Missouri River Recovery Program
Independent Science Advisory Panel and
Independent Social Economic Technical Review Panel

Final Report

of the

Independent External Peer Review

of the

Draft Missouri River Recovery Management Plan and Environmental Impact Statement

June 21, 2017

Prepared for:
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Prepared by:
Missouri River Independent Science Advisory Panel,
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Executive Summary

The United States Army Corps of Engineers (USACE or the Corps), in cooperation with the United States Fish and Wildlife Service (FWS), prepared a draft environmental impact statement for the Missouri River Recovery Management Plan (MRRMP-DEIS). The Corps decided that a formal Independent External Peer Review (IEPR) was not legally required for this DEIS. However, the lead agencies and The Missouri River Recovery Implementation Committee (MRRIC) considered an informal IEPR to be a "best practice" that would contribute to the technical quality of the continuing MRRMP planning and assessment process.

The review presented herein generally follows the IEPR procedures described in the Department of the Army, U.S. Army Corps of Engineers, Water Resources Policies and Authorities' Civil Works Review (Engineer Circular [EC] 1165-2-214, December 15, 2012). Members of the Independent Science Advisory Panel (ISAP) and the Independent Social Economic Technical Review Panel (ISETR) constituted the Review Panel for the IEPR. The Panel was charged to perform its review guided in part by sets of questions provided separately by the USACE and MRRIC.

Results of the Panel review are reported in four sections. The first section provides overarching general observations by the Panel on the DEIS and its accompanying draft Science and Adaptive Management Plan (SAMP). The second section presents observations describing specific technical concerns using a pre-specified four-part IEPR comment format. This comment section also includes USACE response to each concern, and the Panel's responses to each of the USACE's responses (that is, back-check comments). A third section in the review lists minor comments and clarifications to the texts of the DEIS and SAMP. The fourth section is an addendum containing Panel response to comments received on its presentation of the draft IEPR report at the quarterly MRRIC meeting in Sioux Falls, SD, on May 23, 2017.

A general acknowledgement regarding the DEIS and SAMP

The Panel recognizes and commends the substantial efforts undertaken by the USACE and participating agencies in developing the DEIS, the accompanying revised Science and Adaptive Management Plan, and the many supporting technical documents. Overall, the DEIS is well organized, effectively presented, and consistent with NEPA requirements. The documents together capture key technical points important to managing the three listed species, meaningfully describe risks and benefits of proposed management actions across diverse human considerations, describe the six proposed management alternatives in appropriate detail, and well represent the best available science and adaptive management practices that seek to achieve the conservation goals for the listed species.

The IEPR process has proven valuable in enabling the Panel to articulate several issues in need of further consideration or reconsideration by the USACE, or that require clarification in the DEIS. The Panel recognizes the USACE has generally been responsive to the Panel's concerns by addressing the issues identified in its responses to the Panel and in making necessary clarifications in the DEIS.

IEPR Four-Part Comments

The IEPR process generated 73 four-part review comments that encompass charge questions presented to the Panel by the USACE and the MRRIC. The order, organization, and topics addressed by the review comments largely follows the structure of the DEIS and AM Plan. The review comments are classified according to general topics, including needs and intent of the DEIS, the structure and operation of the Missouri River system, ecological and management-relevant issues regarding the listed species, comments pertaining to human considerations and tribal issues, comments on the AM Plan, and comments on several documents provided in support of the DEIS. For each review comment, the level of significance as judged by the IEPR Panel, ranging from high to low, is indicated.

The Panel acknowledges that the initial 27 pages of the DEIS provides useful background and history of the project, and outlines contributions made through the PrOACT structured decision process to progress under the MRRMP. However, Section 1 should more directly describe the need for the plan and an accompanying EIS. This initial section should acknowledge the fundamental requirement that operations of the six dams on the Missouri River not jeopardize the continued existence of the listed species. The stated need for and intent of the plan and EIS should be to describe a suite of potential actions, and an assessment of the effects of those actions to be implemented within an adaptive management framework, in order to meet the habitat needs of the listed species while minimizing impacts on human uses of the river.

The Panel assigned a medium-high level of significance to its main comment concerning the need and intent as presented in the DEIS. The USACE concurred and outlined modifications to

Section 1 that would be made to strengthen the presentation of this key underpinning of the DEIS.

The Missouri and Mississippi River Physical Systems

Eighteen of the 73 review comments focus on issues related to the physical structure, hydrology, sediments, and operation of the Missouri and Mississippi rivers. Topics of concern identified and discussed by the Panel include flows, hydraulic tipping points, sedimentation, and delta formation, and the extent of inclusion of the Mississippi River in the system being assessed. Comments also address the frequency and opportunity for flow management, as well as proposed ramping rates for managed flows. Concerns are expressed regarding the definition of Emergent Sandbar Habitat (ESH) in relation to proposed management actions. The Panel examines the potential scales of proposed management actions and the likelihood that modifications to the Master Manual would be required for meaningful manipulations of the river system with regard to species objectives.

The levels of significance identified by the Panel for these comments are medium to medium/low. The USACE concurred with all but one comment. The Panel suggested a need for a sediment budget to support the management activities described in the DEIS; the USACE did not agree and offered justification for omitting a sediment budget from the DEIS. The Panel considers it an important component of the forthcoming AM implementation process.

Plovers and Terns

The Panel has been involved in substantial discussions with USACE, FWS, and MRRIC concerning the management of plovers and terns throughout the history of this project. Only five of the 73 comments pertain directly to management of the listed birds, although reviews of various aspects of the physical system are directly or indirectly related to these two species. The primary Panel concerns in the IEPR focus on derivation of population targets, consideration of off-channel reproduction, other breeding habitat, and modeling efforts used in estimating ESH.

Although the IEPR produces few comments directly related to bird management, the Panel assigns medium-high levels of significance to all but the ESH estimation comment, which is deemed medium-low. The USACE concurred only with the Panel comment that addressed nesting habitat.

Pallid Sturgeon

Sixteen IEPR review comments pertain directly to the proposed management of pallid sturgeon. Principal areas of concern include specification of pallid population objectives and corresponding metrics, application of the existing demographic model for pallid sturgeon, specification and description of IRC habitats, effectiveness of proposed spawning habitat construction, and spawning cues. Comments also address the need to consider pallid ecology and

distribution throughout the Missouri and Mississippi rivers in managing the species. The potential impact from pallid sturgeon mortality from past by-catch in the Mississippi River is raised by the Panel.

The levels of significance assigned to the IEPR comments regarding pallid sturgeon management predominantly range from high to medium-high. High significance is associated with the larger-scale issues concerning pallid ecology throughout the Missouri and Mississippi rivers. Except for comments concerning justification of spawning habitat construction and spawning cue releases, the USACE concurred with the Panel comments.

DEIS Human Considerations and Tribal Issues

Overall the Panel is impressed with the effort put into the analysis of Human Considerations in the DEIS. However, the Panel has concerns about several of the analyses and requested a number of clarifications. With the exception of the flood control treatment of risk and uncertainty for which the level of significance is medium/high, the level of significance is low to medium.

Panel concerns related to DEIS human considerations and tribal issues generated 15 review comments in the IEPR (plus an additional one in the Addendum). The topics of concern range from inadequate description of potential impacts on cultural resources, quality of impact assessments for flood risks, hydropower, navigation, and thermal power. The Panel also identifies concerns with land-use and ownership, recreation analysis, evaluation of human health and safety (with emphasis on mosquitoes), and environmental justice. The IEPR addresses the adequacy of DEIS coverage of tribal interests, determining it to be a fair discussion in relation to concerns outlined in the charge to the Panel.

