risk Analysis. http://www.nww.usace.army.mil/Missions/CostEngineering.aspx

Final Panel Comment 3

The hydrologic analyses and hydraulic modeling are focused on design storms and flood event conditions to assess conveyance capacity, but do not consider the more frequent seasonal flows and low flows to understand how the restored river system can be sustained over time.

Basis for Comment

Much of the Los Angeles River was historically an ephemeral stream, described in Section ES.2 of the Integrated Feasibility Report (IFR). Sections 1.2.3, 2.1.1, and 2.1.2 of the IFR describe in detail the characteristics of ephemeral river ecosystems in the southwestern U.S. The current river system, however, is an "effluent-dominated waterbody" with "nearly 70 percent of the [water] volume in the River…from Water Reclamation Plant tertiary-treated effluent discharged outside of storm events" (Section 3.4.3). Section 1.1.2 states perennial surface flow will provide a base for restoration; however, the first planning objective in Section ES.5 calls for the "restoration of…a more natural hydrologic and hydraulic regime."

The Panel found no discussion of the perennial effluent base flow in terms of how it will impose a different hydrologic condition on the river system – when compared to the historic ephemeral flow condition – and how this fundamentally changed hydrologic condition may affect the objective to restore physical functions and ecological habitats that were historically present in the Los Angeles River system. Since the project is guided by planning objectives to restore freshwater marsh habitat and native fish habitat, the Panel believes the lack of discussion and analysis of this perennial base flow and frequent seasonal flows is a significant omission for understanding seasonal ground water-surface water interactions and the design requirements for a channel necessary to restore and sustain in-channel habitats.

The hydrologic data and analyses in Appendix E are primarily focused on design storms and flood event discharges. The Panel found no data or discussion on the magnitude and/or seasonal fluctuations of the effluent discharge in the IFR or Appendix E, or to seasonal flow contributions in addition to the effluent discharges. There is some discussion in Appendix E about average daily flows (Section 10.2), but these flow rates are presented in the context of the water budget and are not incorporated into subsequent hydraulic modeling to assess the ecological aspects of these flows. The Panel notes that Sections C-2.1.5 and C-2.1.6 of ER 1110-2-1150 (USACE, 1999) specifically state that the engineering appendix to the feasibility study report shall include a hydrologic study that analyzes stage-discharge relationships and flow duration.

Section 3.10 of the IFR describes the aesthetics of the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach as "malodorous throughout the year" with respect to the treatment plant effluent combined with debris and litter. The Panel questions if this negative aesthetic of the hydrology will change with the Tentatively Selected Plan (TSP). For example, even though the effluent is tertiary-treated it would be important to know the specific water quality condition of this flow because it will apparently dominate the seasonal hydrology of the restored river system. The Panel notes that the quality of the tributary stormwater discharges is described in Appendix E of the IFR.

The Panel noted that the Appendix A narrative and cross sections describe a 20-foot wide low flow channel beginning in the Glendale Freeway to I-5 sub-reach and extending downstream, with this channel width maintained across grade control structures together with a 2-foot deep

centerline notch. However, the Panel found no hydraulic design data in Appendix A or E for this low flow channel and it is unclear if it was designed to convey the perennial effluent flow and/or other seasonal flows.

In addition, the hydraulic modeling appears to be focused only on flood event conditions (10%, 4%, 2%, 1%, 0.5%, and 0.2% Annual Chance Exceedance [ACE] events) to analyze the flood conveyance capacity of the river. The most significant omission in the hydraulic analysis is the apparent lack of hydraulic model runs analyzing more frequent floods, seasonal flows, and the perennial base flow that would provide information on the ability of a particular alternative to sustain vegetation and habitat. In other words, while the focus of the IFR is on ecosystem restoration, the hydraulic modeling appears to be solely focused on an analysis of flood conveyance capacity and not the ecological aspects of streamflow.

Significance – High

The likelihood that the restored conditions of the TSP channel and floodplain can be sustained is uncertain because not enough data, analyses, and results have been presented with respect to the perennial base flow and seasonal hydrology.

Recommendations for Resolution

1. Discuss the fundamental change from an ephemeral to perennial hydrologic condition and how this change may affect the ability to restore the physical functions and ecological habitats that were historically present in the Los Angeles River system.
2. Review the project hydrology considerations, especially with reference to USACE guidelines such as ER 1110-2-1150 (USACE, 1999), Fripp et al. (2001), and Watson et al. (1999), and expand the hydrologic and hydraulic analyses in Appendix E to include the perennial effluent base flow, the channel-forming discharge, and a flow duration analysis.
3. Clarify whether and how the “malodorous” negative aesthetic of the treatment plant effluent combined with debris and litter will change with the TSP.
4. Clarify the hydrologic and hydraulic design of the low flow channel.
5. Expand the discussion in Appendix E on how the HEC-RAS and HEC-GeoRAS models were applied to achieve planning objectives and why other models, such as HEC-EFM, were not applied in this project to better understand ecosystem responses to changes in the flow regime of a river and/or connected wetlands.

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Final Panel Comment 4

The proposed replacement of grouted rip-rap and reinforced concrete on affected channel slopes by geosynthetic HPTRM has not been analyzed or fully qualified for structural and geotechnical stability during extreme flood conditions.

Basis for Comment

Design flow velocities in the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach are estimated to generally exceed 12 feet per second (fps), and exceed 30 fps in some reaches, according to Appendix E Plate 9. Also, according to Appendix E Section 20, the project is setting 8 fps as the maximum permissible velocity for the unlined portions of the project reach without supplemental protections, and 12 fps as the maximum recommended for planting.

While the design flow velocities generally exceed the 12 fps maximum for planting, the Panel notes that there appears to be no maximum permissible velocity for channel sections where a geosynthetic High Performance Turf Refinement Mat (HPTRM) will be used to replace the hard armoring of grouted rip-rap and reinforced concrete on channel slopes. Replacement of hard armoring by HPTRM will be a major element of the ecological restoration. The Panel is concerned that flow conditions in affected channel sections during extreme flood events could exceed the ability of HPTRM to resist structural and geotechnical instability and damage in these reaches. The capacity and reliability of HPTRM to resist extreme but realistic potential flow conditions (high velocities, particularly at high stage and longer durations) have not been addressed in the Integrated Feasibility Report (IFR) or its appendices (Appendices A, E, or D).

Significance – High

Structural and geotechnical stability of the channel during extreme flood events is critical and necessary for both ecological restoration and flood risk management.

