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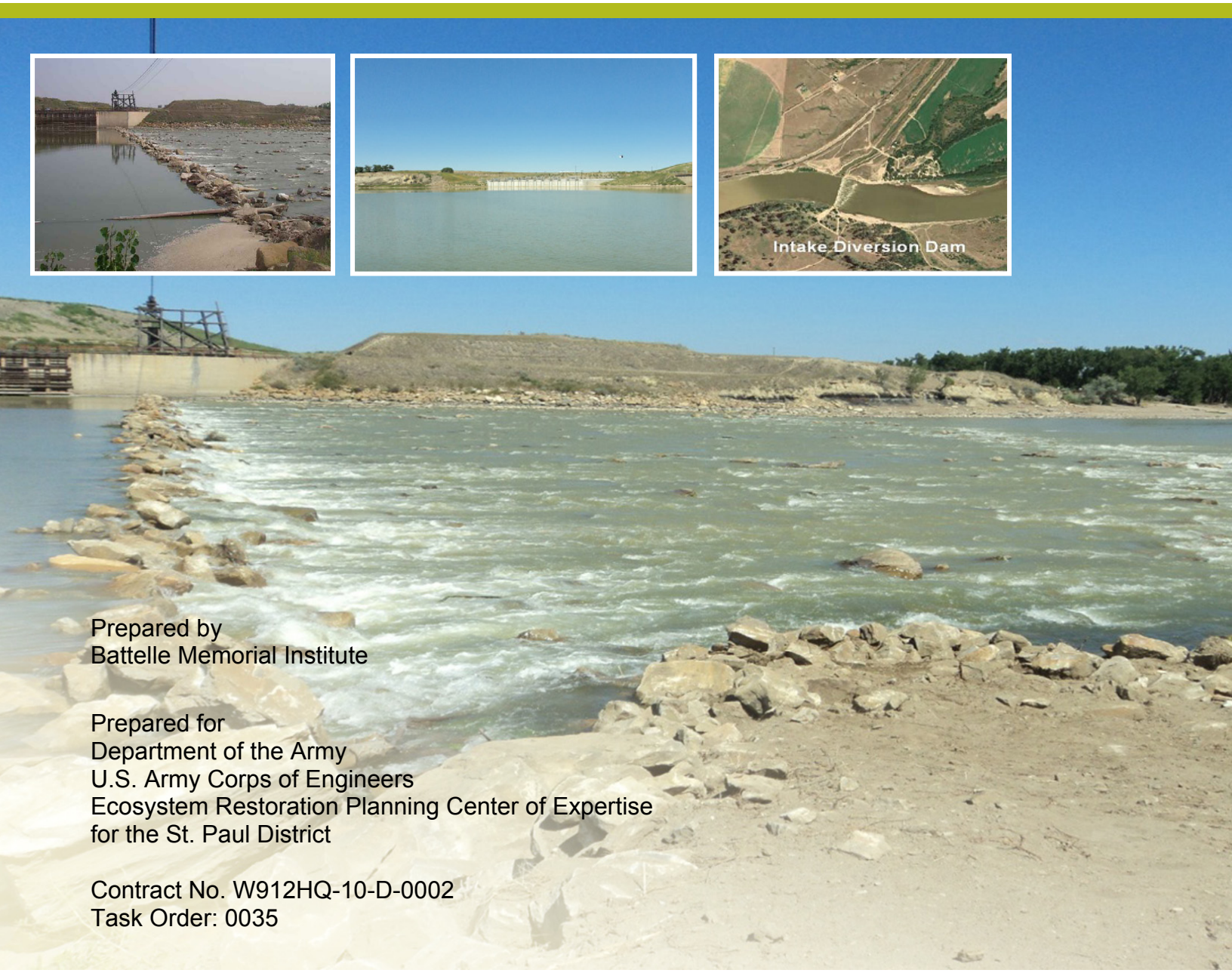
February 8, 2013

Final Independent External Peer Review Report for the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices



Prepared by
Battelle Memorial Institute

Prepared for
Department of the Army
U.S. Army Corps of Engineers
Ecosystem Restoration Planning Center of Expertise
for the St. Paul District

Contract No. W912HQ-10-D-0002
Task Order: 0035

Final Independent External Peer Review Report for the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices

by

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505 King Avenue
Columbus, OH 43201

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Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices

EXECUTIVE SUMMARY

Project Background and Purpose

The Intake Diversion Dam is located along the Lower Yellowstone River, approximately 18 miles downstream from the City of Glendive, Dawson County, Montana. The project site includes the dam and diversion structure, the upper 3,000 feet of the Lower Yellowstone Project Main Canal, and the area extending from about 3 miles downstream of the Dam to about 5 miles upstream of the Dam. The Intake Dam itself is a low-head timber and rock-filled weir (dam) owned by the U.S. Bureau of Reclamation that was originally constructed from 1905 to 1906. The dam is approximately 12 feet high and spans the entire width of the Yellowstone River, about 700 feet.

The purpose of the proposed project is to modify features of the U.S. Bureau of Reclamation's Lower Yellowstone Project Intake Diversion Dam and canal headworks to improve passage and reduce entrainment for endangered pallid sturgeon and other native fish in the Lower Yellowstone River. The U.S. Fish and Wildlife Service listed the pallid sturgeon as endangered under the Endangered Species Act (ESA) in 1990. The wild population of pallid sturgeon inhabiting the Yellowstone River and the Missouri River between Fort Peck Dam, Montana, and Lake Sakakawea, North Dakota, are anticipated to be extirpated by 2018 if reproduction and recruitment of young fish do not improve. The best available science suggests that the Intake Diversion Dam impedes upstream migration of pallid sturgeon and their access to spawning and larval drift habitats. In addition, previous entrainment studies on other native fish in the Yellowstone River suggest that once passage is provided, pallid sturgeon may be entrained in the Main Canal if left unscreened.

An Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) were completed on April 26, 2010, and a contract was awarded for construction of the first phase (entrainment protection) in the fall of 2010. Modifications to the Main Canal and construction of new headworks and fish screens were completed in April 2012. During the second phase, design of the preferred fish passage alternative (a rock ramp), significant cost increases and technical information questioning the reliability and constructability of the alternative became known. As a result, it appeared that the estimated cost of the rock ramp could approach $90 million. In April 2011, the lead agencies determined that other alternatives for providing fish passage needed to be evaluated to address the new/additional information and issues that had arisen since 2010.

In September 2012, a Supplement to the EA was completed to comply with the National Environmental Policy Act (NEPA) to assist the agencies in determining whether the proposed action for improving fish passage would have a significant impact on the human environment. The Supplement to the EA addresses the key issues of pallid sturgeon protection and recovery, examines alternatives for fish passage, and evaluates the environmental impacts of each fish passage alternative.

The Supplement to the EA identified the Bypass Channel Alternative as the Preferred Alternative. It is the least costly alternative. Unlike the No Action Alternative, the Bypass Channel Alternative would meet the purpose and need of the proposed action. In comparison to the other alternatives considered in the 2010 EA, it would improve fish passage by providing an alternative channel for fish to utilize as they migrate upstream. Because the construction footprint is larger, the Bypass Channel Alternative does create temporary and permanent impacts to several natural resources, including riparian areas and wetlands; however, these impacts are considered minor, with benefits of the project offsetting the impacts.

Independent External Peer Review Process

The U.S. Army Corps of Engineers (USACE) is conducting an Independent External Peer Review (IEPR) of the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices (hereinafter: Intake Project). 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 Intake Project. 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 Intake Project review documents and the overall scope of the project, Battelle identified candidates for the Panel in the following key technical areas: economics, geotechnical engineering, hydraulic engineering, structural engineering, environmental compliance/biology, and Civil Works planning. Six panel members were selected for the IEPR from more than 14 candidates identified during the recruitment phase. USACE was given the list of the six selected candidate panel members; Battelle made the final selection of the Panel.

The Panel received an electronic version of the 648-page Intake Project Supplement to the EA document, 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 (PDT) briefed the Panel and Battelle during a kick-off meeting held via teleconference prior to the start of the review to provide the Panel an opportunity to ask questions of USACE and clarify uncertainties. The kickoff meeting and a subsequent mid-review teleconference were the only two instances when the Panel and USACE were in direct communication. No other direct communication occurred between the Panel and USACE during the peer review process. The Panel produced more than 150 individual comments in response to the 30 charge questions.

IEPR panel members reviewed the Intake Project 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, nine Final Panel Comments were identified and documented. Of these, three were identified as having high significance, five had medium significance, and one had low significance.

Results of the Independent External Peer Review

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

Overall, the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 2010 Environmental Assessment is well-written, is generally technically sound, and presents considerable amounts of information and data. Key components, however, were not described in sufficient detail for the Panel to be confident in the successful performance of the Preferred Alternative. The Panel had two principal concerns:

- Some alternatives may have been dismissed prematurely and should have been re-examined in the Supplement to the EA.
- There are significant uncertainties that the Preferred Alternative will function successfully, and that the adaptive management strategy can lead to a successful outcome if the Preferred Alternative does not perform as intended.

The Panel agreed that the Supplement to the EA could be strengthened with a more specific discussion on the formulation, evaluation, and comparison of alternatives, including reconsideration of some alternatives previously dismissed. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation: The documentation of plan formulation, which was missing from the 2010 EA, details a long history of work done on this project over several years and appears to have been prepared only after the actions were completed. Accordingly, it is not apparent that a

Table ES-1. Overview of Nine Final Panel Comments Identified by the Intake Project IEPR Panel

No.	Final Panel Comments
Significance – High	
1	Even though the existing side channel meets all Biological Review Team (BRT) criteria and is more sustainable than the currently proposed bypass channel, its use with modifications for guiding pallid sturgeon into the channel was not investigated as an alternative.
2	It is uncertain that the current design of the bypass channel and the corresponding Adaptive Management Plan will lead to the successful upstream passage of migrating adult pallid sturgeon beyond the intake diversion.
3	Throughout Appendix E, the information on expected habitat unit (EHU) output for the alternatives is not well-defined, and the effects of different output metrics are not considered.
Significance – Medium	
4	The foundation details of dam construction cannot be fully characterized until additional geotechnical and structural evaluations are conducted.
5	Although a wide array of alternatives was assessed, the use of an inflatable dam/collapsible gate may have been prematurely eliminated from consideration.
6	The Supplement to the Environmental Assessment (EA) does not evaluate the impacts to other native fish species from the installation of the bypass channel plug.
7	The Adaptive Management Plan (Appendix J) presents only a few potential actions to improve performance, and it is not clear what potential actions would be taken if the bypass channel is not used or the success criteria are not met within the 8-year monitoring period.
8	The alternatives analysis may benefit from being updated given new information regarding fish passage and the finding that the Rock Ramp Alternative is cost-prohibitive.
Significance – Low	
9	Since the Rock Ramp Alternative was dropped, the decision process and screening criteria used to re-evaluate alternatives have not been clearly documented in the Supplement to the Environmental Assessment (EA).

consistent plan formulation rationale was used throughout the process of identifying and screening alternatives. The Panel is also concerned that the alternatives analysis, conducted after the rock ramp became economically infeasible, was incomplete. Since the re-evaluation of alternatives was narrowly focused on the No Action, Rock Ramp, and Bypass Channel Alternatives, other potentially viable alternatives that were previously eliminated from consideration should have been reconsidered.