Human Considerations comments generally fall into the following categories: a) unexplained or insufficiently explained assumptions used (e.g., environmental justice population exists if minority population represents more than 10% of the population, renting of pumps in the water supply analysis, half of reservoir sightseers are affected by reservoir elevation and half are not in the recreation analysis); b) lack of detail on models used or rationale in some cases for models not used; c) inconsistencies in years chosen for analysis or omitted years (inconsistencies within a given HC analysis such as navigation, recreation or omission of certain years in the Period of Record); d) treatment of risk and uncertainty in relation to flood risk management; e) inconsistencies in analysis between similar HC topic areas (hydropower and thermal power); f) lack of details of impacts (e.g., disaggregating Tribal impacts by Tribe and Reservation, whether 50 miles or state was used as impact area in recreation analysis) or models used (e.g., air quality) or qualitative ratings (e.g., ecosystem services).

The review comments for human considerations and tribal issues include multiple recommendations per comment. The USACE concurred with the majority of the Panel comments and offered comments and clarifications largely concurred with by the Panel.

The Science and Adaptive Management Plan

The charge to the Panel included review of the revised Science and Adaptive Management Plan. The IEPR produced 12 comments specific to the SAMP. Several comments express concerns focused on the justification and expected outcomes of implementing Level 3 management actions without first developing the supporting Level 1 and 2 understanding. The IEPR offers concerns regarding the structure and process of governance and suggests staffing requirements that would buttress the adaptive management program. The Panel comments positively on the development of the data management plan as an improvement on previous versions of the SAMP. Significantly, the Panel questions the ability to meaningfully manipulate the Missouri River system to achieve species objectives given current constraints imposed by human considerations. Correspondingly, concerns are raised regarding the ability to monitor the effectiveness of proposed management actions, particularly for pallid sturgeon, and to determine unequivocally if measured responses are the result of implemented management actions.

The IEPR recognizes the importance of the SAMP as underpinning the proposed management actions and accordingly assigns high and medium-high levels of significance to the IEPR review comments. The USACE concurred with all but two of the Panel comments. The two main areas of disagreement are the implementation of Level 3 actions absent justification derived from the results of Level 1 and 2 actions, and the implications of human considerations in constraining the effective implementation of management actions.

Executing Adaptive Management

The DEIS and SAMP review provides an important and timely opportunity for the standing advisory panels to consider again the latter document as implementation of resource management on the Missouri River under the MRRMP approaches. The SAMP is an evergreen document that itself will need to be "adapted" with adaptive resource management on the river. The SAMP does and will continue to benefit from critique, reconsideration, and new information when that information is acknowledged as the "best available science." Following this prescription, reliable knowledge can guide planners to programmatic management actions that are effective, efficient, and accountable. The SAMP describes and uses data, analyses, and models to reduce the uncertainties that challenge resource managers. That information is constantly changing and will continue to benefit from critical assessment from independent scientist reviewers and stakeholders well after this review of the DEIS.

Species Needs and Human Considerations

One of the key challenges in moving forward with the MRRMP stems from the assumption that sufficient latitude for designing and implementing effective management actions for the three species exists within a decision-space delineated by current and future human considerations. This concern is expressed clearly in the IEPR four-part comments. If the historical construction and operation of infrastructure within the Missouri River Basin has largely contributed to the

conditions that led to listing of the three species, is it realistic to presume that continuing the current level of human uses of the river and appropriation of its resources will afford opportunities for management at scales sufficient to achieve stated species objectives? It would seem prudent to marshal resources (including models, data, experiments, sturgeon population dynamics understood for other large rivers world-wide) to develop the necessary supporting science to determine if a self-sustaining population of pallid sturgeon can be achieved in the Missouri River under current and projected human uses of this system, and identify what specific changes are needed to maintain the species over the long term.

DEIS Supporting Documents

Fourteen technical reports and appendices accompany the DEIS. These documents provide detailed descriptions of many topics included in the DEIS. The hydrologic and hydraulic (H&H) modeling technical report and Appendix D, which describes the analysis of the 82-year period of record (POR) is of particular interest in the IEPR. The key topics of interest include calibration, verification, and evaluation of the ResSim and HecRAS models, as well as methods used to statistically incorporate the flow characteristics of the POR using subsets of the POR. The Panel concludes that despite some remaining questions, the physical modeling used in support of the DEIS represents application of the best available science.

The three comments offered in review are assigned medium (2) and medium-low (1) levels of significance. The USACE concurred with two comments, but disagreed with Panel recommendations for presenting additional calibration/validation information as part of the DEIS.

Minor Comments

The Panel offers a set of comments on issues that do not warrant development of corresponding four-part comments. These comments are intended to help clarify the organization and presentation of any revisions to the DEIS. These comments have been offered with the understanding that corresponding responses were not expected from the USACE.

The IEPR and Path Forward

The IEPR process constitutes an important step in the continuing development and implementation of management alternatives for the Missouri River. The Panel intends this review as a positive contribution towards revising and refining the technical attributes of the proposed management actions and encourages the timely execution of science needed to better design and effectively put in place management actions that meet expectations for avoiding jeopardy and facilitating recovery of the three species.

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Background and review process

The United States Army Corps of Engineers (USACE or the Corps), in cooperation with the United States Fish and Wildlife Service (FWS), has prepared a draft environmental impact statement for the Missouri River Recovery Management Plan (MRRMP-DEIS). The purpose of the MRRMP-DEIS is to identify a suite of actions that meets Endangered Species Act (ESA) responsibilities for three federally listed species that reside on the Missouri River, the pallid sturgeon, Great Plains piping plover, and the interior least tern. The Corps and FWS (lead agencies) have been advised in the plan development process by the Missouri River Recovery Implementation Committee (MRRIC), representing various stakeholder interests and the tribes, states, and resource agencies from within the Missouri River basin, and two external review panels, the Independent Science Advisory Panel (ISAP) and the Independent Social Economic Technical Review Panel (ISETR).

The Corps has determined that a formal Independent External Peer Review (IEPR) is not legally required for this plan and DEIS. However, the lead agencies and MRRIC consider such a review a "best practice" that will contribute to the quality of the ongoing MRRMP planning and assessment process. Recognizing that the ISAP and ISETR may not be strictly considered "external" to the MRRMP process at this point, the Corps decided that the benefits of the panelists' knowledge of the Missouri River system and planning process outweigh the costs of educating new panelists concerning the scientific and management complexities described in the MRRMP-DEIS and its supporting documents.

The review generally followed the IEPR procedures described in the Department of the Army, U.S. Army Corps of Engineers, Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, December 15, 2012), as outlined in the review Work Plan in Appendix A of this report. Some modifications to standard procedures were made to accommodate review questions offered by MRRIC and an additional review report draft and engagement with MRRIC before finalization of the IEPR panel report. For this review, members of the ISAP and ISETR worked together as a single IEPR panel, referred to below as "the

Panel". Panel members, their affiliations and areas of expertise, and links to their bio-sketches are listed in Appendix A. The IEPR was coordinated by a Third Party Science Neutral (TPSN), who was assisted by three panel co-chairs to manage the review process, and followed the schedule included in the Work Plan (Appendix A).

The IEPR charge guidance, including questions received from USACE and MRRIC, is included in Appendix A. Panel members familiarized themselves with all sections of the MRRMP-DEIS to understand the structure of the materials and placement of each component of the DEIS and supporting materials. All panelists reviewed Chapters 1, 2, 4, 5, and 6 of the DEIS. Individual panelists reviewed sections of Chapter 3 and supporting documentation including appendices and technical reports relevant to their particular areas of technical expertise. The IEPR co-chairs and TPSN ensured that all sections of the DEIS were reviewed by at least one panel member.