Recommendations for Resolution

1. Address in the IFR the issue of HPTRM ability to resist potentially high flow velocities and prevent or minimize structural and geotechnical instability and damage to the channel, including physical elements of the ecological restoration, during flood events.
2. Identify measures that may be used to prevent unacceptable performance (as stated in Recommendation 1) in areas where HPTM is used to replace grouted rip-rap and reinforced concrete on channel slopes.
3. Confirm that the Tentatively Selected Plan can be implemented in such a way as to achieve ecological objectives while preventing unacceptable performance (as stated in Recommendation 1) in areas where HPTRM is used to replace grouted rip-rap and reinforced concrete on channel slopes.

Final Panel Comment 5

Risk and uncertainty associated with various aspects of the project have not been clearly identified and communicated, particularly regarding the hydrologic and ecological restoration components.

Basis for Comment

A project of this complexity entails a certain level of risk, as well as uncertainty associated with both the implementation of the restoration activities and achievement of the stated goals. The Panel noted that there was little consideration of the risks and risk mitigation that could affect the success of the restoration including adverse weather, disease, invasive species, stresses from the surrounding urban environment, and human disturbance. A thorough evaluation and comparison of the array of alternatives is not complete without a consideration of associated risks and uncertainties.

The Panel noted guidance in ER 1110-2-1150, Section 13.5.9, which calls for an engineering assessment during the feasibility phase to "assess risk and uncertainty for safety and functional objectives clearly estimating and displaying the probable performance of the selected plan in accordance with current risk and uncertainty analysis policy and criteria."

The Panel noted that in addition to the absence of a discussion of risk and uncertainty associated with ecological restoration elements of the Tentatively Selected Plan (TSP), the Integrated Feasibility Report (IFR) lacks a discussion of hydrologic risk and uncertainty in Appendix E. Section C-2.1.9. in ER 1110-2-1150 states that hydrologic studies shall include, "Risk and uncertainty analysis for sizing of the project under study."

Significance – Medium

A clear understanding and thorough evaluation of risk and uncertainty is necessary to choose the appropriate restoration alternative and thereby increase the likelihood of achieving the objectives of the ecological restoration.

Recommendations for Resolution

1. Conduct a hydrologic risk and uncertainty analysis of predicted flooding for the with-project condition; document the analysis and results in the final IFR.
2. Evaluate the risk to, and uncertainty of, the future success of ecological restoration activities, including effects of failures of plantings, disease, disturbance from invasive species, human activities, stresses created by surrounding urbanization, and future climate change; document the evaluation in the final IFR.
3. Based on findings of the performance risk analysis, revised cost estimates should be developed to account for higher than expected long-term O&M costs to achieve stated restoration goals.

Literature Cited:

USACE (1999). Engineering and Design – Engineering and Design for Civil Works Projects. Engineer Regulation (ER) 1110-2-1150. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 31 August.
http://140.194.76.129/publications/eng-regs/ER_1110-2-1150/ER_1110-2-1150.pdf

Final Panel Comment 6

Post-project monitoring, maintenance, and adaptive management, while necessary for success of the TSP, are not well described in the IFR.

Basis for Comment

There was relatively little detail in the documentation concerning post-project monitoring, maintenance, and adaptive management. Post-project activities are critical to both assessing the success of the project and increasing the chances that objectives will be fully realized. A well-developed post-project management plan with respect to monitoring, maintenance, and adaptive management will be useful on a number of levels, but in particular, will aid in identifying issues critical to the success of the project that may not have been previously identified (e.g., potential planting failure, unfavorable climate, invasive species, human interference, and stresses related to proximity to urban areas) and will potentially improve the ability to make better forecasts of project costs. Systematic monitoring of geomorphic and geotechnical components will be helpful in ensuring the long-term success of the project. In addition, the development of a formal adaptive management plan or strategy will provide important post-project guidance.

Significance – Medium

An assessment of monitoring needs, maintenance activities, and management strategies to assess the extent to which the project has achieved the goals and objectives of the project will increase the understanding of how these activities will be implemented to ensure the success of the ecosystem restoration.

Recommendations for Resolution

1. Document actions that will be taken post-project with respect to monitoring and maintenance that will be used to evaluate how successfully the project met the project objectives. These could be provided in an appendix.
2. Develop a geomorphic and geotechnical monitoring plan that ensures that factors such as seasonal surface and ground water, high flood marks, channel scour, bank erosion, slope stability, and integrity of geotechnical structures are regularly assessed and ensures that should problems be identified they will be corrected in a timely manner.
3. Develop a detailed monitoring plan of the ecological restoration sites in terms of success of plantings, community composition of both plants and animals, invasion of harmful or unwanted species, damage by human encampments or recreation. Within the monitoring plan, more detailed expansion of the adaptive management strategy should be developed.
4. Develop in more detail a maintenance plan that includes major maintenance activities, tasks, milestones, and costs associated with ensuring that the restoration activities are successful.

Final Panel Comment 7

The interaction between the restored landcapes and the wider ecosystem has not been fully considered.

Basis for Comment

Restoration activities will result in alterations of wider ecosystem functions. For example, the local hydrology may be altered because of increased groundwater recharge and reduced surface water runoff. These changes could affect streamflow, particularly for high and low flow conditions. In addition, should the habitat connectivity objective be achieved, there may be wider implications for animal populations in the general project area.

Similarly, the success of restoration activities will be affected by the surrounding environment, particularly interactions between the surrounding urban landscape and the restored areas. Restoration activities may be affected by invasive species, polluted runoff from surrounding area, and disturbance from human activities (e.g., recreation, vagrant encampments, etc.).

Significance – Medium

A more thorough assessment of ecosystem interactions as a result of restoration will be useful in assessing the impacts of the project on the surrounding landscape.

Recommendations for Resolution

1. Discuss the interactions – both positive and negative – between the restored landscapes and the surrounding environments. Specifically there should be consideration of (a) hydrologic flows, (b) urbanized areas, and (c) semi-natural areas outside of the riparian corridor.
2. Specify which species will benefit from the increased connectivity.
3. Better document current recreation use and the assumed level of future restoration, with considerations of how recreation activities may affect restoration.

Final Panel Comment 8

Conflicts and issues related to cleanup of HTRW chemicals and CERCLA hazardous waste may emerge during plan implementation as cleanup issues and costs manifest, affecting the TSP.