Environmental Compliance/Biology: The Panel is concerned that the current Preferred Alternative assumes that pallid sturgeon will use the bypass channel as long as "swimmable" hydraulic conditions are met. The limited research presented on pallid sturgeon decision-making during upstream migration does not confirm a high level of confidence that the fish will actually use the bypass channel. In addition, there may be impacts, associated with the bypass channel plug, on native species that may be currently using the existing side channel. Finally, the Panel found that the Adaptive Management Plan does not provide adequate measures for achieving the project goals if the fish do not use the Preferred Alternative.

Economics: The Panel is concerned that the high level of uncertainty about the likelihood of achieving the expected habitat unit (EHU) outputs was not adequately addressed in the cost effectiveness/incremental cost analysis (CE/ICA). Potential costs that may be incurred if the bypass channel and adaptive management strategy do not achieve the project goals were also not considered.

Hydraulics Engineering: Several of the underlying hydrology/hydraulics assumptions regarding the route of the bypass channel, impacts of flood events on the bypass channel, sustainability of the design, and use of the existing side channel were not adequately investigated or documented. From the Panel's experience, the existing side channel is less likely to be filled by sediment during a Yellowstone River flood event and represents a more sustainable geomorphic platform than the proposed bypass channel.

Structural Engineering: The Panel found that several assumptions related to complying with USACE Engineer Manual (EM) 1110-2-2100 (USACE, 2005), including classifying the site as ordinary (requiring high-confidence-level foundation strengths and governing loads), are not supported in the Supplement to the EA. Existing geotechnical and structural evaluations, including establishment of confidence levels for foundation strengths and governing loads, do not adequately justify the factors of safety used in the stability analysis of the concrete structures.

Geotechnical Engineering: The Panel agrees that the document satisfactorily examined geotechnical constructability issues. Site conditions are fairly well understood, and the available geotechnical information seems to be adequate for the alternatives considered. However, the final diversion dam foundation design cannot be determined until detailed geotechnical and structural analyses are conducted to assess alternative foundation types and depths.

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LIST OF ACRONYMS

AFS	American Fisheries Society
ASCE	American Society of Civil Engineers
ATR	Agency Technical Review
BRT	Biological Review Team
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
COI	Conflict of Interest
DrChecks	Design Review and Checking System
EA	Environmental Assessment
EC	Engineer Circular
EHU	Expected Habitat Unit
EIS	Environmental Impact Statement
EM	Engineer Manual
ER	Engineer Regulation
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
G.E.	General Engineer
HEC-HMS	Hydrologic Engineering Center–Hydrologic Modeling System
HEC-RAS	Hydrologic Engineering Center–River Analysis System
IEPR	Independent External Peer Review
KEA	key ecological attribute
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
O&M	Operations and Maintenance
OEO	Outside Eligible Organization
OMB	Office of Management and Budget
PDT	Project Delivery Team
P.E.	Professional Engineer
PED	Preconstruction Engineering and Design
POP	Period of Performance

TVA	Tennessee Valley Authority
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 Intake Diversion Dam is located along the Lower Yellowstone River, approximately 18 miles downstream from the City of Glendive, Dawson County, Montana. The project site includes the dam and diversion structure, the upper 3,000 feet of the Lower Yellowstone Project Main Canal, and the area extending from about 3 miles downstream of the Dam to about 5 miles upstream of the Dam. The Intake Dam itself is a low-head timber and rock-filled weir (dam) owned by the U.S. Bureau of Reclamation that was originally constructed from 1905 to 1906. The dam is approximately 12 feet high and spans the entire width of the Yellowstone River, about 700 feet.

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the other alternatives considered in the 2010 EA, it would improve fish passage by providing an alternative channel for fish to utilize as they migrate upstream. Because the construction footprint is larger, the Bypass Channel Alternative does create temporary and permanent impacts to several natural resources, including riparian areas and wetlands; however, these impacts are considered minor, with benefits of the project offsetting the impacts.

The objective of the work described here was to conduct an Independent External Peer Review (IEPR) of the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices (hereinafter: Intake Project) 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 Intake Project. 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 Intake Project was conducted and managed using contract support from Battelle, which is an Outside Eligible Organization (OEO) (as defined by EC No. 1165-2-214) under Section 501(c)(3) of the U.S. Internal Revenue Code with experience conducting IEPRs for USACE.

3. METHODS

This section describes the method followed in selecting the members for the IEPR Panel (the Panel) and in planning and conducting the IEPR. The IEPR was conducted following procedures described by USACE (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 (POP), Battelle held a kick-off meeting with USACE to review the preliminary/suggested schedule, discuss the IEPR process, and address any questions regarding the scope (e.g., clarify expertise areas needed for panel members). Any revisions to the schedule were submitted as part of the final Work Plan.

Table 1 presents the schedule followed in executing the IEPR. Due dates for milestones and deliverables are based on the award/effective date of December 18, 2012. The review documents were provided by USACE on December 19, 2012. Note that the work items listed in Task 6 occur after the submission of this report. Battelle will enter the nine Final Panel Comments developed by the Panel into USACE's Design Review and Checking System (DrChecks), a Web-based software system for documenting and sharing comments on reports and design documents, so that USACE can review and respond to them. USACE will provide responses (Evaluator Responses) to the Final Panel Comments, and the Panel will respond (BackCheck Responses) to the Evaluator Responses. All USACE and Panel responses will be documented by Battelle.

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: economics, geotechnical engineering, hydraulic engineering, structural engineering, environmental compliance/biology, and Civil Works planning. These areas correspond to the technical content of the Intake Project documents and overall scope of the Intake Project.

To identify candidate panel members, Battelle reviewed the credentials of the experts in Battelle's Peer Reviewer Database, sought recommendations from colleagues, contacted former panel members, and conducted targeted Internet searches. Battelle initially identified more than 14 candidates for the Panel, evaluated their technical expertise, and inquired about potential COIs. Of these, Battelle chose the most qualified candidates and confirmed their interest and availability, and ultimately proposed six experts for the final Panel. Information about the six candidate panel members, including brief biographical information, highest level of education attained, and years of experience, was provided to USACE for feedback. Battelle made the final selection of panel members according to the selection criteria described in the Work Plan.

The six proposed primary 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.

Table 1. Intake Project IEPR Schedule

Task	Action	Due Date
1	Award/Effective Date	12/18/2012
	Review documents available	12/19/2012
	Battelle submits draft Work Plan[a]	12/19/2012
	USACE provides comments on draft Work Plan	12/20/2012
	Battelle submits final Work Plan	12/21/2012
	Battelle requests input from USACE on the COI questionnaire	12/19/2012
2	USACE provides comments on COI questionnaire	12/20/2012
	Battelle submits list of selected panel members[a]	12/21/2012
	USACE confirms the Panel has no COIs	12/24/2012
	Battelle completes subcontracts for panel members	1/3/2013
	Battelle convenes kick-off meeting with USACE	12/20/2012
3	Battelle sends review documents to Panel	1/3/2013
	Battelle convenes Panel kick-off meeting	1/3/2013
	Battelle convenes USACE/Panel kick-off meeting	1/3/2013
	Panel members complete their individual reviews	1/17/2013
4	Battelle provides Panel merged individual comments and talking points for Panel Review Teleconference	1/21/2013
	Battelle convenes Panel Review Teleconference	1/22/2013
	Panel members provide draft Final Panel Comments to Battelle	1/29/2013
	Battelle finalizes Final Panel Comments	2/4/2013
5	Battelle submits Final IEPR Report to USACE[a]	2/8/2013
6[b]	Battelle convenes teleconference with USACE to review the Post-Final Panel Comment Response Process	2/11/2013
	USACE provides draft Project Delivery Team (PDT) Evaluator Responses to Battelle	2/15/2013
	Battelle convenes teleconference with Panel and USACE to discuss Final Panel Comments and draft responses	2/22/2013
	USACE inputs final PDT Evaluator Responses in DrChecks	2/25/2013
	Battelle inputs the Panel's BackCheck Responses in DrChecks	3/1/2013
	Battelle submits pdf printout of DrChecks project file[a]	3/4/2013
	Project Closeout	5/6/2013

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

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 Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current involvement by you or your firm[2] with ecosystem restoration studies along the Lower Yellowstone River; the Missouri River; the City of Glendive, Dawson County, Montana; eastern Montana; and/or western North Dakota.
- Previous and/or current involvement by you or your firm[2] in the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices and 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 Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices and related projects.
- Current employment by the U.S. Army Corps of Engineers (USACE).
- Previous and/or current involvement with paid or unpaid expert testimony related to the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current employment or affiliation with members of the following cooperating federal, state, county, local, and regional agencies, environmental organizations, and interested groups (for pay or pro bono): Missouri River Recovery Program, Bureau of Reclamation, State of Montana Department of Fish, Wildlife and Parks, U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS), Montana Department of Environmental Quality, The Nature Conservancy, Yellowstone River Conservation District Council, and Lower Yellowstone Irrigation Project.
- Past, current, or future interests or involvements (financial or otherwise) by you, your spouse, or your children related to the Lower Yellowstone River; the Missouri River; the

[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] Note: Includes any joint ventures in which panel member's firm is involved and if the firm serves as a prime or as a subcontractor to a prime. Please clarify which relationship exists in the rows above.

City of Glendive, Dawson County, Montana; eastern Montana; and/or western North Dakota.

- Current personal involvement with other USACE projects, including whether involvement was to author any manuals or guidance documents for USACE. If yes, provide titles of documents or description of project, dates, and location (USACE district, division, Headquarters, Engineer Research & Development Center (ERDC), etc.), and position/role. Please highlight and discuss in greater detail any projects that are specifically with the Omaha District.
- Previous or current involvement with the development or testing of models that will be used for or in support of the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices project.
- Current firm[2] involvement with other USACE projects, specifically those projects/contracts that are with the Omaha 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 Omaha District. Please explain.
- Any previous employment by USACE as a direct employee or contractor (either as an individual or through your firm[2]) within the last 10 years, notably if those projects/contracts are with the Omaha 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 the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices and related contracts/awards from USACE.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years came from USACE contracts.
- A significant portion (i.e., greater than 50%) of personal or firm[2] revenues within the last 3 years from contracts with the non-federal sponsor.
- Any publicly documented statement (including, for example, advocating for or discouraging against) related to the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Participation in relevant prior federal studies relevant to this project and the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices.
- Previous and/or current participation in prior non-federal studies relevant to this project and/or the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplemental Analysis to the 26 April 2010 Environmental Assessment and Appendices.