The following section describes the supporting technical foundation of the MRRMP-DEIS and calls attention to a number of overarching Panel observations, including to the draft *Science and Adaptive Management Plan* (SAMP), with attention to the outcomes of the Human Considerations as they apply to the "affected environment and environmental consequences" of the alternatives presented in the DEIS. The remainder of this report identifies and describes areas of technical concern using the specified four-part IEPR comment format (including USACE responses and Panel back-check comments as fifth and sixth parts). An addendum contains Panel response to comments received on its presentation of the draft IEPR report at the quarterly MRRIC meeting in Sioux Falls, SD, on May 23, 2017.All panelists have reviewed and agreed to the Panel comments.

Observations on the MRRMP-DEIS and role of adaptive management in program implementation

The IEPR Panel acknowledges in its review that the MRRMP-DEIS is a programmatic assessment of federal actions thought to be necessary to avoid a finding of jeopardy to the pallid sturgeon, northern Great Plains piping plover, and interior least tern caused by operation of the Missouri River main-stem and Kansas River Reservoir System and operation and maintenance of the Missouri River Bank Stabilization and Navigation Project in accordance with the Endangered Species Act of 1973 (ESA). Because of standing uncertainties regarding the needs of the listed species, particularly the pallid sturgeon, many details of management and restoration actions that may be required to meet conservation objectives are not yet known. The Panel recognizes in its review that as learning enables identification of large-scale actions, additional site-specific NEPA requirements might be undertaken in the future as appropriate.

The Corps has responsibilities under the ESA to take actions to ensure that the operations of the Missouri River are not likely to jeopardize the continued existence of threatened and endangered

species. The MRRMP-DEIS accordingly recognizes that the "construction, operation, and maintenance" of the Missouri River system and the six dams on it has resulted in hydrologic alterations to the river ecosystem, including "changes to the natural seasonal pattern of river flow and sediment transport" and "[a]lteration and loss of aquatic and terrestrial habitats." In support of an effort to identify and provide for comparison of alternative management-action plans to meet those responsibilities, the Corps in cooperation with the FWS and with input from stakeholders (via MRRIC) undertook an "effects analysis" using the best available science (the best available scientific and commercial data, as per the ESA) to evaluate the effects of actions that could be proposed by federal agencies for the listed species and their habitats. The effects analysis was preceded by problem formulation, which included "defining the proposed action, identifying the area affected, and developing conceptual models with written descriptions and [graphical] representations of the physical and biological relationships between actions and species responses."

The MRRMP-DEIS, including its extensive appendices, has benefitted from the previously conducted effects analysis, including four years of targeted environmental assessment and analyses that link the three species and their supporting habitats to environmental conditions on the Missouri River, and including modeling efforts that address relationships among habitat availability, system hydrodynamics, and management options. All materials developed in anticipation of the MRRMP-EIS were subjected to independent scientific review by the ISAP and others, and were adjusted and improved in response, and only then were used to support the development of the comprehensive *Science and Adaptive Management Plan* and the MRRMP-DEIS proposed management-action alternatives.

A process carried out in parallel to the effects analysis for the listed species focused on "human considerations" effects – that is, on issues of human health and safety and social and economic costs and benefits associated with potential Missouri River management actions for the species. A structured assessment of human considerations explored perspectives beyond those required by the ESA. A set of issues and services related to the authorized purposes for the Missouri River system (including flood control, navigation, fish and wildlife, irrigation, power, recreation, water supply, and water quality), along with other human considerations identified by MRRIC members, were quantitatively or qualitatively analyzed to guide the development of management alternatives that fulfill the requirements of the ESA, while minimizing impacts to authorized purposes and other human considerations in the basin.

The technical foundation of the MRRMP-DEIS through the effects analysis appears to be precedent setting – first, in its structured and sequential approach to incorporating available reliable knowledge in the development of management-action alternatives; second, in terms of the extent of technical information, mobilization of ecological and hydrological data, and directed analyses and modeling efforts; and third, in its straightforward appraisal of uncertainties that limit the understanding of the relationships among the listed species, their habitats, ecological relationships between both, and management opportunities afforded (and constrained)

by operations of the Missouri River system. Extensive relevant data and predictive models have been brought to bear in EIS-related documentation by the Corps (and collaborators) in large-scale environmental assessments elsewhere – for example under the upper Mississippi River Restoration Program, the Gulf Coast Restoration Programs, and the Comprehensive Everglades Restoration Program. However, no other regional planning effort in the nation has more effectively applied scientific and socio-economic information through structured effects analysis into planning products that can support adaptive management decision-making, and subjected them to rigorous technical review before development of management alternatives.

The content and quality of the supporting documents to the MRRMP-DEIS demonstrate that both the best available scientific information and professional standards and practices were employed in the effects analysis. The far-sighted commitment to adaptive management by the Corps under the MRRMP explicitly acknowledges the significant uncertainties that challenge management planning and implementation on the Missouri River. However, reliance on adaptive management, including the package of to-be-resolved management actions in this DEIS, comes with a number of not-fully-articulated responsibilities, including essential, devil-in-the-details commitments that are not completely described in either the *Science and Adaptive Management Plan* or MRRMP-DEIS. Several enabling attributes of management in an adaptive framework, especially management of the poorly understood pallid sturgeon, are essential to meeting MRRMP program objectives and realizing the implicit intention that the future management efforts on the Missouri River should be effective, efficient, and accountable. Given uncertain and likely limited resources, the MRRMP requires management actions be strictly prioritized, assessments and monitoring be rigorously designed, and directed studies draw benefits from hypothetico-deductive approaches.

The development and content of the MRRMP-DEIS underscore the management benefits anticipated as a result of embracing adaptive management as a guiding decision framework in implementing a preferred alternative. The ISAP and ISETR throughout their tenure have encouraged the application of adaptive management in developing Missouri River management actions directed towards sustaining and contributing to the recovery of the three listed species. At the same time, several challenges, both conceptual and methodological, remain to be addressed in establishing and institutionalizing an adaptive approach for managing Missouri River resources.

The IEPR process produced several interrelated considerations and potential concerns regarding the technical merit of the DEIS, the Science and Adaptive Management Plan, and supporting documents (e.g., appendices, technical reports) that the Panel could not summarize to its satisfaction using the four-part template. These broader considerations involved combinations of technical issues that addressed multiple charge questions. Often the concerns lie with the integration of adaptive management and the necessary supporting (best available) science. A few of these issues are presented separately here; others will undoubtedly emerge during discussions and responses to comments as part of the IEPR process.

Importantly, the six management alternatives as described in the MRRMP-DEIS emphasize that the Missouri River will likely remain as a highly physically constrained and human-dominated system. At the same time, those responsible for implementing the MRRMP should remain aware that the primary purpose of the federal ESA, embodied in Section 2(b) of the statute is, "to provide a means whereby the ecosystems upon which endangered or threatened species depend may be conserved…" Accordingly, adaptive management, which in the near-term might necessarily rely on hatchery stock for pallid sturgeon and constructed habitats for birds, should strive through time to understand and engage the system's natural structure, processes, and function that might be usefully managed or advantageously usurped to meet species needs and achieve habitat targets.