Basis for Comment

The Panel notes that the potential effects and risks from the environmental chemistry of the channel sediments are not addressed in the Integrated Feasibility Report (IFR), and that the channel sediments in the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach have not been tested for potential hazardous, toxic, or radioactive waste (HTRW) chemicals and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous waste. The Los Angeles River has a history of being used as an uncontrolled dumping ground for solid waste, as well as receiving treated waste water and unregulated storm drain discharges. It is therefore possible that there are contaminated sediments in the river bottom that could affect ecological restoration and the Tentatively Selected Plan (TSP). However, the potential costs and ecological consequences associated with the cleanup of contaminated channel sediments have not been considered.

The Panel also notes that while costs beyond site exploration and remedial action planning are to be borne 100% by the non-Federal sponsor, the cost and schedule effects related to HTRW-CERCLA cleanups may be generally underappreciated, particularly for Taylor Yard and Piggyback Yard, which are not included in any cost estimates.

Significance – Medium

Potential HTRW and CERCLA hazardous waste chemicals in the channel sediments have not been tested for and could, if present, affect ecological restoration, including the TSP.

Recommendations for Resolution

1. Explain in the IFR that existing channel sediments have not been tested for HTRW chemicals and CERCLA hazardous waste, which may exist in the sediments because of the historical and present use of the Los Angeles River as dumping ground for solid waste and receiving body for storm drain discharges.
2. Address in the IFR the potential effect of contaminated channel sediments on the alternatives, particularly the TSP.
3. Conduct an appropriate field sampling and testing investigation for potential sediment contamination to inform the ecological study, including alternatives formulation and selection of the TSP.
4. Address the effect on the TSP of potential future chemical contamination or recontamination of river sediments, including operations and maintenance issues.
5. Develop a risk management plan that includes consideration of cleanup actions as part of the TSP.

Final Panel Comment 9

The water budget discussion in Appendix E characterizes water budget parameters, but these parameters have not been applied in a water budget analysis.

Basis for Comment

The water budget discussion in Appendix E characterizes current baseline conditions of water budget parameters (e.g., streamflow, precipitation, infiltration, evaporation, and evapotranspiration); however, an actual water budget analysis (the application of these parameters to analyze the continuity of the flow of water over a certain time period) was not performed.

It is not clear to the Panel how the proposed habitat and open water areas will be sustained if the water budget analysis was not applied to assess the seasonal availability of water. USACE guidance is provided on water budget (or water balance) procedures in Hayes et al. (1983), describing water balance components, a general method of computation, and presentation of data.

Significance – Medium

Water budget parameters need to be applied in a water budget analysis in order to confirm the seasonal availability of water to restore and sustain the habitat and open water areas proposed in the Tentatively Selected Plan (TSP).

Recommendations for Resolution

1. Clearly state the purpose and objectives of the water budget.
2. Complete the water budget analysis.
3. Demonstrate how the results of the water budget are used to confirm the seasonal availability of water to restore and sustain the habitat and open water areas proposed in the TSP.
4. If recommendations 1 through 3 are implemented, briefly add a discussion on the water budget in Appendix E to Section 3.5 Water Resources of the Integrated Feasibility Report.

Literature Cited:

Hayes, R.J., K.A. Popko, and W.K. Johnson (1983). Guide Manual for Preparation of Water Balances. RD-16. U.S. Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, Davis, California. November 1980, revised April 1983. http://www.hec.usace.army.mil/publications/ResearchDocuments/RD-16.pdf

Final Panel Comment 10

Groundwater conditions specific to the project reaches have not been fully described and data are lacking, especially on groundwater/surface water exchanges.

Basis for Comment

USACE guidance in ER 1110-2-1150 (USACE, 1999) states that the engineering appendix to the feasibility study report shall include a hydrologic study that analyzes groundwater conditions (Section C-2.1.11).

The groundwater section of the Integrated Feasibility Report (IFR) (Section 3.4.4) primarily describes regional groundwater basins and their characteristics. The San Fernando Valley and Central Groundwater Basins are identified as the basins underlying the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach (Figure 3-8), and monitoring efforts and water quality data are discussed for wells in this basin. However, the information is not specific enough to elaborate on groundwater surface water exchanges.

There is no discussion or data on groundwater in the Hydrology and Hydraulics Appendix E, but Section 2.0 in Appendix G mentions “a high groundwater table that did not allow the bed to be constructed with concrete.” Appendix D provides a narrative description of groundwater conditions in Section 3.2.2 and Section 5.0, but the discussion predominantly relates to hazardous, toxic, or radioactive waste (HTRW) issues and contaminated groundwater, as opposed to the influence of groundwater on the restoration design of in-channel habitats. Water table contour maps are provided in Appendix D, but the Panel found no supporting data describing the date (age) of the data, whether the water table changes on a seasonal basis, and the relationship between the water table and the channel restoration designs with respect to groundwater/surface water exchanges along the river channel.

This lack of data on groundwater, specifically groundwater/surface water exchanges, does not allow a proper characterization of the geomorphic criterion required for the “channel bed type” described in Section 2.2 of the IFR. These data are also required for the “Groundwater” conceptual model component shown in Table 2-1, which would provide “elevation of and connections between groundwater table and river and floodplain habitats.”

Groundwater/surface water exchanges occur within the “hyporheic zone,” but the Panel notes that there is no mention of “hyporheic” conditions of the river system in the IFR or Appendix E. The hyporheic zone is located at the interface of aquifers and rivers, and consists of the sediments in which there is exchange and mixing of groundwater and river water. It is an important zone for pollutant, energy, and carbon cycling, and can be an important component of the riverine habitat. This topic is briefly described in Section 1.2.3, where ephemeral streams are recognized as having water below ground that may be accessible to a rich assemblage of plant and animal life, but it could be addressed better in Section 2.1.3 “Importance of Restoring Hydrology,” which just contains a general discussion. The Panel believes the proposed action of removing concrete channel bed and bank material will significantly change (i.e., restore) the groundwater and surface water interface. However, the Panel could not find a detailed discussion and supporting data specific to this aspect of the restoration in the report.

Without discussion and data on groundwater/surface water exchanges, the Panel does not have a complete understanding of how historically altered conditions along the river have changed hyporheic conditions over time leading to the current baseline condition and, more importantly,

how the Tentatively Selected Plan (TSP) will restore these hydrologic conditions to benefit the restoration of riparian and freshwater marsh habitat.