- Is there any past, present, or future activity, relationship, or interest (financial or otherwise) that could make it appear that you would be unable to provide unbiased services on this project? If so, please describe.

In selecting the final members of the Panel, Battelle chose experts who best fit the expertise areas and had no COIs. One of the six final reviewers is affiliated with an academic institution, and another is working as an independent engineering consultant. The other four 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. Section 4 of this report provides names and biographical information on the panel members.

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 to review the IEPR process, the schedule, communication procedures, and other pertinent information for the Panel.

3.3 Preparation of the Charge and Conduct of the IEPR

Charge questions were provided by USACE and included in the draft and final Work Plans. In addition to a list of 30 charge questions/discussion points, the final charge included general guidance for the Panel on the conduct of the peer review (provided in Appendix B of this final report).

Battelle planned and facilitated a kick-off meeting via teleconference during which USACE presented project details to the Panel. Before the meeting, the IEPR Panel received an electronic version of the final charge as well as the Intake Project 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. In addition, throughout the review period, USACE provided additional documents at the request of panel members. These additional documents were provided to Battelle and then disseminated to the Panel as supplemental information only and were not part of the official review. A list of these additional documents requested by the Panel is provided below.

- **Intake Diversion Dam Modification, Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment (113 pages)**
- **Appendix A.1 Plan Formulation (35 pages)**
- **Appendix A.2 Engineering Appendix (386 pages)**
- **Appendix C Federally Listed Species and State Species of Special Concern (2 pages)**
- **Appendix D Federally Protected Species (1 pages)**
- **Appendix E Cost Effectiveness Incremental Cost Analysis (42 pages)**
- **Appendix F Species Common and Scientific Names (5 pages)**
- **Appendix G NHPA Consultation (6 pages)**
- **Appendix H Indian Trust Assets (11 pages)**

- **Appendix I Actions to Minimize Effects (10 pages)**
- **Appendix J Adaptive Management and Monitoring Plan (18 pages)**
- **Appendix K Intake Diversion Dam Modification Lower Yellowstone Project, Waters of the U.S. Delineation Report (16 pages)**
- **Environmental Review Comments/Responses (3 pages)**
- 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

Additional documents requested by the Panel:

- McElroy, B., DeLonay, A., and R. Jacobson (2012). Optimum swimming pathways of fish spawning migrations in rivers. *Ecology, 93(1), pp. 29-34*
- Intake Diversion Dam Modification Lower Yellowstone Project, Montana Bypass Channel 30% Design Documentation Report, Draft, USACE December 2012
- Geologic Investigations Report Lower Yellowstone Project Intake, Montana, U.S. Department of Interior Bureau of Reclamation March 2009
- Jordan, G. (2012) Summary of the Biological Review Team's review of the bypass channel 30% design features and channel entrance and exit pre-appraisal study to provide fish passage around Intake Dam, Montana. U.S. Fish and Wildlife Service, March 5, 2012.
- Revised Appendix C

About halfway through the review of the Intake Project 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 mid-review teleconference, Battelle submitted eight questions to USACE. USACE was able to provide responses to all but one of the questions during the teleconference. Information on the unanswered question was supplied the following day.

3.4 Review of Individual Comments

The Panel was instructed to address the charge questions/discussion points within a comment-response form provided by Battelle. At the end of the review period, the Panel produced 150 individual comments in response to the charge questions/discussion points. Battelle reviewed the comments to identify overall recurring themes, areas of potential conflict, and other overall impressions. As a result of the review, Battelle summarized the 150 comments into a preliminary list of 16 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 3.5-hour teleconference with the Panel so that the panel members could exchange technical information. The main goal of the teleconference was to identify which issues should be carried forward as Final Panel Comments in the Final IEPR Report and decide which panel member would serve as the lead author for the development of each Final Panel Comment. This information exchange ensured that the Final IEPR Report would accurately

represent the Panel's assessment of the project, including any conflicting opinions. The Panel engaged in a thorough discussion of the overall positive and negative comments, added any missing issues of high-level importance to the findings, and merged any related individual comments. In addition, Battelle confirmed each Final Panel Comment's level of significance to the Panel.

The Panel also discussed responses to a charge question 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. The comment was determined to be consistent with other Final Panel Comments already developed.

At the end of these discussions, the Panel identified nine 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 Intake Project:

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

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

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

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

4. PANEL DESCRIPTION

Candidates for the Panel were identified using Battelle's Peer Reviewer Database, targeted Internet searches using key words (e.g., technical area, geographic region), searches of websites of universities or other compiled expert sites, and referrals. Battelle prepared a draft list of primary 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 six members of the Panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. Additional biographical information regarding each panel member and his area of technical expertise is presented in the text that follows the table.

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

Technical Criterion	Burke	Hubert	Milon	Philips	Rudolph	Ghanaat
Civil Works Planner						
Minimum 10 years planning experience	x					
Minimum 5 years of experience working directly with/for the USACE on Civil Works projects	x					
Very familiar with USACE Civil Works planning policies, methodologies, and procedures	x					
Experience related to USACE and large river engineering projects	x					
Experience with large USACE ecosystem restoration projects	x					
Experience with ecosystem models	x					
Experience with incremental cost analysis	x					
Experience with Institute for Water Resources Planning Suite	x					
Minimum M.S. degree in relevant field	x					
Environmental Compliance/Biology						
Minimum 10 years of demonstrated experience with projects along the Yellowstone River		x				
Knowledge of construction impacts on fisheries and aquatic ecology of the Yellowstone River and warm water fish passage		x				
Familiar with all NEPA Environmental Impact Statement (EIS) requirements		x				
Experience with the ESA		x				
Active participation in related professional societies		x				
Minimum M.S. degree in an appropriate field of study		x				

Technical Criterion	Burke	Hubert	Milon	Philips	Rudolph	Ghanaat
Economics						
Minimum 10 years of experience directly related to water resource economic evaluation or review			x			
Minimum 2 years of experience in reviewing federal water resource economic documents justifying construction efforts			x			
Experience related to evaluating traditional National Ecosystem Restoration plan benefits associated with ecosystem projects			x			
Experience in USACE methodologies for performing cost effectiveness/incremental cost analysis (CE/ICA)			x			
Experience in determining cost effectiveness of fish passage			x			
Active participation in related professional societies			x			
Minimum M.S. degree in economics			x			
Hydraulic Engineer						
Licensed Professional Engineer (P.E.) with a minimum 10 years of experience in hydraulic engineering with an emphasis on large river engineering projects in complex systems or a professor from academia with extensive background in large river processes and hydraulic theory and practice				x		
Experience in hydraulic engineering with an emphasis on large public works projects associated with ecosystem restoration and natural channel design				x		
Familiar with HEC-RAS 4.0 (Hydrologic Engineering Center-River Analysis System) and similar USACE hydrologic and hydraulic computer models				x		
Experience with both computer simulation and physical modeling of large river systems				x		
Active participation in related professional societies				x		
Minimum M.S. degree in engineering				x		

Technical Criterion	Burke	Hubert	Milon	Philips	Rudolph	Ghanaat
Geotechnical Engineer						
Licensed P.E. with a minimum 10 years of experience in geotechnical engineering or a professor from academia with extensive background in large river processes in complex systems and geotechnical theory and practice					x	
Familiarity with large, complex Civil Works projects with high public interagency interests					x	
Design and construction experience of foundations, earthworks, and pavement subgrades for low-head dams					x	
Active participation in related professional societies					x	
Experience in large river engineering projects					x	
Experience in geomorphology					x	
Experience in sediment transport					x	
Experience in the design of secondary channels in large river systems					x	
Experience in the design and construction of engineered structures in large rivers					x	
Minimum M.S. degree in geotechnical engineering					x	
Structural Engineer						
Registered P.E. with a minimum 10 years of experience in structural engineering with an emphasis on large river engineering projects in complex systems or a professor from academia with extensive background in large river construction projects						x
Experience in the design and construction of low-head weirs						x
Familiar with large, complex Civil Works projects with high public and interagency interests						x
Active participation in related professional societies						x
Minimum M.S. degree in structural engineering						x

Roger Burke

Role: Civil Works Planner expertise.
Affiliation: Tetra Tech, Inc.

Mr. Burke is a Senior Project Manager with Tetra Tech, Inc. with over 43 years of experience in water resources planning and project management, performing and overseeing the performance of feasibility studies and associated economic analyses. He earned a Master of Business Administration from the University of South Alabama in 1984 and is a member of the Society of American Military Engineers.

Mr. Burke worked for 39 years as USACE Branch Chief, plan formulator, economist, and operations research analyst and is therefore familiar with USACE Civil Works planning policies, methodologies, and procedures. As Plan Formulation Branch Chief, he was responsible for providing guidance to planners and economists within the Branch regarding USACE planning policy and procedures, which required an in-depth familiarity with Engineer Regulation (ER) 1105-2-100 (USACE, 2000) and other ERs, engineer circulars, and engineer pamphlets pertaining to Civil Works planning.

Mr. Burke's familiarity with large USACE ecosystem restoration projects and experience with ecosystem models is demonstrated through his service on the ATR Team for the Louisiana Coastal Areas Study and, since his retirement from USACE in 2007, his employment by Tetra Tech serving as senior planner on various USACE studies and projects advising on USACE planning policies and procedures. Additionally, Mr. Burke has been involved in several relevant projects and studies, including the Neuse River Basin Study (North Carolina) and the Indian, Sugar, Intrenchment, and Snapfinger Creeks Study (Georgia). His experience with USACE large river engineering projects is reflected primarily in the last 20 years of his USACE career and his involvement with the interstate water issues in two major river basins (Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint River Basins). Additionally, he has served as a subject matter expert with the states of Alabama, Georgia, and Florida, and with the Federal Commissioner regarding federal and interstate water issues, which involved water management and water supply policies related to federal reservoirs.

Wayne Hubert, Ph.D.

Role: Environmental Compliance/Biology expertise.
Affiliation: Hubert Fisheries Consulting, LLC

Dr. Hubert is President/CEO of Hubert Fisheries Consulting LLC with more than 40 years of experience as an aquatic biologist. Dr. Hubert earned his Ph.D. at Virginia Polytechnic Institute and State University in 1979 and is a Certified Fisheries Professional with the American Fisheries Society (AFS).