Correspondingly, the currently limited management opportunities – that is, a narrowly defined actionable decision space, bounded by human considerations (e.g., flood protection, navigation) – poses potential methodological problems and operational limitations in usefully designing and implementing management actions to achieve stated goals and objectives for the listed species. For example, the opportunities to meet drift-distance requirements in young pallid sturgeon or to manage flows to facilitate a desirable aggradation-degradation regime to naturally construct habitat for the listed birds are currently limited in magnitude, timing, frequency, and duration by operational mandates. As another example, the full range of opportunities to manage flows to build emergent sandbar habitat (ESH) remains to be explored. Only a subset of potentially useful and reasonable flow conditions that can affect in-channel habitat creation and persistence has been simulated in support of management planning for the birds. The technical design of management actions and associated monitoring programs to evaluate the effectiveness of the actions would benefit from increased operational flexibility in identifying and developing management alternatives of sufficient scale (e.g., number, size, and location of spawning habitats and IRCs) to generate measurable and unequivocal responses ("treatment effect"). The ability to produce sufficiently scaled manipulations to ensure measurable system response is fundamental to adaptive management.

At the interface of science and management, embracing general scientific endeavor under a broadly defined conceptual umbrella and calling it "adaptive management" can potentially dilute the power of adaptive management as a guiding framework for efficient and successful management in the face of uncertainty. For example, the title of the *Science and Adaptive Management Plan* underscores two related, but distinct, categories of activity in adaptively managing pallid sturgeon: one, a science agenda (Level 1 and 2); and two, the implementation of experimental management actions (Level 3). Adaptive management of the species does not start until Level 3 actions are put in place, which requires the timely development and integration of Level 1 and 2 research. The IEPR Panel encourages the MRRMP to assiduously apply learning from research and findings from monitoring to move pallid sturgeon management from scientific study to "scaled implementation," that is, actual adaptive management, as soon as practical. Adaptive management as it evolves in support of the MRRMP would benefit from continuation

of select analytical efforts (i.e., effects analysis) for both the pallid sturgeon and the listed birds that were initiated before and during the development of the *Science and Adaptive Management Plan.*

Relatedly, the direct and comprehensive measurement of salient components of habitat that affect pallid sturgeon recruitment and demographics will likely remain challenging for years to come. Therefore, proposed research and monitoring for pallid sturgeon habitat should prioritize timely identification of well-supported surrogates and proxy habitat metrics that can be used to inform management decisions, define useful management actions, and facilitate monitoring in the near-term.

Perhaps most important are technical concerns associated with the actual implementation of an adaptive management program in support of the selected management alternative. Adaptive management for the MRRMP will importantly benefit from "adaptive management champions" at all levels in the Corps. Successful adaptive management needs program managers who remain dedicated and committed to adaptive management approaches and structured decision-making. Just as important, technical staff who are quantitatively competent in sampling design, data collection, data analysis, interpretation, and communication will be critical to the success of adaptive management in support of the MRRMP. The Panel strongly suggests that representatives from the current AM team actively guide and participate in the initial implementation of the selected management actions and recruitment of technical staff sufficient to the challenges of adaptive management on the Missouri River. This recommendation is offered to help ensure that technical aspects important to the success of the selected alternative are correctly addressed and corresponding management actions are properly implemented within the current and evolving adaptive management framework.

Comments in assigned format

The remainder of this document provides Panel comments on the DEIS and supporting technical documents including the SAMP. The format of the IEPR comments presented below provides a statement of the issue, its significance, and panel suggestions for resolution. The Corps Product Delivery Team (PDT, or DEIS/SAMP authors – see Appendix C) then provide response to each comment, and the Panel provides back-check comments in response.

The comments are numbered sequentially and generally are arranged following the order of chapter/sections as presented in the MRRMP-DEIS. Importantly, the review comments focus on the technical merit of the proposed alternatives, the presumed efficacy of the preferred alternative, and the science underlying the development and analysis of the proposed management alternatives. The interdependencies among the chapters of the MRRMP-DEIS and the *Science and Adaptive Management Plan* often produced review comments that cut across

two or more chapters, as well as the AM Plan. These comments were organized and placed in the comments section where they seemed to best fit.

The specific questions, areas of interest, and issues of concern stated in the charge to the review panel by the government lead agencies and the MRRIC (see Appendix A) have been considered by the Panel in formulating review comments. However, the charge questions are not addressed one-by-one. Rather, review comments regarding specific topic areas of the DEIS highlight particular questions specified in the charge.

During the IEPR, the Panel and Corps PDT held three clarification teleconferences (facilitated by the US Institute) for the purpose of answering questions about the other's document or comments prior to providing responses. These occurred 1) February 28th, after the Panel had had a chance to read and formulate questions about the DEIS; 2) April 13th, after the Panel had submitted its comments to USACE for their response; and May 2nd, after USACE had submitted its responses to the Panel for its back-check. Summary notes from these calls are contained in Appendix B.

NOTE: USACE has not yet had the opportunity to determine responses for all Tribal, public, other agency, and stakeholder comments received during the public comment period ending April 24, 2017. Endangered Species Act consultation with the U.S. Fish and Wildlife Service and Tribal consultation are also ongoing. Review of these additional comments could lead to a change in how USACE intends to move forward with respect to a given IEPR comment. This Final IEPR Report on the Draft EIS will be published with the Final EIS and any deviations in the Final EIS from responses given in this report will be noted and briefly explained.

USACE makes no assertions concerning the Panel's Comments or Basis for Comment. 'Concurrence', 'non-concurrence', and 'partial concurrence' is the USACE's response to the Panel's Recommendation for Resolution only.

Panel Comment #1, Sec 1.0, Need and intent statement

The need for and intent of the DEIS is lost in its presentation.

Basis for Comment

The first "Broad Evaluation" charge question asks "Is the need for and intent of the DEIS clear?" The answer to that question at this point is no.

Twenty-seven pages describe background and history, the PrOACT process, an attempt to describe the need for and purpose of the plan, plan objectives, and scope of the plan. However, nowhere in the DEIS is there a succinct statement of the need for and intent of the plan/EIS. Indeed, attempts to do so are contorted – e.g., on page 1-14, "The emergence of this new information created a need for its evaluation and integration into USACE management actions on the Missouri River for the listed species and the associated AM Plan," and on page 1-17 "There is a demonstrated need to develop a management plan comprised of actions informed by best available science, as presented in the effects analysis, that provides an adaptive framework to address the uncertainty associated with potential pallid sturgeon limiting factors." Much of the 27-page discussion is helpful background and elaboration, but a concise formal statement of the need belongs right at the front of the section (and in the Executive Summary).

The need for the plan and an EIS should acknowledge the fundamental requirement that operations of the six dams on the Missouri River not jeopardize the continued existence of the listed species. It then should recognize that: 1) despite compliance with a 2000-2003 BiOp, monitoring of the piping plover population and numerical modeling of its likely persistence suggests substantial risk of local extirpation of piping plovers on the river within 50 years, 2) despite compliance with the BiOp, there is no evidence of successful natural recruitment of pallid sturgeon in the river; augmentation of pallid sturgeon population via hatchery rearing and stocking is not a sustainable solution, and 3) effective adaptive management for the listed species, called for in the 2003 BiOp, has not been implemented. The stated need for and intent of

the plan and EIS should be to describe a suite of potential actions, and an assessment of the effects of those actions to be implemented within an adaptive management framework, in order to meet the habitat needs of the listed species while minimizing impacts on human uses of the river.