Significance – Medium

A more thorough discussion of current groundwater baseline conditions is warranted and will increase the understanding of how the TSP will restore groundwater/surface water exchanges to benefit the restoration of riparian and freshwater marsh habitat.

Recommendations for Resolution

1. Describe the literature review conducted to assess the availability and quality of groundwater data for application, especially in the context of a riverine ecosystem restoration project.
2. Provide data on the seasonal elevations of, and connections between, groundwater table and river and floodplain habitats, as called for in Table 2-1.
3. Incorporate hyporheic zone conditions in the water budget analysis.

Literature Cited:

USACE (1999). Engineering and Design – Engineering and Design for Civil Works Projects. Engineer Regulation (ER) 1110-2-1150. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 31 August.
http://140.194.76.129/publications/eng-regs/ER_1110-2-1150/ER_1110-2-1150.pdf

Final Panel Comment 11

The Integrated Feasibility Report and Appendices do not provide an analysis of sediment processes, which is a component of a planning objective for the restoration project.

Basis for Comment

The first planning objective in ES.5 of the Integrated Feasibility Report (IFR) states that the restoration project is intended to improve natural sediment processes, but the Panel found no analyses of sediment processes in the IFR or Appendix E. Section 3.4.1 of the IFR states that flood and debris flows are regulated at the upstream dams and debris basins and Section 10.1 of Appendix E states that "relatively little sediment enters the channel downstream from the dams aside from the fine material carried in suspension." The implication is that the transport of debris and sediment into the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach is not significant.

However, Section 5.10.3 of the IFR describes an operational impact, where "substrate and debris deposits have amassed soils suitable for establishment of vegetation," in Section 15.6 an allowance for floating debris is added to bridge pier widths in the hydraulic modeling, and Section 22.4 of Appendix E describes existing conditions where "sediment held in place by the vegetation has reduced the conveyance capacity of the originally authorized project." Sedimentation of the channel within the ARBOR Reach is mentioned qualitatively in several other places in the Appendix E.

It is not clear to the Panel why no sediment analysis was performed in this study. Since an objective of this project is to reintroduce vegetation into the river channel and floodplain, the Panel believes it is important to understand the sources and movement of sediment through the river system to assess how ecosystem restoration objectives can be achieved and sustained. For example, the HEC-RAS hydraulic model is used appropriately to assess flood hazards, but it is not used to assess sediment transport and deposition and the subsequent contribution to increased flood hazards as a result of decreased conveyance capacity.

USACE guidance used for the hydraulic analysis to determine the impacts and feasibility for each of the proposed alternatives in Section 20 of Appendix E (e.g., EM 1110-2-1601 and EM 1110-2-1205) were published in the late 1980s and early 1990s. They relate to the design and engineering of flood control channels and may not be the most appropriate guidance to solely rely on for an ecosystem restoration project. This USACE guidance pre-dates more recent USACE guidance that addresses stream restoration and rehabilitation, such as ER 1110-2-1150 (USACE, 1999), Fripp et al. (2001), and Watson et al. (1999).

As an example, the more recent USACE stream restoration guidelines call for a sediment impact assessment that requires an assessment of the sediment budget, i.e., the magnitude and frequency of all sediment transporting flows and sediment supply (Fripp et al., 2001). In relation to this, it is not clear whether a major land cover disturbance from wildfire and subsequent increased sediment erosion, transport, and deposition into the river system has been considered in the development of the alternative plans.

Section 22.5 in Appendix E states that the hydrology and hydraulics (H&H) analyses in the next phase (i.e., Preconstruction Engineering and Design phase) will consider "existing vegetation and sediment not associated with the restoration features." This statement should be clarified, especially if this is intended to mean sediment studies will be conducted in the next phase of this

Civil Works project. USACE guidance in ER 1110-2-1150 (USACE, 1999) states that the engineering appendix to the feasibility study report shall include a hydraulic study that analyzes existing and post-project sedimentation (Section C-2.5.10), but these studies have not been done.

Significance – Medium

The lack of an analysis of sediment processes affects the completeness of the IFR and the ability of the Panel to understand the significance of these processes with respect to ecosystem restoration and flood conveyance.

Recommendations for Resolution

1. Review and refine the hydraulic analyses in accordance with more recent USACE guidance that is specific to stream restoration and rehabilitation.
2. Clarify whether an estimate has been made of the amount of sediment and debris entering the ARBOR Reach, and the subsequent effects on operations and maintenance and the sustainability of the restoration project as proposed.
3. Clarify whether major land cover disturbances and subsequent increased sediment erosion, transport, and deposition into the river system have been considered in the development of the alternative plans.
4. Clarify the statement in Section 22.5 in Appendix E that the H&H analyses in the next phase will consider “existing vegetation and sediment not associated with the restoration features.”

Literature Cited:

Fripp, J., R. Copeland, and M. Jonas (2001). An Overview of USACE Stream Restoration Guidelines. Proceedings of the Seventh Federal Interagency Sedimentation Conference, Reno, Nevada. March 25-29. http://pubs.usgs.gov/misc/FISC_1947-2006/pdf/1st-7thFISCs-CD/7thFISC/7Fisc-V1/7FISC1-2.pdf

Watson, C.C., D. S. Biedenharn, and S.H. Scott (1999). Channel Rehabilitation: Processes, Design, and Implementation, U.S. Army Engineer, Engineer Research and Development Center, Vicksburg, Mississippi. July. 312 pp. http://chl.erdc.usace.army.mil/Media/2/9/0/ChannelRehabilitation.pdf

USACE (1999). Engineering and Design – Engineering and Design for Civil Works Projects. Engineer Regulation (ER) 1110-2-1150. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 31 August. http://140.194.76.129/publications/eng-regs/ER_1110-2-1150/ER_1110-2-1150.pdf

Final Panel Comment 12

It is not clear whether the Tentatively Selected Plan is consistent with the goals of the Los Angeles River Revitalization Master Plan, as directed by WRDA 2007.

Basis for Comment

Section 6.3.2 of the IFR states that: "The Corps was directed by WRDA 2007, as part of this study, to develop plans consistent with the goals of the Los Angeles River Revitalization Master Plan (LARRMP)" and Section 4.2.1 of the Integrated Feasibility Report (IFR) states the objectives of the feasibility study are consistent with those from "ongoing state and local efforts within the watershed, including the Los Angeles River Revitalization Master Plan (LARRMP) published by the City of Los Angeles in 2007." However, Section 6.3.2 primarily addresses goals related to ecosystem restoration and states that "the study alternatives vary in their responsiveness to the [LARRMP] plan."