Dr. Hubert has conducted research on native riverine fishes of the Mississippi/Missouri River system, including warm water tributaries to the Lower Yellowstone River, since 1972. From 1982 to 2010, Dr. Hubert served as the Assistant Leader and Leader of the Wyoming Cooperative Fish and Wildlife Research Unit at the University of Wyoming. There, he conducted numerous fisheries research projects in the Lower Yellowstone River watershed upstream from

Intake, Montana, on the Powder, Bighorn, and Tongue rivers. These projects addressed needs for information on the ecology of native fishes as a result of human activities in the Yellowstone River drainage. The specific research included studies on seasonal movements, habitat associations, and effects of barriers to movements on shovelnose sturgeon, channel catfish, sauger, and burbot, as well as communities of small fishes. Through his research, Dr. Hubert has published numerous reports and is familiar with the literature on the Lower Yellowstone River and Upper Missouri River systems, the ecology of the native fishes in these rivers, and the water development issues related to preservation of native fishes in these rivers.

In addition to his research on native riverine fishes, Dr. Hubert has been familiar with NEPA since its inception in 1969 and taught the requirements of the Act in courses at the University of Wyoming from 1982 to 2010. Furthermore, he has contributed information to federal agencies for EAs and Environmental Impact Statements (EISs) throughout his career.

Dr. Hubert has been involved with rare fish issues and the ESA since its passage in 1973, and while at the University of Wyoming, he taught courses that addressed the processes and requirements of the ESA. Additionally, substantial portions of his research program in Iowa and Wyoming focused on fish species that were listed as threatened or endangered or species in decline that may warrant listing.

Dr. Hubert has been very active in his field. He was elected as Second Vice President of the AFS in 2007 and served as an officer for the next 5 years, including President in 2010 to 2011. Additionally, he has served as an associate editor and editor of the North American Journal of Fisheries Management. He has been the recipient of three AFS awards: the Award of Excellence for Outstanding Career Accomplishments, Colorado/Wyoming Chapter; the Award for Excellence in Fisheries Education; and the Award of Excellence, Western Division. He was inducted to the Fisheries Management Hall of Excellence, AFS, in 2006.

J. Walter Milon, Ph.D.

Role: Economics expertise.
Affiliation: University of Central Florida

Dr. Milon is the Provost's Distinguished Research Professor in the Department of Economics at the University of Central Florida's College of Business Administration, where he teaches graduate-level courses in benefit-cost and social impact analyses, economic theory, and natural resource and environmental economics. He earned his Ph.D. in economics from Florida State University in 1978 and has more than 30 years of experience in natural resource and environmental economics and water resource economic evaluation. He is a member of the Association of Environmental and Resource Economists and the American Economics Association.

Dr. Milon has more than five years of experience reviewing federal water resource economic documents justifying construction efforts. He has participated in the planning and technical advisory for the USACE Florida Everglades Restudy (1995 to 1999) and was lead economist on four USACE IEPRs, including the Everglades C-111 construction project (2009), the Louisiana

Coastal Areas Restoration Project (2009 to 2011), and the White Oak Bayou, Texas, flood control plan (2011).

Dr. Milon is experienced in the evaluation of traditional National Ecosystem Restoration plan benefits associated with ecosystem restoration. In addition to more than 20 years of experience in teaching and research related to estimation of ecosystem benefits and ecosystem restoration, he is a member of National Research Council Committee with USACE Water Resources Science, Engineering, and Planning. He is experienced in USACE methodologies for performing cost effectiveness/incremental cost analysis (CE/ICA), and has over 20 years of experience in teaching and research related to cost-benefit and CE/ICA analysis. He is also experienced in determining cost effectiveness of fish passages, as demonstrated by his 20 years of experience in research and economic analysis associated with fisheries economics and recreational fishing. Additionally, he has supervised several fisheries research projects for the National Marine Fisheries Service and served as technical expert for federal fishery management councils and journals.

Through his research and teaching experiences, Dr. Milon has authored an economics book and more than 15 book chapters; 45 reports; and 40 journal articles. He has been involved with more than 25 university contracts and grants and serves as a private economic consultant to both government and private clients.

Chris Philips, P.E., CFM

Role: Hydraulic Engineering expertise.
Affiliation: Riverbend Engineering

Mr. Philips is the owner and senior engineer at Riverbend Engineering in Albuquerque, New Mexico. He earned his Master's degree in civil engineering, with a specialty in water resources, in 1996 from the University of New Mexico. He is a registered professional engineer in New Mexico, Colorado, and Texas; a certified floodplain manager in New Mexico; and NRCS Technical Services Provider in New Mexico and Colorado. He has 27 years of experience in hydrologic and hydraulic engineering, with an emphasis on large public works projects associated with ecosystem restoration and natural channel design. He has designed more than 60 river restoration, fish habitat, and fish passage/barrier projects, most of which were based on natural channel design methods. His design work has included all types of flood conveyance systems: closed conduit and open channel, with and without detention facilities, energy dissipaters, weirs, and side-channel spillways. He also designed more than 50 irrigation diversion structures on rivers.

Mr. Philips is familiar with USACE hydrologic and hydraulic computer models, including Hydrologic Engineering Center−River Analysis System (HEC-RAS) 4.0, and has project experience using HEC-1, HEC-2, and HEC−Hydrologic Modeling System (HEC-HMS) models. Mr. Philips' specific hydraulic modeling experience includes two Alamogordo Flood Control channels for the USACE Albuquerque District; the Rio Fernando in Taos, New Mexico; the San Juan River at Pagosa Springs, Colorado; La Cueva arroyo in Albuquerque, New Mexico; and the Uncompahgre River in Ridgway, Colorado. Additionally, he is experienced with both computer simulation and physical modeling of large river systems and has project experience using HEC-6

and SAMwin. Relevant projects include watershed-based sedimentation studies and reach level sediment transport analyses on the Zuni River and sediment transport studies on numerous arroyos in New Mexico.

Mr. Philips' firm, Riverbend Engineering, has its own in-house laboratory for physical hydraulic modeling of river systems (fixed boundary) and has combined numeric and physical scale modeling of hydraulic structures on the San Juan and Animas Rivers. In addition to his work experiences, he actively participates in related professional societies including the American Society of Civil Engineers (ASCE) and the American Water Resources Association.

R. William Rudolph, P.E., G.E.

Role: Geotechnical Engineering expertise.
Affiliation: Independent Consultant

Mr. Rudolph is an independent, licensed P.E., G.E., and Principal Engineer with 34 years of experience on a wide variety of geotechnical engineering projects throughout the western United States. He earned his M.S. degree in geotechnical engineering from the University of California at Berkeley in 1978 and is an active member of the ASCE and the Coasts, Oceans, Ports, and Rivers Institute.

Mr. Rudolph has project experience with large river and Civil Works projects with high levels of public and interagency interest, including his work on the American, Sacramento, and San Joaquin Rivers near Sacramento, California, and projects on the Mississippi River in Illinois, Missouri, and New Orleans, Louisiana. He has consulted on projects involving weirs, drop structures, embankments, and low-head dams for water diversion and flood control, including flood control projects in Contra Costa and Napa counties, California. He has been a principal consultant on more than 150 small, earth-fill dams and reservoirs for the Vineyard Development Water Supply Reservoirs in California, and has consulted on site selection, including geologic and seismic assessment, material sources, and design alternatives. Several of the projects involved diversion structures within nearby rivers. Many of the projects are in sensitive environments and required coordination with the Department of Fish and Game for spillway design and modification, including seepage cutoffs and construction of paved weirs for low-head dams.

Additionally, Mr. Rudolph has supervised geomorphologic studies in support of geotechnical evaluations of complex river systems and levee designs across the United States. He has also worked closely with sediment transport modeling on numerous studies and has provided geotechnical input to the sediment transport models.

Mr. Rudolph is experienced in the design and construction of secondary channels on large river systems and has been involved in many flood control projects with elements including secondary channels in large river systems such as the Truckee River in Reno, Nevada. His experience in the design and construction of engineered structures in large river systems and estuaries is reflected in his involvement with projects that included the construction of weirs, bridge piers, and intake and outlet structures. He has extensive design and construction experience with foundations, earthworks, and pavement subgrades for low-head dams, has designed, and evaluated various

deep foundations, including driven piles and cast-in-drilled-hole piles. He also has extensive experience with the design and construction of ground improvement for enhanced foundation support and lateral stability, including cement deep soil mixing columns, stone columns, and grouting. Mr. Rudolph has designed and monitored large earthworks, including earthfill dams and mass grading, and has designed and monitored many earthfill dams and reservoirs.

Mr. Rudolph has been a geotechnical engineering expert for numerous USACE IEPRs, including the East St. Louis (Illinois) Design Deficiency Limited Reevaluation Report; the Truckee Meadows (Nevada) Flood Control Project; the Melvin Price Wood River Underseepage Reevaluation Report (Illinois and Missouri); and Isabella Lake Dam (California). He is knowledgeable of USACE Safety Assurance Review procedures and of the Risk-Based Analysis for Flood Damage Reduction Studies (USACE, 1996).

Yusof Ghanaat, P.E., Ph.D.

Role: Structural Engineering expertise.
Affiliation: Quest Structures, Inc.

Dr. Ghanaat is the president of Quest Structures, Inc. in Orinda, California. He earned his Ph.D. in structural engineering in 1980 from University of California at Berkeley and is a registered professional civil engineer in California. Dr. Ghanaat has over 35 years of experience in structural and civil engineering projects. He has extensive experience in large river engineering projects in complex systems, with structural engineering experience related to hydraulic structures, including dams, inlet/outlet towers, outlet works, navigation locks, retaining walls, and spillway structures. Additionally, he is an active participant in professional engineering societies, including the United States Society on Dams, the Association of State Dam Safety Officials, the ASCE, the Earthquake Engineering Research Institute, the Seismological Society of America, and the Structural Engineers Association of Northern California. Dr. Ghanaat was a recipient of an honor award from the Chief of Engineers Design and Environmental Awards Program in 2002 for his work on seismic design and analysis of the Seven Oaks Dam Intake Tower (California).

Dr Ghanaat has been involved in the design and construction of major dams, locks, and outlet works with high-head and high-seismic-load demands, which uniquely qualifies him with any design and construction issues related to low-head weirs. Relevant low-head projects include the Tennessee Valley Authority's (TVA's) 30-foot-high Ocoee No. 2 diversion dam located in Tennessee, constructed of a timber crib structure filled with rock and covered on the downstream with roller-compacted concrete, and the U.S. Forest Service's 33-foot-high Hemlock concrete arch weir located on Trout Creek near the town of Carson, Washington.