There is confusion and disagreement about the proposed plan, its approaches, and the available decision space – among MRRIC members and likely the general public – because the fundamental needs of/objectives for the species and resultant needs for the plan and EIS have not been clearly stated and justified. Clear and transparent communication is crucial to the successful identification and assessment of the potentially necessary range of management actions that may be within and outside of USACE responsibilities or authorities, as well as stakeholder buy-in and acceptance of and trust in that process.

Significance

Medium/high.

Recommendation for Resolution

1) Add a succinct need statement focused on the listed species at the beginning of Chapter 1.

2) Reorder the presentation. Start with the current first paragraph, but directly follow with material in current sections 1.3-1.6, and then present the background material in the current sections 1.1 and 1.2.

3) Elaborate and justify the purpose and need for the DEIS in edited and tightened-up sections 1.3-1.6. Be clear to distinguish scientific/evidence-based considerations from policy- and authority-based considerations.

USACE/PDT Response

Concur with recommendation. USACE believes some of the statements in the comments are generalizations that misstate the Corps commitment to the 2003 BiOp; however, it does agree with the Panel's recommendation. USACE will reorder chapter 1 to bring the purpose and need discussion forward. USACE will also develop succinct statements similar to that provided by the IEPR to better characterize the need and purpose of taking action and distinguish scientific/evidence-based considerations from policy and authority based considerations where applicable.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #2, Sec 1.1.3, Figure 1-4 is not effective

Figure 1-4 on page 1-5 is incomplete and ineffective in communicating its message about the directional changing nature of the geomorphology of the Missouri River channel.

Basis for Comment

The figure is too small to be of optimal use and shows a reach that is too long, forcing a loss of detail to fit the figure onto the page. The display colors have meaning, some islands are white and others yellow, with no explanation; red patches designate unknown land status. A legend with key is necessary.

Significance

Medium/low. The figure is important because it sets the stage for many discussions that follow in the DEIS by transmitting the nature and history of channel changes.

Recommendation for Resolution

The Figure could be redesigned in one of two ways. First, reduce the length of channel shown to about 1/3 of its present length to allow for an expanded view of each channel example with details. Labels between the channels can be mostly eliminated since exact location is not important in achieving the purpose of the figure. If a portion of the present figure is used, the colors must be interpreted for the user as standard cartographic practice. Second, the figure might be replaced by aerial images of a reach of a few miles with repeated coverage of the same reach to show channel changes.

USACE/PDT Response

Concur with recommendation. The length of the channel shown will be reduced to allow for an expanded view of each channel example and non-essential labels will be removed. A legend will be added and the use of aerial images instead of, or in addition to, graphics will be investigated.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #3, Sec 1.5.1, Pallid sturgeon objectives/metrics

Section 1.5.1 identifies the pallid sturgeon objectives, metrics, and targets. The metric for the sub-objective 1 suggests a need to obtain a population estimate of age-0 and age-1 pallid sturgeon. The population estimate for age-0 pallid sturgeon is not directly related to the sub-objective and the target, and obtaining a reliable population estimate of age-0 pallid sturgeon is not realistic.

Basis for Comment

A reliable population estimate on age-0 pallid sturgeon is not obtainable; furthermore, there is no evidence to suggest the number of age-0 pallid sturgeon is readily related to the number of age-1 pallid sturgeon. It is of concern that limited resources may be used to attempt to estimate age-0 density, which is not an objective of the program.

Significance

Medium.

Recommendation for Resolution

It is inadvisable to attempt to estimate abundance of age-0 pallid sturgeon. Focus instead on metrics that provide the most information for the least cost and directly link to the objectives, such as catch-per-unit effort of age-0 pallid sturgeon or occurrence. The metrics outlined in sub-objective 2 seem more reasonable, and match the objective.

USACE/PDT Response

Concur with recommendation. The focus of near-term monitoring is more accurately outlined in Section 4.1.1 of the AM Plan. Section 4.1.1 indicates the primary metric for sub-objective 1 is catch rates of age 0 and age 1 pallid sturgeon; secondary metrics include model-based estimates of abundance of age 0 and age 1 pallid sturgeon, and the survival of hatchery and naturally reproducing fish to age 1. The text in the EIS will be edited to be consistent with the AM Plan.

The AM Plan has the following wording, which is much more consistent with the perspective described in the comment above:

Sub-objective 1: Increase pallid sturgeon recruitment to age 1.

> **Metrics:** primary metric is catch rates of age 0 and age 1 pallid sturgeon; secondary metrics include model-based estimates of abundance of age 0 and age 1 pallid sturgeon, and the survival of hatchery and naturally reproducing fish to age 1.

One difference is that we propose using model-based inferences of the abundance of age 0 and age 1 pallid sturgeon and survival rates to age 1. While these estimates will have uncertainty,

their trend will be informative, and such an application of the pallid sturgeon model is consistent with the Panel's recommendations under comment 7.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #4, Sec 1.5.2, Piping plover population target derivation

Contrary to implications in the DEIS (Section 1.5.2, page 1-23, paragraph 2), the numerical population target for piping plovers (sub-objective 2) was not derived from results of plover population modeling for the Missouri River; it was defined to correspond to the recovery goal established in the most recent version of the piping plover recovery plan.

Basis for Comment

The recovery goal was established using a model constructed for recovery purposes, and not developed to mimic dynamics of the Missouri River or to assess impacts of reservoir operation on piping plovers.

After the Missouri River target was adopted from the Recovery Plan, a post hoc analysis was conducted on several river operational scenarios using the plover population model described by the EIS and referenced planning documents. The modeling results for three scenarios, "existing conditions", "no-operations", and "unregulated" can be compared to get an estimate of reservoir operational impacts on the plover, to estimate the magnitude of impacts that may need to be mitigated to avoid jeopardy, and to validate the chosen numerical target.

Modeling results show that the plover population under the "existing conditions" scenario has about an 87% chance of persistence to 50 years in the northern region and 54% probability in the southern region; less probability of persistence than the level prescribed by the target. Plovers under the "no operations" scenario had a very high probability of persistence for 50 years; 99%, and 98% in the northern and southern regions respectively. Results for the "unregulated" were intermediate; 94% and 85% in the northern and southern regions respectively. The plover target provides a level of persistence lower than would be expected without reservoir operations. Moreover, the target exceeds the level of persistence predicted for an "unregulated" scenario. No explanation has been provided reconciling the established target with these post hoc modeling results.

Significance

Medium/High.

Reconciliation of plover targets with model assessments of operational impacts is a fundamental task, and this information has been asked for by MRRIC and the ISAP many times during the effects analysis and adaptive management planning. The fundamental assumptions and analyses that inform the chosen alternative should be made transparent to all concerned parties.

Recommendation for Resolution

Provide a clear, unambiguous description of how the chosen piping plover population target is supported by and consistent with the modeling results.

USACE/PDT Response

Non-Concur with recommendation, clarification provided

The comment states: "the numerical population target for piping plovers (sub-objective 2) was not derived from results of plover population modeling for the Missouri River; it was defined to correspond to the recovery goal established in the most recent version of the piping plover recovery plan." There is no numerical population target for plovers, for reasons explained in Buenau (2015). There are persistence criteria that were defined by the USFWS and correspond to the recovery goal in the piping plover recovery plan (although confined to Missouri River in this case). There are numerical ESH targets defined from those persistence criteria using the model that is described on page 1-23, paragraph 2 that was designed specifically for the Missouri River Recovery Management Plan.