It is not clear whether the requirements of Water Resources Development Act (WRDA) 2007 have been achieved. For example, the IFR indicates the LARRMP identified opportunities for flood risk management and a stated goal of the LARRMP is to "Enhance Flood Storage." However, flood storage is not addressed in Appendix E or the IFR and, according to Section 1.4.4 of the IFR, "The USACE determined that no Federal action resulted from the information and analyses developed for, and presented in, the LARRMP and accompanying Programmatic EIR/EIS since it was a local master plan with no associated Federal recommendations."

Significance – Medium

The lack of clarity on whether the objectives of the study, and the resulting Tentatively Selected Plan (TSP), are consistent with ongoing state and local efforts affect the Panel's ability to understand if the project has complied with the WRDA directive.

Recommendations for Resolution

1. Provide clarification in the IFR as to the extent to which the TSP meets the requirements of WRDA 2007 Section 4018.

Final Panel Comment 13

Cost estimates for the eight specific reaches comprising the ARBOR Reach have not been identified for each of the four final alternatives and the TSP in particular.

Basis for Comment

In order to assess and evaluate the total first cost of each of the four final alternatives and the Tentatively Selected Plan (TSP) in particular, it is necessary to identify and understand the estimated costs associated with each of the eight reaches comprising the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) Reach. The Panel believes that reach-specific estimated costs should include the individual feature costs and their sum or "total cost" and be clearly and completely presented (as tables) in the final Integrated Feasibility Report (IFR).

These reach-specific costs are missing in the draft IFR. Cost Appendix C omits reach-specific costs for the TSP and all alternatives except Alternative 20, as presented in Attachment 3, Spreadsheet Takeoffs; the Quantity Takeoffs of Attachment 2 are not for the TSP; and the Cost Breakdown for Final Array of Alternatives in Attachment 5 is not reach-specific and does not include all feature accounts that make up the Total Project Costs [Total First Costs] listed in Appendix C, Table 9.2. Additional clarification is also necessary for some of the infrastructure elements. For example, daylighting streams is described in Section 7, but without design details on the linear length of storm drain removal. Accordingly, the cost estimates can only be defined at a conceptual level. Assumptions should be clearly stated and the risk analysis should reflect an appropriate level of uncertainty.

The Panel also could not find in the final IFR a discussion of the approximate accuracy of the total first cost for each alternative, consistent with the Classification of Cost Estimates identified in ER 1110-2-1302, Section 15, Table 1 (USACE, 2008).

Significance – Medium

A clear understanding of the estimated costs by feature account for each reach is necessary to fully understand, compare, and evaluate the four final alternatives and the TSP in particular.

Recommendations for Resolution

1. Identify and include in the IFR the estimated total cost for each of the eight reaches for each of the four alternatives, including the TSP.
2. Break down the total cost for each reach and alternative by feature account.
3. Identify for each alternative the expected accuracy of the project Total First Cost (IFR Table 6-1 and Appendix C Table 9-2) consistent with the Classification of Cost Estimates discussed in ER 1110-2-1302, Section 15, Table 1 (USACE, 2008).
4. Adopt cost definitions consistent with USACE (2011).

Literature Cited:

USACE (2008). Engineering and Design - Civil Works Cost Engineering. Engineer Regulation (ER) 1110-2-1302, Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 15 September.

USACE (2011). Corps of Engineers Civil Works Cost Definitions and Applicability. CECW-P memorandum. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 25 August.
http://planning.usace.army.mil/toolbox/library/MemosandLetters/11sep12-DCWCostMemo.pdf

Final Panel Comment 14

Future without project conditions related to operation and maintenance, population growth, climate change and hydrology are not adequately described.

Basis for Comment

The following are future without project conditions related to operation and maintenance, population growth, climate change and hydrology from the Integrated Feasibility Report (IFR) that the Panel believes are not well established:

- Section 3.0: "[O]peration and maintenance (O&M) of the River is assumed to continue unchanged into the future." However, no assessment was made of the potential for increased O&M due to increased vegetation growth in the river channel or failure of concrete infrastructure, or due to climate change caused by changes in the magnitude, duration, or intensity of future river flows or tributary stream or storm drain discharges that may exacerbate or otherwise affect O&M efforts in the future.
- Section 5.3.3: "Land uses within the study area under future without-project conditions would be similar to existing conditions." It is not clear if this future condition discounts the potential for infill development or Brownfield redevelopment.
- Section 5.4.3: "Hydrology, water quality, and groundwater conditions within the study area will continue changing based on population pressures, new and continuing regulations, and future climate conditions." The Panel believes that "population pressures" are not adequately defined for the study area. The study does identify population projections out to 2040 in Table 3-19 and shows the study area census tracts in Figure 3-23, but does not provide future projections for the census tracts of interest. The California Association of Governments provides estimates of the 2035 total population, household, and employment growth at the census tract and city levels for Los Angeles County; incorporation of these data would better describe this future condition (SCAG, 2013).
- Section 5.4.3: "Current climate change studies have indicated a likely increase in the frequency of extreme weather conditions in the future. These extreme weather events could compound and increase watershed peak flows." However, no quantitative estimates of these peak flow increases and impacts on flood risk or restoration design assumptions have been discussed in the IFR or Appendix E. The IFR focuses primarily on greenhouse gas emissions. The Panel understands that an ongoing study is not complete and that is why climate change has not been addressed in more detail; however, other published climate change studies are available, such as the July 2012 California Energy Commission studies (CEC, 2013), and this information could have potential application to this study.

Significance – Medium

The lack of clarity regarding some future without project conditions may affect the ability to properly evaluate alternatives against the without project condition.

Recommendations for Resolution

1. Provide information in the report to demonstrate that O&M of the Los Angeles River will continue unchanged into the future.
2. Provide information in the report to demonstrate that land uses within the study area under future without project conditions would be similar to existing conditions.
3. Refine the future population projections using California Association of Governments

data (SCAG, 2013) analyzed at the census tract level within the project reach.
4. Estimate peak flow increases and impacts on flood risk or restoration design due to climate change using available data and other published studies.