Dr. Ghanaat is familiar with large, complex Civil Works projects with high public interagency interests and has experience with numerous Civil Works projects throughout his career. Related studies include his independent review and consultation to USACE Louisville District on the design and construction of Olmsted Locks and Dam (Illinois); serving on a Consultant Review Board on Phases I, II, and III of the Folsom Dam Auxiliary Spillway (California), a Federal Joint Project involving USACE, the U.S. Bureau of Reclamation, and other state stakeholders; and serving on the TVA's Independent Review Board since 2002, overseeing and assessing study

plans, designs and design modifications, and construction of TVA's dams, locks, and coal combustion product storage facilities. Dr. Ghanaat has authored many engineering manuals for USACE as well as arch dam analysis guidelines for the Federal Energy Regulatory Commission.

5. SUMMARY OF FINAL PANEL COMMENTS

The panel members agreed among one another on their "assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (USACE, 2012; p. D-4) in the Intake Project 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.

Overall, the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 2010 Environmental Assessment is well-written, is generally technically sound, and presents considerable amounts of information and data. Key components, however, were not described in sufficient detail for the Panel to be confident in the successful performance of the Preferred Alternative. The Panel had two principal concerns:

- Some alternatives may have been dismissed prematurely and should have been re-examined in the Supplement to the EA.
- There are significant uncertainties that the Preferred Alternative will function successfully, and that the adaptive management strategy can lead to a successful outcome if the Preferred Alternative does not perform as intended.

The Panel agreed that the Supplement to the EA could be strengthened with a more specific discussion on the formulation, evaluation, and comparison of alternatives, including reconsideration of some alternatives previously dismissed. The following statements summarize the Panel's findings, which are described in more detail in the Final Panel Comments (see Appendix A).

Plan Formulation: The documentation of plan formulation, which was missing from the 2010 EA, details a long history of work done on this project over several years and appears to have been prepared only after the actions were completed. Accordingly, it is not apparent that a consistent plan formulation rationale was used throughout the process of identifying and screening alternatives. The Panel is also concerned that the alternatives analysis, conducted after the rock ramp became economically infeasible, was incomplete. Since the re-evaluation of alternatives was narrowly focused on the No Action, Rock Ramp, and Bypass Channel Alternatives, other potentially viable alternatives that were previously eliminated from consideration should have been reconsidered.

Environmental Compliance/Biology: The Panel is concerned that the current Preferred Alternative assumes that pallid sturgeon will use the bypass channel as long as "swimmable" hydraulic conditions are met. The limited research presented on pallid sturgeon decision-making during upstream migration does not confirm a high level of confidence that the fish will actually use the bypass channel. In addition, there may be impacts, associated with the bypass channel plug, on native species that may be currently using the existing side channel. Finally, the Panel

Table 3. Overview of Nine Final Panel Comments Identified by the Intake Project IEPR Panel

No.	Final Panel Comments
Significance – High	
1	Even though the existing side channel meets all Biological Review Team (BRT) criteria and is more sustainable than the currently proposed bypass channel, its use with modifications for guiding pallid sturgeon into the channel was not investigated as an alternative.
2	It is uncertain that the current design of the bypass channel and the corresponding Adaptive Management Plan will lead to the successful upstream passage of migrating adult pallid sturgeon beyond the intake diversion.
3	Throughout Appendix E, the information on expected habitat unit (EHU) output for the alternatives is not well-defined, and the effects of different output metrics are not considered.
Significance – Medium	
4	The foundation details of dam construction cannot be fully characterized until additional geotechnical and structural evaluations are conducted.
5	Although a wide array of alternatives was assessed, the use of an inflatable dam/collapsible gate may have been prematurely eliminated from consideration.
6	The Supplement to the Environmental Assessment (EA) does not evaluate the impacts to other native fish species from the installation of the bypass channel plug.
7	The Adaptive Management Plan (Appendix J) presents only a few potential actions to improve performance, and it is not clear what potential actions would be taken if the bypass channel is not used or the success criteria are not met within the 8-year monitoring period.
8	The alternatives analysis may benefit from being updated given new information regarding fish passage and the finding that the Rock Ramp Alternative is cost-prohibitive.
Significance – Low	
9	Since the Rock Ramp Alternative was dropped, the decision process and screening criteria used to re-evaluate alternatives have not been clearly documented in the Supplement to the Environmental Assessment (EA).

found that the Adaptive Management Plan does not provide adequate measures for achieving the project goals if the fish do not use the Preferred Alternative.

Economics: The Panel is concerned that the high level of uncertainty about the likelihood of achieving the expected habitat unit (EHU) outputs was not adequately addressed in the CE/ICA

analysis. Potential costs that may be incurred if the bypass channel and adaptive management strategy do not achieve the project goals were also not considered.

Hydraulics Engineering: Several of the underlying hydrology/hydraulics assumptions regarding the route of the bypass channel, impacts of flood events on the bypass channel, sustainability of the design, and use of the existing side channel were not adequately investigated or documented. From the Panel's experience, the existing side channel is less likely to be filled by sediment during a Yellowstone River flood event and represents a more sustainable geomorphic platform than the proposed bypass channel.

Structural Engineering: The Panel found that several assumptions related to complying with USACE Engineer Manual (EM) 1110-2-2100 (USACE, 2005), including classifying the site as ordinary (requiring high-confidence-level foundation strengths and governing loads), are not supported in the Supplement to the EA. Existing geotechnical and structural evaluations, including establishment of confidence levels for foundation strengths and governing loads, do not adequately justify the factors of safety used in the stability analysis of the concrete structures.

Geotechnical Engineering: The Panel agrees that the document satisfactorily examined geotechnical constructability issues. Site conditions are fairly well understood, and the available geotechnical information seems to be adequate for the alternatives considered. However, the final diversion dam foundation design cannot be determined until detailed geotechnical and structural analyses are conducted to assess alternative foundation types and depths.

6. REFERENCES

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USACE (2012). Water Resources Policies and Authorities: Civil Works Review. Department of the Army, US Army Corps of Engineers, Washington, D.C. Engineer Circular (EC) No. 1165-2-214. December 15.

White, R.G., and B. Mefford (2002). Assessment of Behavior and Swimming Ability of Yellowstone River Sturgeon for Design of Fish Passage Devices. Montana Cooperative Fishery Research Unit, Montana State University-Bozeman and Water Resources Research Laboratory, Reclamation, Denver, Colorado.

APPENDIX A

Final Panel Comments

on the

Intake Project IEPR

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Final Panel Comment 1

Even though the existing side channel meets all Biological Review Team (BRT) criteria and is more sustainable than the currently proposed bypass channel, its use with modifications for guiding pallid sturgeon into the channel was not investigated as an alternative.

Basis for Comment

The existing side channel was considered as an option for upstream fish passage during the 2005 Value Planning Study. At that time, this option was eliminated from further consideration because of concerns that the pallid sturgeon would not "find" and use this channel. Since it was certain that pallid sturgeon would find the existing dam the development of a bypass alternative logically concluded that any side channel option must begin at the base of the dam. When the rock ramp was found to be infeasible due to cost, the hydraulic solution to fish passage reverted to a bypass channel approach, but the range of alternatives was constrained by the assumption that any bypass channel must begin at the base of the dam. Alternative alignments for the bypass channel were considered in the 2012 Supplement to the Environmental Assessment (EA), utilizing the same endpoints in each alternative.

The Panel considers this alternative analysis to be a refinement of one option: a bypass channel beginning at the base of the dam and ending at the entrance to the existing side channel. The Supplement to the EA included a geomorphic assessment of 11 existing side channels in the Yellowstone River, because side channels are used by some pallid sturgeon during their upstream migrations. While the proposed bypass channel does satisfy the basic hydraulic requirements set forth by the BRT (maximum velocity and minimum depth), it appears that the existing side channel also meets these criteria.

The proposed bypass channel crosses the floodplain, perpendicular to the "down valley" direction of overbank flows in the past (see Figure 1, Attachment 6, Appendix B). This suggests that during an overbank flood event, the proposed bypass channel will be inundated, and with its perpendicular orientation, it is likely to suffer scour damage and potential sediment deposition. All 11 side channels evaluated as reference reaches have a "down-valley" channel alignment, which is a much more geomorphically stable channel pattern than the proposed bypass channel. This raises questions for the Panel regarding the sustainability of the bypass channel, the severity of damage in an overbank flood event, and the frequency of maintenance that may be required.

The Panel did not find documentation of studies or designs to encourage the pallid sturgeon to use the existing side channel. For either the proposed bypass channel or for the existing side channel, some encouragement or form of guidance may be necessary to have the migrating pallid sturgeon find and enter one of these channels. Some form of low weir across the Yellowstone River just upstream of the existing side channel entrance appears to be necessary to ensure that the migrating pallid sturgeon do not swim past the entrance. There also appears to be an opportunity for river channel

shaping that would create hydraulic conditions consistent with the pallid sturgeon's upstream swimming preferences (McElroy et al., 2012). This study indicates the pallid sturgeon's preference in migratory path decision-making to seek slower-moving water near the bank or on the inside of bends in lieu of faster moving water in mid-channel or on the outside of bends. The Panel did not find evidence Supplement to the EA that the hydraulic design had been optimized to match the pallid sturgeon's observed behavior.

Significance – High

Utilization of the existing side channel for fish passage, with enhancements to direct pallid sturgeon to this channel, has not been adequately assessed. The existing side channel has already proved to be geomorphically sustainable, and may represent a solution that requires less capital cost for channel excavation and less maintenance cost after an overbank flood event.

Recommendations for Resolution

1. Explore options to maximize the pallid sturgeon's likelihood of "finding" the existing side channel and using it for upstream migration. Construction of a low weir across the main river channel just upstream of the side channel entrance would guide pallid sturgeon before they move up to the base of the existing dam. The evaluation of options should include optimizing the hydraulic conditions in the Yellowstone River leading into any bypass or side channel, so that pallid sturgeon utilization can be maximized.

2. Consider conducting physical modeling of a low weir and other hydraulic modifications in the Yellowstone River to optimize the angles, depth, and velocity patterns, so that pallid sturgeon discovery of the entrance to the existing side channel is maximized.

Literature Cited

McElroy, B., A. DeLonay, and R. Jacobson (2012). Optimum swimming pathways of fish spawning migrations in rivers. Ecology 93:29–34.

Final Panel Comment 2

It is uncertain that the current design of the bypass channel and the corresponding Adaptive Management Plan will lead to the successful upstream passage of migrating adult pallid sturgeon beyond the intake diversion.

Basis for Comment

After completion of the Environmental Assessment (EA) in April 2010, observations during 2011 of upstream-migrating adult pallid sturgeon in the Yellowstone River, downstream from the intake diversion, showed their use of natural side channels during migration. A bypass channel to facilitate upstream migration of adult pallid sturgeon had not been fully assessed as an alternative in the EA because it was believed that pallid sturgeon only used the more sizable main channel during migration. The 2012 Supplement to the EA assessed the No Action, Rock Ramp, and constructed Bypass Channel Alternatives, and the Preferred Alternative was identified as the Bypass Channel Alternative. A major assumption in the Supplement to the EA was that because pallid sturgeon have been observed to use natural side channels during upstream migration in the Lower Yellowstone River, they will use a constructed bypass channel around the intake diversion that provides flow velocities and depths identified by the Biological Review Team (BRT) as suitable for sturgeon migration. The Panel finds that there is not sufficient evidence to support this assumption or support the design of the proposed bypass channel.