The recovery goal of 95% persistence probability was not established using a model constructed for recovery purposes. It was a policy decision by the FWS. Any such criteria would be a policy decision based on agreed-upon levels of acceptable risk and, to some extent, convention; there is no quantitative "right" answer related to persistence probabilities that can be derived from a model. The recovery team used that policy-defined goal to establish population targets using their model. We used the model developed for the MRRMP to develop habitat goals based upon the persistence criteria. Consequently, we arrive at different targets than the recovery team did, based on the differences in models.

The analysis done to evaluate river operations scenarios was done *prior* to the selection of quantitative targets by the USFWS, and as soon as the hydrological modeling capability was available, beginning in November 2014. Buenau (2015) was published in May 2015 reflecting the analyses done from November 2014 through March 2015. Targets were first provided to the Corps and shared with MRRIC in a Planning Aid Letter to the Corps on November 13, 2015. Interim presentations to MRRIC discussed the target development process prior to November, but the decision was not final until the PAL was released.

The unregulated scenario was presented with heavy caveats because it was an exploration of modeling an unregulated river with no dams as it may have existed historically, but using a

model of ESH developed for the period 1998-2014. Sediment budgets, channel form, and a number of other factors differ greatly between the pre-dam era and the 2000's. Additionally, the bird population models are parameterized under modern conditions with highly regulated summer flows and are not ideal for use for historical conditions, which include conditions out of the domain of our model parameterization. We shared these results in the interest of scientific transparency but with many cautions for their interpretation and use. The no-operations scenario is somewhat less problematic for modeling as it is meant to reflect the current river and channel forms if the operation of the dams were to cease. However, such an alteration to the hydrograph would likely also challenge the predictive capability of the current ESH model over the long term due to channel morphology changes. The bird population models are also less suited, particularly on the reservoir shorelines, which would look quite different if the dams were not operated.

The finding that the no-operations scenario had highest persistence probability is not surprising, as it increases the area of the river, provides more habitat-forming flows, and retains some buffer in the reservoirs at dead pool elevations. Upon receiving the modeling results, the FWS decided that it was not necessary to provide the MRRMP with persistence targets more stringent than those deemed necessary for population recovery under the Recovery Plan, so chose to use the 95% persistence probabilities. This choice was documented on page 8 of the USFWS white paper released on October 1, 2016.

The analyses have already been provided in Buenau 2015. Assumptions were further provided in EA documents and text comparing the recovery plan models with the EA models. Text in the DEIS does not appear to contain false or misleading statements in this matter but will be re-evaluated for clarity and modified if necessary.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #5, Sec 1.5.2, Standardized ESH definition not adequate

Standardized ESH is a reasonable approach in assessing available sandbar habitat, but its explanation on page 1-23 is not adequate. To assess the amount of ESH acreage at constant defined flows requires complete resurvey of cross sections of the channel each year as basic input to the analysis, yet resurvey is not mentioned.

Basis for Comment

The reader is forced to assume that the value of the standardized approach is that it provides a measure of changing habitat availability and conditions. Habitat changes are keyed to

measurement of changing geomorphology, and such measurement takes place under the same parameters of hydrology each year. These standardized parameters are the discharges at Gavins Point, Fort Randall, and Garrison dams. Although the explanation of the protocol is not the subject of the text on the page, a sentence on this subject would strengthen the text here.

Significance

Medium/Low.

Recommendation for Resolution

On Page 1-23 explain how the Standardized ESH connects with changing geomorphology of the channel and where the data come from (aerial photography, or supplemental ground measurements) to assess area above water during the max July release.

USACE/PDT Response

Concur with recommendation

Concur with recommendation. The text in the DEIS can be clarified and briefly elaborated upon to explain how standardized ESH is estimated (and these values are only estimates and will not be known perfectly.) ESH monitoring and quantification is described in more depth in the AM plan. Quantification of ESH is primarily done with satellite imagery and uses discharge-area curves to adjust between image flows and standardized or max July flows. Discharge-area curves require periodic updates for accuracy, but it is not anticipated that these would be updated every year.

Complete resurvey of cross sections of the channel each year is not required; the reference plane is established using the HEC-RAS models and is updated as needed to reflect aggradation or degradation trends (or other geomorphic changes). The Corps will adjust the description in the EIS as follows:

Acres of ESH are calculated using the ESH Models for each reach and is confirmed annually using remotely sensed imagery and the HEC-RAS models. Sandbar acreage is expressed in two ways:

- Standardized ESH: The sandbar area meeting definitions for ESH that is above a reference plane corresponding to the water surface profile at 31.6 kcfs in the reach below Gavins Point Dam, 30.5 kcfs in the reach between Fort Randall Dam, and 23.9 kcfs in the reach below Garrison Dam. Estimating ESH acreage relative to a consistent reference plane permits tracking of changes in overall sandbar area independent of variable flow levels.
- Available ESH: The sandbar area meeting definitions for ESH that is above the maximum observed water surface during July of each year. It is calculated using stage/area relations for sandbars determined from field measurements and applied to acreages obtained from remotely sensed imagery for that period. Available ESH is an estimate of usable habitat for the

birds during the nesting season in each year, and may be more or less than Standardized ESH depending on flow releases that year relative to the standardized reference flows.

Note that the comment in "recommendation for resolution" misstates that standardized ESH is related to the max July release; it is available ESH that is measured at the maximum July release.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #6, Sec 1.5.2, Table 1-1 Piping plover population targets reservoir dependent

The piping plover targets are not completely explained.

Basis for Comment

The alternatives focus on the management of in-channel sandbar habitat; however, the plover population objective of a 95% probability of persistence for the next 50 years cannot be achieved with in-channel habitat alone. Piping plovers that nest on reservoir shorelines comprise about 40% of the lower Missouri River plover numbers and about 60% of the upper river numbers. Hence, the reservoir segment of the population contributes significantly to the likelihoods of persistence in the alternatives, and reservoir habitat must continue to be available to the birds in the amounts assumed in the models for the adaptive management program to succeed. Reservoir targets must be clearly documented to achieve full disclosure of the assumptions underlying jeopardy determinations and the adaptive management of in-channel piping plover habitat on the Missouri River.

Significance

Medium.

Recommendation for Resolution

The population targets for birds using both in-channel and reservoir habitats should be documented and transparently presented in support of Table 1-1.

USACE/PDT Response

Non-concur with recommendation, clarification provided

There are no population targets for birds, as explained in Section 3.2.3.1.1 of the AM Plan and following the analyses in Buenau (2015). There are ESH habitat targets for the riverine

segments. As explained in Section 3.2.3.1.2 of the AM Plan, reservoir-nesting birds are included in the persistence calculations that determine ESH targets and so those targets depend in part upon the reservoir operating rules. If those rules change or there are changes to hydrology that affect reservoir habitat availability, ESH targets will be recalculated. (Periodic recalculation of ESH targets as described in the AM plan will naturally incorporate updates to hydrological patterns.) While there are no reservoir targets, the metrics are defined in the AM plan and will be reported and assessed to understand the status of that habitat and the birds nesting on the reservoirs. Reservoir targets are likely infeasible due to the current operating rules, but what matters is the long term habitat availability, not annual amounts.

A summary of factors triggering recalculation are thoroughly covered in the AM Plan, and a brief summary will be added to the EIS and appropriate sections of the AM Plan referenced.