Literature Cited:

CEC (2013). Reports on the Third Assessment from the California Climate Change Center. California Energy Commission, California Climate Change Portal. http://climatechange.ca.gov/climate_action_team/reports/third_assessment/index.html

SCAG (2013). Integrated Growth Forecast. Southern California Association of Governments. http://www.scag.ca.gov/forecast/index.htm

Final Panel Comment 15

The validity of some aspects of the hydraulic and hydrologic analyses cannot be confirmed because several assumptions are unclear or supporting data are not provided.

Basis for Comment

Appendix E describes the existing and with project conditions hydraulic modeling conducted as part of the alternatives analysis. In general, the analyses have been conducted properly; however, the Panel made the following observations:

1. It is not clear whether the 2005 aerial survey flight described in Section 15.1 provided LiDAR data from which the digital terrain models (DTMs and TINs) were generated.
2. Section 15.3 indicates the 2008 HEC-RAS models could not be used for this feasibility study because the sections did not extend far enough laterally to encompass the floodplain of the 0.2% Annual Chance Exceedance (ACE) flood. It is not clear why the sections were not extended by "cutting" them from the digital terrain models.
3. It is not clear why the existing conditions model uses K values for hydraulic roughness (Section 15.5.2), whereas the design conditions model uses Manning's n values.
4. Section 15.8 indicates that most of the flow regime through the study reach is in supercritical flow. It is not clear whether critical flow depth was evaluated in this situation because when flow depths approach a critical depth, surface undulations may occur, potentially impacting freeboard assumptions.
5. Most of the reaches are indicated as having "no modifications to the hydraulic models" from existing conditions; however, it seems that the roughness values should be adjusted for the restored riparian corridor.
6. In reaches 3, 4, and 5, storm drains are daylighted. It seems that this would increase the storage volume of the channel and effective or ineffective flow areas.
7. Contraction/expansion coefficients for all bridges are set at 0.3 and 0.5, respectively; however, they can range from 0.1 to 0.5 and 0.1 to 0.65, respectively. It is not clear if the hydraulic conditions at all of the bridges are similar enough to warrant the use of one set of coefficients. USACE guidance (Bonner and Brunner, 1996) recommends an initial value be used, followed by a sensitivity analysis to refine the coefficient estimate. It is not clear if a sensitivity analysis was performed.
8. The evaluation of hydraulic impacts is based on the change in maximum water surface elevations and velocity. It is not clear whether energy grade line changes (water surface elevation plus velocity head) were also considered. Similarly, clarification is needed as to whether shear stress and/or stream power (available as HEC-RAS output parameters) were considered to evaluate the impact of streamflow changes on vegetation and habitat.
9. The Manning's n values are identified and the methods used to arrive at these values are described; however, only three different n values are used. The Panel believes that a more detailed analysis of vegetation roughness is important at this Feasibility Study phase because so much of the restoration plan involves the introduction of vegetation into the channel-floodplain section. The USACE ERDC HYDROCAL software would be a suitable tool to refine this methodology.
10. It is not clear how vegetation bending or breaking was taken into account when selecting n values (Section 20.1); i.e., whether these conditions were attributed to specific plant species proposed for the restoration plan.
11. Section 13.6.2 of ER 1110-2-1150 (USACE, 1999) indicates that available data can be relied

upon at the feasibility phase; however, the Panel is concerned about the description of HEC-2 cross sections generated using 1:24,000 scale USGS quad maps and their potential use in the current HEC-RAS modeling because these data would likely not meet the accuracy requirements implied in ER 1110-2-1150.

12. A range of return period flood discharges are used in the hydraulic modeling to assess conveyance capacity and flood hazards. The Panel understands that these discharges are from a 1992 study that used streamflow data ending in 1985 and that the USACE has spot-checked the annual peak discharge record since 1985 to conclude that there would not be any significant difference in flood frequency. The IFR would benefit by having this work described in the IFR Appendix E together with a comparison of the results.

Significance – Medium

The unclear assumptions and lack of supporting data affect the Panel's ability to understand the hydraulic and hydrologic analyses in their entirety.

Recommendations for Resolution

1. Revise the report to clarify the issues presented in items 1 to 12 above.

Literature Cited:

Bonner, V.R., and G.W. Brunner (1996). Bridge Hydraulic Analysis with HEC-RAS. TP-151. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. April. http://www.hec.usace.army.mil/publications/TechnicalPapers/TP-151.pdf

USACE (1999). Engineering and Design – Engineering and Design for Civil Works Projects. Engineer Regulation (ER) 1110-2-1150. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. 31 August. http://140.194.76.129/publications/eng-regs/ER_1110-2-1150/ER_1110-2-1150.pdf

Final Panel Comment 16

Reach cross sections for the Tentatively Selected Plan have not been presented in a consistent and clear way.

Basis for Comment

The Panel expected to find representative cross sections (CXs) for each of the eight reaches of the Tentatively Selected Plan (TSP) in the Integrated Feasibility Report (IFR). It was, however, difficult for the Panel to confirm from the IFR which CXs belonged to the TSP, as opposed to other alternatives, and whether CXs for all of the eight reaches of the TSP were included in the IFR. The Panel has been provided CXs used for the TSP hydraulics analysis, but it is not clear whether they include the excavations and related project features affecting the surface grade outside the channel and not necessarily used in the hydraulics analysis. The CX for each reach should be reasonably consistent with the earthwork and other volumes used to estimate costs.

Significance – Low

Clear communication and understanding of the TSP requires appropriate illustrative, representative, and accurate CXs for each reach of the TSP.

Recommendations for Resolution

1. Include in the IFR representative CXs of the TSP for each of the eight reaches in the Area with Restoration Benefits and Opportunities for Revitalization (ARBOR) study area; the CXs should be an integral part of describing the TSP.
2. Use more than one CX per reach if appropriate to represent cross-sectional configuration changes within the reach (e.g., at Taylor Yard, the Arroyo Saco confluence, and Piggyback Yard).

Final Panel Comment 17

The reasonableness of key drivers in estimating recreational benefits has not been substantiated with local data.

Basis for Comment

The methodology for assessing recreation benefits follows standard procedures, and reasonable conclusions are drawn from the data and results. The Panel recognizes that project elements to support recreational activities are supplemental to the overall purpose of the project, which is to enhance habitat quality and flood protection.

At the same time, the Panel finds that a sensitivity analysis is warranted to estimate the recreational benefits. The key driver of benefits and park usage is based on an 'average' value of 90 users per day per mile of trail. Little information is provided about whether this assumption is reasonable – the specific concern is that the assumed park usage level in this project area is too high. For example, park use elsewhere in the local region could be used as a proxy for adjusting the national average to local conditions. The Panel finds that a sensitivity analysis should be performed on the assumed level of existing visitation (baseline users), because the increase in visitation (additional users) is a direct function of initial levels.