There is not sufficient information about adult pallid sturgeon behavior to indicate that the proposed bypass channel will be used by adult pallid sturgeon migrating upstream in the Yellowstone River. The BRT (Jordan, 2012) described migratory upstream movements of adult pallid sturgeon as taking place along the inside of river bends and their use of side channels that flow into the main channel at the inside of bends (Supplement to the EA, Chapter 4, page 14). Comparisons of natural side channel features observed in the Lower Yellowstone River to the bypass channel design indicate substantial differences in channel features (Supplement to the EA, Attachment 6, Appendices C and D). The bypass channel design differs from the natural side channels documented in the Supplement to the EA in terms of its sinuosity, its down-valley channel alignment, and its lack of variation in channel width and depth. Alignment of the bypass channel is being forced to begin (downstream) at the toe of the existing rock rubble dam, because fish are thought to be more likely to find the bypass channel and utilize it in their movement upstream. McElroy et al. (2012) developed a model and validated it using data on a migrating adult pallid sturgeon. Their research is cited as support for the proposed bypass channel (Supplement to the EA, Chapter 4, page 14). The model accounts for upstream movement pathways of adult pallid sturgeon that minimize energy expenditure migration, thereby suggesting their avoidance of high-velocity turbulent flows. White and Mefford (2002) conducted laboratory research with a surrogate species, shovelnose sturgeon, and identified ranges of current velocities, water depths, and substrate particle sizes that influence upstream movement tendencies (Chapter 3, page 2). Their observations appear to have been used in the design and evaluation of the Rock Ramp and Bypass Channel Alternatives (Supplement to the EA,

Appendix A.1, Attachment 3, page 1, Passage Criteria; Attachment 6, page 13, Depths and Velocities). White and Mefford (2002) found that adult shovelnose sturgeon oriented to current velocities of 2-6 feet/second, but upstream movements declined with increasing size of eddies such as those that may be encountered at the entrance to the proposed bypass channel. Cumulatively, these observations provide little scientific evidence that adult pallid sturgeon are likely to find, be attracted to enter, or migrate through the proposed bypass channel.

The Panel identified numerous uncertainties associated with the proposed bypass channel that are illustrated by statements from the Supplement to the EA. The BRT stated that numerous uncertainties related to the design and performance of the proposed project could affect the ability of the project to meet its stated goals and objectives (Jordan, 2012). A major uncertainty involves the complex flow patterns, turbulence, and boulder-sized substrates near Intake Diversion Dam that pallid sturgeons are known to avoid. This array of conditions makes it difficult to predict the ability of pallid sturgeon to search for and locate a potential bypass channel located close to the dam face These uncertainties are reiterated in the Adaptive Management Plan, which goes on to discuss whether:

- the proposed attraction flow volume in the bypass channel will be sufficient to attract migrating pallid sturgeon,
- the bypass channel design, including designed depth, width, velocity, degree of turbulence, and entrance location, will permit the passage of pallid sturgeon, and
- a flow augmentation structure, physical changes to the bypass channel, physical changes to the Yellowstone River channel, or intake diversion weir revision may facilitate passage.

A Bypass Channel Alternative may be a feasible alternative for passage of adult pallid sturgeon upstream beyond the intake diversion, but the proposed bypass channel design appears to have limited probability of success.

The Adaptive Management Plan presents only one alternative for improving pallid sturgeon discovery and utilization of the proposed bypass channel. The Panel feels that the Adaptive Management Plan should include a broader range of measures that could be taken if the proposed alternative does not yield the desired results.

Significance – High

The probability that the preferred alternative will perform as proposed is very low based on the scientific information presented, the number of project uncertainties and risks, and concerns regarding the sustainability of the bypass channel.

Recommendations for Resolution

1. Obtain further information on the movement and behavior of adult pallid sturgeon to determine conditions that attract them along specific migratory routes and the channel features that they utilize in order to design a Bypass Channel Alternative with a good probability of allowing adult pallid sturgeon passage.

2. Provide designs that mimic the hydraulic conditions in a river, which form the basis for pallid sturgeon route selection.

Literature Cited

Jordan, G. (2012). Summary of the Biological Review Team's review of the bypass channel 30% design features and channel entrance and exit preappraisal study to provide fish passage around Intake Dam, Montana. March 5.

McElroy, B., A. DeLonay, and R. Jacobson (2012). Optimum swimming pathways of fish spawning migrations in rivers. Ecology 93:29–34.

White, R.G., and B. Mefford (2002). Assessment of Behavior and Swimming Ability of Yellowstone River Sturgeon for Design of Fish Passage Devices. Montana Cooperative Fishery Research Unit, Montana State University-Bozeman and Water Resources Research Laboratory, Reclamation, Denver, Colorado.

Final Panel Comment 3

Throughout Appendix E, the information on expected habitat unit (EHU) output for the alternatives is not well-defined, and the effects of different output metrics are not considered.

Basis for Comment

Appendix E, Attachment 1, 'Fish Passage Benefits Analysis,' describes the methods used to estimate EHU output. Table 10 summarizes the analysis for each alternative in which a point estimate of the fish passage connectivity index for 13 different species is used to calculate the aggregate EHU results. The attachment provides a thorough general overview of the index methodology. However, there is no specific discussion of the uncertainty about the connectivity index values for the different species and whether the aggregate estimates provide a reliable measure of EHU for ranking project alternatives. In addition, the loss of the existing side channel and the impact on EHU for different species was not addressed.

The cost effectiveness/incremental cost analysis (CE/ICA) presented in Appendix E utilizes the aggregate EHU results from Attachment 1 to evaluate plan alternatives. While the analysis supports the selected alternative, it is not clear how the results would change if the analysis focused on pallid sturgeon alone. This focus on an individual species is potentially informative given that the project purpose is recovery of pallid sturgeon and that the adaptive management strategy (Appendix J) is wholly focused on pallid sturgeon.

Significance – High

The choice of EHU metrics is an important element in project evaluation, and different metrics may lead to different results, particularly when there is a high degree of uncertainty about ecosystem response.

Recommendations for Resolution

1. Provide more discussion in Attachment 1 about the uncertainty associated with fish passage connectivity benefit estimates for different species, most notably pallid sturgeon.

2. Provide more discussion of the impacts of plugging the existing side channel on fish populations and EHU.

3. Evaluate project alternatives using CE/ICA for pallid sturgeon EHU alone and provide some discussion of the uncertainty associated with these results.

Final Panel Comment 4

The foundation details of dam construction cannot be fully characterized until additional geotechnical and structural evaluations are conducted.

Basis for Comment

The conceptual design of the concrete diversion dam with integral sheetpile is based on several assumptions that could adversely impact the design costs and schedule, if a mass concrete foundation similar to that considered for the Rock Ramp Alternative is needed. These assumptions and their impacts on design and construction of the dam are discussed below.

a. The design as presented implies that the sheetpile for construction of the concrete diversion dam in the wet can be driven to required depths (e.g., bedrock) without difficulties. The risk of encountering boulders that could impede driving of the sheet pile has been mentioned in the 2012 Supplement to the Environmental Assessment (EA), but plans and costs to locate and remove them have not been considered.

b. The design assumes that the river bottom can provide a foundation of adequate strength and compressibility to support the concrete diversion dam. Long-term risks of settlement due to soft subgrade have been mentioned in the Supplement to the EA. It appears that geotechnical test borings and laboratory tests needed to establish strength and compressibility of the subgrade material, including bedding and the presence of soft zones, shears, and other defects within the river, have been conducted. However, the result of these investigations has not been fully reported nor have geotechnical analyses supporting the foundation selection been provided. In addition, it does not appear that detailed bathometric or geophysical surveys showing the extent of the existing rockfill near the proposed new diversion dam alignment have been conducted.

   In general, weak compressible soil, including boulders, should be removed or the design modified to accommodate such defects. Excavation and removal of river bottom materials have been considered in the design of the concrete diversion dam proposed for the Rock Ramp Alternative where the dam is constructed on top of a mass concrete foundation embedded 10 feet into the river bottom. Regardless of the method of construction, a similar mass concrete foundation or some form of engineered fill may be required to provide support for the dam with integral sheetpile. The condition of the resulting foundation should be consistent with the assumptions made for stability and settlement analysis and design.

c. The conceptual design considers pulling the sheetpile out after the concrete has cured to ensure passage for the pallid sturgeon and possibly other electroreceptive fish over the dam. Removing sheetpile in combination with pouring concrete on top of the existing river bottom without engineering treatment would leave the foundation with no cutoff and potentially unprotected against

erosion. If sheetpiles are removed, the construction of a cutoff in the foundation may be required to reduce seepage, improve stability, and protect the dam against erosion that could lead to failure.

d. Stability analysis of the concrete diversion dam with integrated sheetpile, the upstream control structure, and the flow-augmented structure, as presented in the 30% Design Documentation Report, uses sliding factors of safety corresponding to the ordinary site classification category (USACE, 2005). The use of the ordinary site classification implies that the foundation strengths and governing ice loads (USACE, 2002) have been determined at a high confidence level. Considering that the foundation condition has not been fully investigated and potential weaknesses within the dam's foundation have not been ruled out, the foundation strengths used in the analysis may not qualify for a high confidence level. Similarly, the governing ice impact loads used to analyze the concrete diversion dam and the other two concrete structures were obtained from available literature data. Although they were considered conservative, they may not represent high confidence ice loading events that could be expected at this site, especially when larger ice loads capable of displacing these structures have not been ruled out (Appendix A2, Attachment 7, Section 2.3).

Significance – Medium

Additional geotechnical and structural analyses will validate the proposed diversion dam construction assumptions and potentially minimize adverse impacts to the design cost and schedule.

Recommendations for Resolution

1. Conduct supplemental geotechnical and geophysical investigations as part of the Preconstruction Engineering and Design (PED) phase to locate and remove soft areas and boulders and to design a foundation with high confidence strength values and compressibility to support the dam.

2. Conduct geotechnical and structural evaluations during PED that consider stability along horizontal sections at the bottom of the dam as well as within the foundation, when applicable.

3. Establish the confidence level for governing ice impact loads to justify the use of sliding factors of safety associated with the ordinary site classification category.

Literature Cited

USACE (2002). Ice Engineering. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Manual (EM) 1110-2-1612. October 30.