IEPR Panel Back-Check Response

Concur with USACE response, further consideration needed in site-specific environmental assessments and/or as adaptive management is implemented

The Panel understands the strengths and limitations of the current bird population modeling in relation to species objectives, targets, and metrics. However, the non-concurrence explanation provided by the USACE does not entirely address the concerns raised by the IEPR. The Panel underscores the importance of more comprehensively examining the implications of habitat availability on associated population responses for piping plovers. Birds that nest on reservoir shorelines and other off-channel habitats contribute to the persistence of the Missouri River population and the northern Great Plains meta-population. Importantly, the extent and distribution of off-channel piping plover habitat can vary independent of in-channel habitat managed under the MRRMP. Therefore, during implementation of AM, the Panel recommends that the contribution of all relevant Missouri River habitat types to plover populations be addressed by the bird EA team. Increased understanding of these relative contributions to plover persistence can provide resource planners with critical information for prioritizing conservation actions within available budgets. Effectively communicating the importance of alternative available habitats in determining plover persistence can help MRRIC understand and evaluate such prioritization.

Panel Comment #7, Sec 2.4.4, Addition of pallid demographic model

The Section 2.4.4 emphasizes the use of the 2-dimensional hydrodynamic models for assessing pallid sturgeon habitat. It might be useful at this point to also introduce the pallid sturgeon demographic model and describe its strengths and limitations in supporting the identification and selection of management alternatives.

Basis for Comment

A strength of the approach for developing management alternatives for the plover and terns lies in the integration of a demographic population model with hydrological models to characterize the potential implications of habitat management on bird population dynamics. It would prove beneficial if similar capabilities could be developed for the pallid sturgeon. Despite potentially daunting uncertainties, implementation of the existing pallid sturgeon demographic model in combination with available physical models might be used to help define management alternatives that might produce a measurable impact on pallid sturgeon population dynamics. Considerable effort was directed at developing the pallid demographic model. It might prove beneficial to incorporate the model into the assessment sooner than later.

Significance

Medium/High. This concern is of medium/high significance. There needs to be methods to quantitatively link proposed pallid sturgeon management actions to anticipated population responses. The pallid model, despite its uncertainties, might be used to examine if a self-sustaining population of pallid sturgeon is even possible in the Missouri River, given its current physical structure and operation (e.g., human considerations and associated constraints).

Recommendation for Resolution

1. Evaluate and discuss potential use of the current pallid sturgeon demographic model to explore the population-level implications of management alternatives.
2. Evaluate and discuss the potential use of the demographic model as a template to incorporate the results of research and monitoring in relation to the Big Questions for the Upper and Lower Missouri River.

USACE/PDT Response

Concur with recommendation, clarification provided

Section 2.4.4 describes what models were actually applied in the generation of alternatives for the DEIS, so no changes are proposed to section 2.4.4. As noted in section 3.3.2.1 of the DEIS:

> "A comprehensive pallid sturgeon population model relating the effects of all potential management actions to population dynamics is not currently available, although the framework of such a model has been developed (Jacobson et al. 2016). As a result, the analysis of potential impacts on pallid sturgeon is based on review of available scientific literature discussing key life history processes and population dynamics, conceptual ecological models, diet, habitat, movements, recruitment, spawning, and extensive information from the effects analysis for pallid sturgeon."

Going forward, the recommendations made by the Panel are helpful, and are consistent with the modeling work proposed in Appendix D.5 of the AM Plan, which will be summarized to support revisions to section 3.3.2.1 describing the intended future applications of the model.

As noted by the Panel, some of the uncertainties are indeed "potentially daunting". In the short term, linking IRCs to age-0 survival in the model would involve *exploring* hypotheses based on expert elicitation, as described in Appendix D.5. In the medium term, as IRCs and spawning habitat sites are implemented, the data that are collected in the field, as well as results from laboratory and mesocosm studies, will provide a stronger scientific basis for bracketing model assumptions on the survival benefits of implemented actions.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #8, Sec 2.5.1.6, Mechanical vegetation management

Vegetation management is almost certain to require annual maintenance as indicated on page 2-18, but it is also most likely to require mechanical approaches to supplement chemical efforts. The mechanical efforts add substantially to the annual costs.

Basis for Comment

Removal of riparian vegetation such as that along the Missouri River, and particularly invasive species, is rarely successful for more than a year without mowing, cutting, chaining, or root plowing. In other sand-bed river systems of the interior western US, cutting is done first, followed by application of chemicals on remaining roots and stumps. The discussion on page 2-18 would be more complete if it were to include an expanded discussion of mechanical approaches.

Significance

Medium/Low. The DEIS would be more complete if it included an expanded discussion of mechanical approaches to vegetation management on page 2-23.

Recommendation for Resolution

1. Add a short paragraph outlining the importance and role of mechanical approaches to vegetation management. The statement should also include broad estimates of cost for mechanical supplements to chemical efforts.

USACE/PDT Response

Concur with recommendation

To-date, vegetation management on Missouri River sandbars has mostly occurred through herbicide treatments, but we concur a more in-depth discussion of mechanical approaches is warranted. The below text or similar will be added to the DEIS:

Vegetation management strategy is to treat vegetation during its first year of growth and follow up with maintenance spraying. Maintenance spraying is done on an annual basis to control any vegetation that emerges after the initial removal/spraying efforts which minimizes the need for mechanical removal of vegetation. In cases where vegetation is very thick, such as stands of Phragmites, it is often more effective and less expensive to use controlled burns. In cases where woody vegetation has established, mechanical removal activities are often necessary, but areas where extensive mechanical removal of vegetation is necessary are mostly avoided because of cost and efficiency.

If mechanical removal is undertaken, the preferred methods of removal, in terms of efficiency are, 1) mowing, 2) mulching, 3) cutting. Mowing is typically used when stem diameters are less than an inch. For larger stems, mulching tends to be more effective. For very large stems with low abundance, cutting may be the preferred method. Typically the first step is to apply the herbicide on the vegetation, which is absorbed by the plant roots, stems, or leaves. Once the herbicide has taken effect and the vegetation dies off, any standing dead woody debris would be removed using one of the aforementioned methods. Past results have indicated that removal without prior herbicide treatment of the vegetation often leads to a quick return of even thicker vegetation. A compact trackloader along with a mowing, mulching, or cutting attachment is typically used to clear the sandbars of remaining dead vegetation.

Cost information for these additional methods will be added to the cost appendix. In general, prescribed fires have run $65/acre for a prescribed burn. For mechanical removal, the most recent efforts have averaged roughly $500/acre although numbers can vary greatly depending on terrain, vegetation types, and other logistical issues.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #9, Sec 2.5.1.14, Sand in Lewis and Clark Lake

The discussion of sand transport related to sediment redistribution is incomplete as presented on page 2-22. The presentation and analysis of sand in Lewis and Clark Lake is over-simplified and fails to take into account contributions from the Niobrara River.

Basis for Comment

Sand is deposited in the basin of the Lewis and Clark Lake in large quantities from the Niobrara River, with the deposition occurring in the lower reaches of the reservoir. The reservoir is slightly less than 30% filled with sediment, with the majority likely to be sand (National Research Council, 2011, Missouri River Planning: Recognizing and Incorporating Sediment Management, Washington, D.C., National Academies Press). It might be unwise to dismiss this large quantity of sand as a candidate for redistribution downstream since it has a source close to the dam.

Significance

Medium. To exclude discussion of the Niobrara River sediment contribution is to miss an issue that might have positive bearing on the recovery project, perhaps in the long run.

Recommendation for Resolution

1. Add a discussion of the Niobrara River as a sand source.
2. Explore the possibility of moving some of the sand from Lewis and Clark Lake or the Niobrara to the Missouri River below Gavins Point Dam (by slurry pipeline, for example, or other options).