Significance – Low

A sensitivity analysis would help determine the threshold number of baseline users (without the project) and additional users (with the project) necessary for benefits to exceed costs.

Recommendations for Resolution

1. Perform a sensitivity analysis on the number of recreational users without and with the project.

APPENDIX B

Final Charge to the Independent External Peer Review Panel as Submitted to USACE on September 27, 2013

on the

LA River IEPR

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Charge Questions and Guidance to the Panel Members for the Independent External Peer Review of the LA River

BACKGROUND

The baseline study area initially considered during the planning process included 32 miles of the River within the City of Los Angeles, within a half mile of each bank. It begins at the origin of the River, which is the confluence of Bell Creek and Arroyo Calabasas in the northwest San Fernando Valley at Owensmouth Boulevard, and ends near the City of Vernon in the downtown Los Angeles area. Through initial investigation of constraints in the baseline study area and the identification of where ecosystem restoration might best be accomplished, the planning process defined the focused study area as the "Area with Restoration Benefits and Opportunities for Revitalization" (ARBOR) Reach, which extends from the Headworks downstream to First Avenue.

This study area includes the Glendale Narrows, which is the only portion of the River that does not have a hardened bed (bottom of the river channel), and contains several distinctive sites and connections including the Headworks, Pollywog Park, Bette Davis Park, the Burbank Western Channel and Glendale River Walk, Griffith Park, Ferraro Fields, Verdugo Wash, Atwater village, Taylor Yard and the Rio de Los Angeles State Park, the "Cornfields" (Los Angeles State Historic Park), Arroyo Seco, Elysian Park, "Piggyback Yard" (also known as "Los Angeles Transportation Center" as well as "Mission Yard"), and downtown Los Angeles. These sites provide key opportunities for restoration and enhanced connectivity.

The study was authorized by Senate Committee on Public Works Resolution and approved on June 25, 1969. Section 4018 of the Water Resources Development Act of 2007 provided authorization for a "feasibility study for environmental ecosystem restoration, flood control, recreation, and other aspects of Los Angeles River revitalization that is consistent with the goals of the Los Angeles River Revitalization Master Plan published by the city of Los Angeles…."

The feasibility study provides an interim response to the study authority, and the study efforts will determine the feasibility of ecosystem restoration of the Los Angeles River and surrounding environment. There is no sponsor available to investigate flood risk management at this time.

The primary purpose of the proposed project and alternatives considered in the study is to restore 11 miles of the Los Angeles River from approximately Griffith Park to downtown Los Angeles. The project will be reestablishing riparian strand, freshwater marsh, and aquatic habitat communities and reconnecting the River to major tributaries, its historic floodplain, and the regional habitat zones of the Santa Monica, San Gabriel, and Verdugo Mountains while maintaining existing levels of flood risk management. A secondary purpose is to provide recreational opportunities consistent with the restored ecosystem within this 11-mile reach of the river.

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement, September 2013 (hereinafter: LA River IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (EC 1165-2-214; December 15, 2012), and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004).

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

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the LA River 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 arid region riverine systems ecology, socioeconomics, hydrologic and hydraulic modeling, and geotechnical engineering issues relevant to the project. They will also have experience applying their subject matter expertise to ecosystem restoration.

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

DOCUMENTS PROVIDED

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

Documents for Review

The following documents are to be reviewed by designated discipline:

Title	Approx. No. of Pages	Required Disciplines
Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement, September 2013	505	All Disciplines
Appendix A: Design	150	H&H Modeling, Geotechnical Engineering
Appendix B: Economics	164	Socioeconomics
Appendix C: Cost	169	Socioeconomics, Geotechnical Engineering
Appendix D: Geotechnical	97	Geotechnical Engineering
Appendix E: Hydrology and Hydraulics	131	H&H Modeling,
Appendix F: Air Quality	29	Arid region riverine systems ecology, Socioeconomics
Appendix G: Habitat Evaluation (CHAP)	161	Arid region riverine systems ecology, Socioeconomics
Appendix H: Supplemental Baseline Conditions Information	12	All Disciplines
Total Page Count	**1,418**	

Supplemental Documents (not part of the official review):

- Appendix I: Value Engineering
- Appendix J: Real Estate
- Appendix K: HTRW

Documents for Reference

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

SCHEDULE

This final schedule is based on the September 18, 2013 receipt of the final review documents. The schedule will be revised upon receipt of final review documents.

Task	Action	Due Date
Conduct Peer Review	Battelle sends review documents to panel members	9/25/2013
	Battelle convenes kick-off meeting with panel members	9/25 - 10/1/2013
	Battelle convenes kick-off meeting with USACE and panel members	10/1/2013
	Battelle convenes mid-review teleconference for panel members to ask clarifying questions of USACE	10/8/2013
	Panel members complete their individual reviews	10/16/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides panel members with talking points for Panel Review Teleconference	10/18/2013
	Battelle convenes Panel Review Teleconference	10/21/2013
	Battelle provides Final Panel Comment templates and instructions to panel members	10/22/2013
	Panel members provide draft Final Panel Comments to Battelle	10/28/2013
	Battelle provides feedback to panel members on draft Final Panel Comments; panel members revise Final Panel Comments	10/29 - 11/3/2013
	Battelle finalizes Final Panel Comments	11/4/2013
	Battelle provides Final IEPR Report to panel members for review	11/5/2013
	Panel members provide comments on Final IEPR Report	11/6/2013
	*Battelle submits Final IEPR Report to USACE	11/8/2013
Comment/ Response Process	Battelle inputs Final Panel Comments to DrChecks and provides Final Panel Comment response template to USACE	11/12/2013
	Battelle convenes teleconference with Panel to review the Post-Final Panel Comment Response Process (if necessary)	11/12/2013
	USACE provides draft PDT Evaluator Responses to Battelle	11/22/2013
	Battelle provides the panel members the draft PDT Evaluator Responses	11/26/2013
	Panel members provide Battelle with draft BackCheck Responses	12/3/2013
	Battelle convenes teleconference with panel members to discuss draft BackCheck Responses	12/4/2013
	Battelle convenes Comment-Response Teleconference with panel members and USACE	12/5/2013
	USACE inputs final PDT Evaluator Responses to DrChecks	12/19/2013
	Battelle provides final PDT Evaluator Responses to panel members	12/26/2013
	Panel members provide Battelle with final BackCheck Responses	12/31/2013
	Battelle inputs the panel members' final BackCheck Responses to DrChecks	1/7/2014

CHARGE FOR PEER REVIEW

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

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

General Charge Guidance

Please answer the scientific and technical questions listed below and conduct a broad overview of the LA River 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 (Rachel Sell, sellr@battelle.org) or Program Manager (Karen Johnson-Young (johnson-youngk@battelle.org) for requests or additional information.
3. In case of media contact, notify the Battelle Program Manager, Karen Johnson-Young (johnson-youngk@battelle.org) immediately.
4. Your name will appear as one of the panel members in the peer review. Your comments will be included in the Final IEPR Report, but will remain anonymous.