USACE (2005). Stability Analysis of Concrete Structures. Department of the Army, U.S. Army Corps of Engineers, Washington, D.C. Engineer Manual (EM) 1110-2-2100. December 1.

Final Panel Comment 5

Although a wide array of alternatives was assessed, the use of an inflatable dam/collapsible gate may have been prematurely eliminated from consideration.

Basis for Comment

Chapter 1 – Purpose and Need, of the 2012 Supplement to the Environmental Assessment (EA) states that in 2011, the lead agencies determined that further evaluation of other fish passage alternatives was needed to address additional information and issues that had arisen since 2010, taking into consideration both cost and full river fish passage (page 1-3). The evaluation was limited to the No Action, Bypass Channel, and Rock Ramp Alternatives that can provide fish passage in conjunction with the new head works and screen facilities.

As described in Appendix A-1, the project has been subject to several alternative analyses. As presented in Table A.1.5 - Final Value Planning Alternative Screening Matrix, both “open river” and “diversion dam” alternatives were screened and several were considered but eliminated from consideration. One alternative was a “collapsible gate structure.” Few details were given regarding this alternative; however, the Panel assumes this may include an inflatable dam structure. This alternative was eliminated due to “concerns relative to greater operation and maintenance costs” and to the possibility that the alternative would “remain a barrier to fish passage while in operation.”

The Panel submits that this alternative has significant potential merits and that elimination of the alternative has not been fully justified, particularly in light of the more narrowly focused re-evaluation of alternatives. A collapsible gate/inflatable dam might be designed to provide full river access when in the collapsed position and could possibly eliminate the need for a bypass channel or rock ramp. Such structures have been constructed in ice-affected rivers (USACE, 2001).

Details regarding operation and maintenance issues/costs, operational constraints relative to the irrigation diversion, and the timing of fish passage and diversions are not addressed. It is unclear if intermittent or seasonal full river access is feasible and whether it represents a possible cost-effective alternative to a bypass channel. A gate/inflatable dam operated in conjunction with utilization of the existing side channel for fish passage may be another alternative that warrants consideration.

Significance – Medium

A collapsible gate/inflatable dam structure may be a cost-effective alternative that has not been fully considered.

Recommendations for Resolution

1. Provide additional details regarding a possible collapsible gate/inflatable dam alternative.

2. Discuss the potential acceptability of intermittent or seasonal full river fish passage either alone or in combination with utilization of a side channel for fish passage.

3. Evaluate the potential logistical and cost implications associated with operation and maintenance.

Literature Cited

USACE (2001). Performance Survey of Inflatable Dams in Ice-Affected Waters. Ice Engineering Information Exchange Bulletin, Issue 30. U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory. October 2001.

Final Panel Comment 6

The Supplement to the Environmental Assessment (EA) does not evaluate the impacts to other native fish species from the installation of the bypass channel plug.

Basis for Comment

The design of the preferred Bypass Channel Alternative shows that the upstream portion of the bypass channel will flow through a natural side channel on the south side of Joe's Island until it reaches a constructed "channel plug" that will divert water into the constructed portion of the bypass channel. The channel plug will be fitted with an 18-inch pipe that will allow some water to flow downstream through the natural side channel when there is sufficient discharge in the Yellowstone River. The Panel identifies the proposed structure of the channel plug to be a probable barrier to upstream movements of fish through the existing side channel on the south side of Joe's Island. It is probable that several species of fish in the Yellowstone River utilize the existing side channel to achieve some level of upstream passage around the intake diversion. The existing side channel, which provides connectivity of the river system, will be blocked with the installation of the channel plug. The Panel is unable to determine the potential effect of this component of the Bypass Channel Alternative on fish and other aquatic species in the Yellowstone River, many of which are native and contribute to both natural communities and sport fisheries.

The 2012 Supplement to the EA states that one of the key ecological attributes (KEAs) related to pallid sturgeon reproductive success is river habitat size and connectivity – the total extent and connectivity among natural habitats within the river network that permit the flow of organisms, sediments, and nutrients (the existing structure currently limits upstream and downstream migration and affects larval drift). The Panel suggests that this KEA relative to the channel plug in the natural side channel has not been addressed.

Significance – Medium

Determining the effects of the structure forming the channel plug on fish passage around the intake diversion and connectivity of the river system will provide a more thorough evaluation of the Bypass Channel Alternative.

Recommendations for Resolution

1. Assess the effects of the structure forming the channel plug on fish passage around the intake diversion and connectivity of the river system in the Supplement to the EA.

2. Include alternative designs of the structure forming the channel plug and bypass channel that facilitate fish passage and connectivity of the river system in the Supplement to the EA.

Final Panel Comment 7

The Adaptive Management Plan (Appendix J) presents only a few potential actions to improve performance, and it is not clear what potential actions would be taken if the bypass channel is not used or the success criteria are not met within the 8-year monitoring period.

Basis for Comment

The Adaptive Management Plan identifies a number of uncertainties about the likelihood of project success and describes a plan to monitor pallid sturgeon movement and recruitment success. A list of proposed measures is provided to address potential modifications to the project if the success criteria are not achieved. It is not clear that this list is complete and that all scenarios have been considered. For example, it is assumed that the proposed bypass channel will be stable, but there are no contingencies in the event of channel migration, degradation, or sediment deposition.

In addition, the discussion of flow augmentation structures to increase attractive flows is very general and provides no details on engineering, design, and cost alternatives. The main assumption is that bypass channel flow modifications will correct initial deficiencies, but there is no discussion of adaptive management strategies to improve pallid sturgeon movement within the bypass channel itself. Also, the potential impacts on fish populations from plugging the existing side channel were not addressed. It is also not clear what actions would be taken if the success criteria in the plan are not met within the 8-year monitoring period.

Significance – Medium

In light of the high level of uncertainty about project outcomes, an expanded Adaptive Management Plan that includes discussion of potential bypass channel modifications and alternatives such as the existing side channel is needed to guide future monitoring and responses.

Recommendations for Resolution

1. Provide an expanded list of both in-river and bypass channel constraints on pallid sturgeon movement after construction of the channel.

2. Provide a detailed discussion of alternative management responses to address these constraints and the associated costs.

3. Discuss specific management actions if pallid sturgeon do not utilize the bypass channel during the 8-year monitoring period.

Final Panel Comment 8

The alternatives analysis may benefit from being updated given new information regarding fish passage and the finding that the Rock Ramp Alternative is cost-prohibitive.

Basis for Comment

Table A.1.4 presents "Choosing by Advantages" scores and rankings for a variety of alternatives that were considered in the 2005 Value Planning Study. Since the headworks and fish screens have been completed, some of the alternatives considered are no longer appropriate. In the 2005 study, the bypass channel was ranked #1; however, the rock ramp (ranked #2) was selected because it was "most likely to meet biological and [Endangered Species Act] requirements."

The Panel submits that some of the important assumptions that support the alternatives analysis have changed since the initial screening of alternatives. This includes new information regarding fish passage, the need to accommodate the new fish screen and headworks facilities, the cost of rock, and the feasibility of rock placement "in the wet." Updated assessments of construction costs, methods, constructability, and fish passage issues may show that previously unidentified or eliminated alternatives are feasible and cost-effective. Reconsideration and ranking of alternatives may provide additional justification for the bypass channel or identify another preferred alternative. These include, but may not be limited to, an "L"-shaped diversion dam configuration, an operable gate/inflatable dam, and use of an existing side channel with a low downstream weir to divert fish.

Significance – Medium

The choice of the Preferred Alternative would be better supported by reconsideration and ranking of a broader set of alternatives.

Recommendations for Resolution

1. Re-evaluate the alternative selection process by reviewing the previously identified alternatives.

2. Consider and assess new sustainable alternatives, if identified.

3. Rank the alternatives and document the process for selecting the Preferred Alternative.

Final Panel Comment 9

Since the Rock Ramp Alternative was dropped, the decision process and screening criteria used to re-evaluate alternatives have not been clearly documented in the Supplement to the Environmental Assessment (EA).

Basis for Comment

In the 2012 Supplement to the EA, the Panel notes the following justification for the preferred Bypass Channel Alternative:

> "Reclamation and the Corps have identified the Bypass Channel as the preferred alternative. It is the least cost alternative. Unlike the No Action Alternative, the Bypass Channel Alternative would meet the purpose and need of the proposed action. In comparison to the other alternatives considered in the Intake EA, it would improve fish passage by providing an alternative channel for fish to utilize as they migrate upstream. The bypass channel would also provide a more natural fishway than the Rock Ramp alternative, and would require much less fill to be placed within the main channel of the Yellowstone River. Recreational resources would be less affected under the Bypass Channel alternative because most of the temporary construction effects would take place on Joe's Island, avoiding closure of the main recreation area and boat ramp on the north bank, and it would not require that a new boat ramp replacement be built." (p. 2-10)

Appendix A1 reviews the History of Alternative Development and states (p. A1-31):

> "All alternatives that were previously evaluated were reviewed and reconsidered. These alternatives were screened through the criteria and three alternatives are included in the Supplemental EA Addendum…"

However, the rescreening process and results are not documented in the appendix or the Supplement to the EA. In essence, it appears that the original screening process, which led to the recommendation of the rock ramp as the Preferred Alternative, was relied upon again. The Panel is unable to identify how goals, objectives, and constraints established for the project were considered in a systematic reanalysis of all of the information regarding the No Action, Rock Ramp, and Bypass Channel Alternatives provided in the Supplement to the EA to reach the recommendation of the Preferred Alternative. Screening criteria and the assessment process for the reconsideration of alternatives are not described.

Significance – Low

A description of the screening protocol used to reassess the alternatives would provide a basis for understanding and comparing the relative strengths and impacts of each alternative and the justification for the Preferred Alternative.

Recommendation for Resolution

1. Describe the rescreening process and its results in the Supplement to the EA.

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APPENDIX B

Final Charge to the Independent External Peer Review Panel as Submitted to USACE on December 21, 2012

on the

Intake Project

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Charge Questions and Guidance to the Peer Reviewers
for the
Independent External Peer Review of the Intake Diversion Dam Modification Lower Yellowstone Project, Montana Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices

BACKGROUND

Project Location

The project area is located along the Lower Yellowstone River, approximately 18 miles downstream from the City of Glendive, Dawson County, Montana. The project site includes the intake dam and diversion structure and the upper 3,000 feet of the Lower Yellowstone Project main canal; and extends approximately three (3) miles downstream of the dam to about five (5) miles upstream from the Dam. The intake dam is the diversion dam feature for the Bureau of Reclamation's Lower Yellowstone irrigation project. The irrigation project covers about 55,000 acres in eastern Montana and western North Dakota.