Please submit your comments in electronic form to Rachel Sell, sellr@battelle.org, no later than October 16, 2013, 10 pm ET.

Independent External Peer Review of the

Los Angeles River Ecosystem Restoration Feasibility Study, Draft Integrated Feasibility Report and Environmental Impact Statement, September 2013

Charge Questions and Relevant Sections as Supplied by USACE

MAIN REPORT

SECTION 1.0 – INTRODUCTION

1. Is the project's purpose and scope complete and understandable?

2. Does this section adequately provide context for the role of this study in relation to other projects and programs listed?

SECTION 2.0 – PROBLEMS AND OPPORTUNITIES

3. Are the problems and opportunities appropriately defined and addressed in this study?

4. Have the alternatives been reasonably formulated? Do they appropriately address the needs and objectives of the project?

5. Comment on the evaluation of alternatives and analyses conducted.

6. Based on your best professional judgment, was the recommended plan appropriately developed and selected?

SECTION 3.0 – FORMULATON OF ALTERNATIVE PLANS

7. Are the objectives and constraints appropriately defined and addressed in this study?

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

9. Have the alternatives been reasonably formulated? Do they appropriately address the needs and objectives of the project?

SECTION 4.0 – AFFECTED ENVIRONMENT

10. Comment on whether the special status species and resource areas in the project area have been accurately described.
11. Comment on whether the water resources in the project area have been accurately described.

12. Comment on the adequacy of the environmental and without-project condition summaries in terms of data quality, timeliness of the data, and breadth of information covered.

13. Was the hydrology discussion sufficient to characterize current baseline conditions and to allow for evaluation of how forecasted conditions (with and without proposed actions) are likely to affect hydrologic conditions. Please comment on the completeness of the discussion on the relationship between subsurface hydrology and the hydrodynamics of the project area.

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

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

SECTION 5.0 – EVALUATION OF ALTERNATIVE PLANS AND ENVIRONMENTAL CONSEQUENCES

16. Comment on the evaluation of alternatives and analyses conducted.

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

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

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

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

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

22. Please comment on the screening of the proposed alternatives. Are the screening criteria appropriate? In your professional opinion are the results of the screening acceptable? Were any measures or alternatives screened out too early?

23. Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies? Why or why not?

24. Does any alternative include identified separable elements (a portion of a project that is physically separable, and produces hydrologic effects or physical or economic benefits that are separately identifiable from those produced by other portions of the project) ? If so, is each identified separable element independently justified and are the benefits, costs, and effects of the separable elements correctly divided?

SECTION 6.0 – COMPARISON OF ALTERNATIVE PLANS

25. Based on your best professional judgment, was the recommended plan appropriately developed and selected?

26. Are the expected changes in the quality and abundance of desired ecological resources clearly and precisely specified in justifying the ecosystem restoration and protection investment?

27. Are the required long-term commitments (both Federal and non-Federal) to sustaining the restored ecological resource quality adequately described and adequately demonstrated?

28. Is it clear that the restored ecological resource quality will be sustainable over the long run?

    a) Are the risks facing successful restoration of sustainable ecological resource quality clearly shown to be managed and any residual risks identified in terms of :

    - Sufficient geophysical support (hydrology and geomorphology)?
    - Sufficient environmental chemistry?
    - Sufficient biological support (e.g., food, habitat and systems-stabilizing species)?
    - Changes in climate and in the influential ecoregion (e.g., major land use changes)?

SECTION 7.0 – DETAILS OF RECOMMENDED PLAN

29. Is the description of the recommended plan clearly presented?

30. Comment on the risk and uncertainty elements.

31. Have the environmental effects been adequately described and accounted for?

32. Discuss if the parameters proposed for monitoring address project objectives to measure success.

33. Discuss proposed adaptive management framework and its adequacy.

34. Please comment on the likelihood of the recommended plan to achieve the expected outputs.

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

SECTIONS 8.0 – PUBLIC INVOLVEMENT

36. Public review will occur concurrently with the IEPR. Has adequate stakeholder and agency involvement occurred to identify issues of interest and to solicit feedback from interested parties?

APPENDICES FOR REVIEW

Appendix A. Design Appendix

37. Comment on the information provided and overall reasonableness of conclusions.

38. Comment on the risks and uncertainty elements.

Appendix B. Economics

39. Comment on the analyses conducted and overall reasonableness of conclusions.

Appendix C. Cost Appendix

40. Comment on the overall reasonableness of the detailed cost estimates.

41. Discuss the appropriateness of the explicit or implicit assumptions that are included in the cost estimates and whether assumptions are adequately addressed.

42. Comment on the overall reasonableness of the cost schedule risk analysis.

Appendix D. Geotechnical

43. Comment on the analyses conducted and overall reasonableness of conclusions.

Appendix E. Hydrology and Hydraulics

44. Comment on the analyses conducted and overall reasonableness of conclusions.

Appendix F. Air Quality

45. Comment on the analyses conducted and overall reasonableness of conclusions.

Appendix G. Habitat Evaluation (CHAP)

46. Comment on the analyses conducted and overall reasonableness of conclusions.

Appendix H. Supplemental Baseline Conditions Information

47. Comment on the analyses conducted and overall reasonableness of conclusions.

Safety Assurance Review Type I IEPR Questions

48. In accordance with ER 1110-2-1150, is the quality and quantity of the surveys, investigations, and engineering sufficient for a concept design?

49. Are the models used to assess hazards appropriate?

50. Are the assumptions made for the hazards appropriate?

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

Summary Questions

52. Please identify the most critical concerns (up to 5) 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.

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