Purpose

The purpose of the proposed project is to modify the intake diversion dam and canal head-works to improve passage and reduce entrainment for endangered pallid sturgeon and other native fish in the Lower Yellowstone River. The Fish and Wildlife Service listed the pallid sturgeon as endangered under the Endangered Species Act in 1990. The wild population of pallid sturgeon inhabiting the Yellowstone River and the Missouri River between Fort Peck Dam and Lake Sakakawea are anticipated to be extirpated by 2018 if reproduction and recruitment of young fish does not improve. The best available science suggests the intake diversion dam impedes upstream migration of pallid sturgeon and their access to spawning and larval drift habitats. In addition, previous entrainment studies on other native fish in the Yellowstone River suggest that once passage is provided, pallid sturgeon may be entrained in the Main Canal if left unscreened.

The intake dam is a low-head timber and rock-filled weir (dam) originally constructed between the years 1905 to 1906. The dam is approximately 12 feet high and spans across the entire width of the Yellowstone River, about 700 feet. The dam is owned by the Bureau of Reclamation, and does not create a pool or provide any flood protection.

The Decision Document for this project is the Supplemental Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) with integrated Plan Formulation Analysis, Cost Effectiveness/Incremental Cost Analysis (CE/ICA), and documented results of the Agency Technical Review (ATR) and IEPR. The Supplemental EA/FONSI is a stand-alone Decision Document. The study received authority from Congress through Section 3109 of the Water Resources Development Act (WRDA) of 2007. In order to meet Implementation Guidance requirements, the Decision Document will recommend a plan to improve fish passage for endangered pallid sturgeon and other native fish in the Lower Yellowstone River. The Decision Document will also provide planning, engineering, and implementation details for the recommended plan to allow final design and construction to proceed subsequent to the approval of the Supplemental EA and signing of the finding of no significant impact (FONSI).

OBJECTIVES

The objective of this work is to conduct an independent external peer review (IEPR) of the Lower Yellowstone Project, Montana Intake Diversion Dam Modification Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices (hereinafter: Lower Yellowstone River IEPR) in accordance with the Department of the Army, USACE, Water Resources Policies and Authorities' *Civil Works Review* (EC 1165-2-214) dated December 15, 2012, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

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

The purpose of the IEPR is to assess the "adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used" (EC 1165-2-214; p. D-4) for the Lower Yellowstone 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 economics, geotechnical engineering, hydraulic engineering, structural engineering, environmental compliance/biology, and Civil Works planning 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 table provides a list of documents that are to be reviewed by the designated discipline and a list of supporting documents available to all panel members:

Title	Approximate Number of Pages	Required Disciplines
Review Documents		
Intake Diversion Dam Modification, Lower Yellowstone Project, Montana, Draft Supplement to the 26 April 2010 Environmental Assessment	113	All Disciplines
Appendix A.1 Plan Formulation	35	Civil Works Planner
Appendix A.2 Engineering Appendix	386	Geotechnical Engineer, Hydraulic Engineer, Structural Engineer
Appendix C Federally Listed Species and State Species of Special Concern	2	Environmental Compliance/Biologist
Appendix D Federally Protected Species	1	Environmental Compliance/Biologist
Appendix E Cost Effectiveness Incremental Cost Analysis	42	Economist; Environmental Compliance/Biologist
Appendix F Species Common and Scientific Names	5	Environmental Compliance/Biologist
Appendix G NHPA Consultation	6	Civil Works Planner; Environmental Compliance/Biologist
Appendix H Indian Trust Assets	11	Civil Works Planner; Environmental Compliance/Biologist
Appendix I Actions to Minimize Effects	10	Civil Works Planner; Environmental Compliance/Biologist
Appendix J Adaptive Management and Monitoring Plan	18	Civil Works Planner; Environmental Compliance/Biologist
Appendix K Intake Diversion Dam Modification Lower Yellowstone Project, Waters of the U.S. Delineation Report	16	Civil Works Planner; Environmental Compliance/Biologist
Model Review Comments/Responses	3	Environmental Compliance/Biologist
TOTAL	648	
Supporting Documents		
Intake Diversion Dam Modification Lower Yellowstone Project, Montana, Final Environmental Assessment and Appendices (April 2010)		

Documents for Reference

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

SCHEDULE

This draft schedule is based on the December 19, 2012 receipt of the final review documents.

TASK	ACTION	DAYS TO COMPLETE ACTION	DUE DATE
Conduct Peer Review	Battelle sends review documents to Panel	Within 0 days of Panel being under subcontract	1/3/2013
	Battelle/Panel kick-off meeting	Within 0 days of Panel being under subcontract	1/3/2013
	USACE/Battelle/Panel kick-off meeting	Within 0 days of Panel being under subcontract	1/3/2013
	Battelle convenes mid-review teleconference for panel to ask clarifying questions of USACE	Upon panel members completing 50% of review	~1/9/2013
	Panel members complete their individual reviews	Within 10 days of Battelle/panel kick-off meeting	1/17/2013
Prepare Final Panel Comments and Final IEPR Report	Battelle provides Panel merged individual comments and talking points for panel review teleconference	Within 2 days of receipt of individual comments	1/22/2013
	Convene panel review teleconference	Within 2 days of panel members completing their review	1/22/2013
	Battelle provides Final Panel Comments directive to Panel	Within 1 day of panel review teleconference	1/23/2013
	Panel members provide draft Final Panel Comments to Battelle	Within 4 days of panel review teleconference	1/29/2013
	Battelle provides feedback to Panel on draft Final Panel Comments; Panel provides revised draft Final Panel Comments per Battelle feedback (iterative process)	Iterative process, no more than 1 days for each revision	Not Applicable
	Final Panel Comments finalized	Within 4 days of receipt of draft Final Panel Comments	2/4/2013
	Battelle provides Final IEPR Report to Panel for review	Within 1 day of Final Panel Comments being finalized	2/5/2013

TASK	ACTION	DAYS TO COMPLETE ACTION	DUE DATE
Prepare Final Panel Comments and Final IEPR Report (Con't)	Panel provides comments on Final IEPR Report	Within 1 day of receipt of Final IEPR report	2/7/2013
	*Battelle submits Final IEPR Report to USACE	Within 13 days of panel review teleconference	2/8/2013
Post-Final Panel Comment Response Process	Battelle inputs Final Panel Comments to DrChecks; Battelle provides Post-Final Panel Comment Response Process template to USACE	Within 0 days of submittal of final report	2/8/2013
	USACE provides draft PDT Evaluator Responses and clarifying questions to Battelle	Within 5 days of receipt of final report	2/15/2013
	Battelle provides the Panel the draft PDT Evaluator Responses and clarifying questions	Within 0 days of receipt of draft PDT Evaluator responses and clarifying questions from USACE PDT	2/15/2013
	Panel members provide Battelle with draft comments on draft PDT Evaluator Responses (i.e., draft BackCheck Responses)	Within 1 day of receipt of draft PDT Evaluator responses from Battelle	2/19/2013
Post-Final Panel Comment Response Process, Continued	Teleconference with Battelle and Panel to discuss draft BackCheck Responses	Within 1 day of receipt of draft BackCheck comments	2/20/2013
	Teleconference between Battelle, Panel, and USACE to discuss Final Panel Comments, draft responses, and clarifying questions	Within 1 day of teleconference with Battelle and panel members	2/21/2013
	USACE inputs final PDT Evaluator Responses in DrChecks	Within 2 days of Final Panel Teleconference	2/25/2013
	Battelle provides PDT Evaluator Responses to Panel	Within 0 days of PDT Evaluator comments being available	2/25/2013
	Panel members provide Battelle with final BackCheck Responses	Within 2 days of receipt of PDT Evaluator comments	2/27/2013
	Battelle inputs the Panel's BackCheck Responses in DrChecks	Within 4 days of notification that USACE responses have been posted in DrChecks	3/1/2013
	*Battelle submits pdf printout of DrChecks project file	Within 1 day of DrChecks closeout	3/4/2013

CHARGE FOR PEER REVIEW

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

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

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

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

Please submit your comments in electronic form to Lynn McLeod, mcleod@battelle.org, no later than January 17, 2013, 10 pm ET.

Independent External Peer Review
of the
Intake Diversion Dam Modification Lower Yellowstone Project, Montana
Draft Supplement to the 26 April 2010 Environmental Assessment and Appendices

Charge Questions and Relevant Sections As Supplied By USACE

General

1. In your opinion, are there sufficient analyses upon which to base the recommendation?
2. To what extent has it been shown that the project is technically sound, environmentally acceptable and economically justified?
3. Are the assumptions that underlie the economic, engineering and environmental analyses sound?
4. In general terms, are the planning methods sound?
5. Are the interpretations of analysis and conclusions based on the analysis reasonable?

Affected Environment

6. Do you agree with the general analyses of the existing social, financial, and natural resources within the study area?

Environmental Consequences

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

Appendix A.1: Plan Formulation

Problems, Opportunities, Objectives, and Constraints

8. Are the problems, opportunities, objectives, and constraints adequately and correctly defined?

Plan Formulation / Alternative Development

9. Was a reasonably complete array of possible measures considered in the development of alternatives?
10. Please comment on the screening of the proposed alternatives.
11. Are the screening criteria appropriate?
12. In your professional opinion, are the results of the screening acceptable?
13. Were any measures or alternatives screened out too early?
14. Were the engineering, economic, and environmental analyses used for this study consistent with generally accepted methodologies?

Recommended Plan

15. Comment on whether you agree or disagree with how the selected alternative was formulated and selected.

16. Comment on the plan formulation. Does it meet the study objectives and avoid violating the study constraints?
17. Please comment on the likelihood of the recommended plan to achieve the expected outputs.

Appendix A.2: Engineering

18. Are the models' capabilities and limitations clearly defined?
19. Is the methodology used to conduct the model sensitivity analysis complete and valid?
20. Are the descriptions of the risk and uncertainties associated with the development, selection, and construction of the Tentatively Selected Plan sufficiently comprehensive?
21. Were the technical assumptions used to determine the proposed alignment and features of the preferred alternative valid?
22. What other assumptions should be included in the Preliminary Alternative Plans discussion to justify the alignment?
23. Are the key assumptions used to complete the cost and schedule risk analysis adequate? Is anything missing?
24. In your expert opinion, do the major findings of the risk analysis provide adequate support for scheduling, budgeting, and project control purposes?

Appendix E: Cost Effectiveness Incremental Cost Analysis

25. Was the methodology used to conduct the incremental cost analysis adequate and valid?
26. Was the Fish Passage Connectivity Index (FPCI) applied in an appropriate manner?

Appendix J: Adaptive Management and Monitoring Plan

27. Are the proposed monitoring procedures clear and appropriate?
28. Is the proposed monitoring plan sufficiently detailed and comprehensive?
29. Are the costs for administering a monitoring and assessment program reasonable?
30. Is adaptive management adequately addressed?