USACE/PDT Response

Concur with recommendations, clarification added

The presentation of sand in LCL is indeed simplified, but it does take into account the contributions from the Niobrara River. The USACE study referenced on page 2-22 is based on an assessment of all of the sediment deposited in the reservoir, including sand, silt and clay fractions derived from both the Niobrara River and the reach of the Missouri between the delta and Ft. Randall Dam. Clarity could be improved in the EIS by adding the following points.

The study demonstrated that sediments can be flushed beyond the dam. Even with extreme measures (lowering the spillway 10 ft and discharging 176,000 cfs for 7 days), however, only a tiny fraction of the material mobilized past the dam is sand (0.07 percent). Sands are required for development of ESH and the models demonstrated that flushed sediments generally behaved as wash load, passing through the target reach and into the downstream navigation channel.

Sands flushed from the delta redeposited in the reservoir further downstream. The spillway crest elevation above the reservoir bottom prevents complete draining of the reservoir through the spillway, resulting in a sediment trap at the face of the dam. Repeated flushing events may result in better sediment transport to the downstream channel once deeper areas of the lake are filled in. Similarly, some flushing scenarios coupled with infrastructure changes may prove more effective as the delta fronts move closer to the dam over time.

All the scenarios included draining Lewis and Clark Lake (to increase effectiveness) and the socio-economic effects were not evaluated. Unstated in the DEIS summary is that a pipeline slurry option was considered, but the cost estimates (~$50M/yr) made that option prohibitive. Some concepts involving "channelization" of the reservoir sediments to improve transport efficiency were developed and may be investigated further in the future.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #10, Sec 2.5.3.1, Geomorphic location of channel modifications

The discussion of channel reconfiguration (page 2-29) is incomplete without commentary about the geomorphic location of various possible modifications, but particularly bank, dike, and revetment notches. While the existing draft text indicates (page 2-29) that it is appropriate to locate such efforts where the new structures minimize their effects on authorized uses, it is at least as important to define for each type of structure where it is most effective and least effective: outsides of bends, insides of bends, or relatively straight reaches. Location with respect to islands and bars is also important.

Basis for Comment

The geomorphic location of channel modifications such as notches partly determines how rapidly the notches may cut or fill themselves. Notches on the outsides of bends, for example, are more likely to be eroded quickly than notches cut into the insides of bends. Islands and bars alter channel flow hydraulics and may direct flows into or away from notches. The stability of new structures is partly related to their geomorphic setting.

Significance

Medium. Assessment of the geomorphic positioning of notches and other channel reconfigurations is part of the due diligence in river engineering projects and is a standard

component in planning for such features because such assessment goes directly to issues of efficiency and risk of structural failure.

Recommendation for Resolution

1. Add to page 2-29 an extended discussion of the role of locating reconfiguration projects in light of their position with respect to channel geomorphology.

USACE/PDT Response

Concur with recommendation.

Text will be added to the EIS referring the reader to the more-detailed description of locating reconfiguration projects in relation to geomorphology which will be located in Appendix E.1 of the AM Plan. The AM team is working on revising the text in Appendix E.1 which describes the process for selecting sites for IRCs and designing IRC projects, based on feedback from this Panel as well as MRRIC.

Geomorphic aspects of IRCs relate to two specific scales. The settling region scale addresses 10's – 100's of miles where interception and rearing are most likely to support survival and growth of age-0 sturgeon. This scale will be addressed through 1-dimensional advection and dispersion modeling of dispersal from probable spawning sites. These results will determine the most beneficial area for IRCs to be placed (settling region) based primarily on upstream spawning location and subsequent drift distance.

The second scale is within the settling region scale and addresses among-bend and within-bend variation in channel morphology. The statistical sampling designed described in Appendix E.1 depends on a geomorphic classification to pair up similar treatment and control bends. The classification may also include an assessment of inherent interception capability if existing data support ranking.

For within-bend geomorphology, we will amend the discussion in Chapter 2 to emphasize that the initial implementation will focus on development of IRCs through structure modifications on the insides of bends because that will tend to minimize potential adverse impacts from erosion and shoaling and because it is thought that interception and foraging improvements might be most readily accomplished in these areas.

Note that the IRC projects are implemented at a bend scale in the experimental design, and generally will involve concurrent modifications to several structures. Because of potential complications arising from the interactions of these multiple adjustments, each site will be thoroughly assessed for potential impacts from erosion and shoaling using two-dimensional modeling. Monitoring and assessment will include structure modification effects to erosion, transport and deposition of sediments and O&M will be undertaken as needed to correct areas where effects are outside tolerable ranges. Note also that the monitoring and assessment will

provide opportunities to refine design concepts for broader-scale implementation, and that future activities will likely include expansion of the IRC implementation to include crossings and outsides of bends where interception and foraging can be improved, and may be implemented at smaller scales (i.e. single-structure modifications to develop distinct, but effective, habitat patches). We will make use of multi-dimensional hydrodynamic models and advanced particle-tracking techniques to design and evaluate alternative configurations. Note USACE would evaluate any redesign or modification of any structure for IRC habitat for potential impacts on authorized purposes.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #11, Sec 2.6.2, Turbulent flow and pallid sturgeon larvae

Section 2.6.2 identifies drift dynamics (e.g., entrainment without escape) of pallid sturgeon larvae as a prominent hypothesis for recruitment failure in the lower Missouri River. The possibility of damage to larvae from turbulent flow in the main channel is also mentioned in this discussion but with limited supportive evidence (page 2-34, final paragraph).

Basis for Comment

This appears to be a relatively new concern that has had limited discussion in the past. Can some related work be cited to support this hypothesis?

Significance

Medium. The possibility of physical damage from flow to young larvae is a legitimate concern, especially if entrainment in the thalweg is persistent. Such damage has been demonstrated for organisms such as mussel veligers.

Recommendation for Resolution

1. Provide relevant information from the literature to support this hypothesis.
2. Suggest research that can help to test the hypothesis (perhaps using shovelnose sturgeon as a surrogate) and a time frame to accomplish the studies. If the hypothesis is supported, what are the implications for management of the lower Missouri River system?

USACE/PDT Response

Concur with recommendation

The AM Plan is likely a better location for this information, but a reference can be added to the EIS. The hypothesis that turbulent flow could be physically damaging to pallid sturgeon free embryos was introduced as a corollary hypothesis based on expert elicitation after the Effects Analysis completed evaluations of hypotheses. It therefore did not receive the same consideration as other EA hypotheses. Nevertheless, consideration of the hypothesis was included in science components in the AM plan.

Recommendation 1. Literature on this issue is reviewed in Appendix 6 of Delonay et al. 2016[1] (Free-Embryo Drift Experiments in an Experimental Stream) and in the Effects Analysis (Jacobson et al. 2016a[2], pages 43, 101-104, 123-125).

Recommendation 2. Proposed research on this issue has been described in the AM Plan since V3 in 2015. In V6 of the AM Plan, work on this issue is described in section C.3.4.5.2 of Appendix C (Big Question 4, Level 1, Component 2 – Field studies: Resilience, stamina in turbulent flows), which relate to hypotheses 14 and 19 in the AM Plan.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #12, Sec 2.6.3, IRC characteristics

Section 2.6.3 describes characteristics of Interception-Rearing Complexes (page 2-35) that include (1) interception of larvae from the channel thalweg, (2) production of invertebrate food, and (3) foraging habitat for larvae, along with some general habitat features such as flow velocity. For successful rearing of pallid sturgeon larvae, however, it may be necessary for these characteristics to coincide.

[1] DeLonay, A.J., Chojnacki, K.A., Jacobson, R.B., Albers, J.L., Braaten, P.J., Bulliner, E.A., Elliott, C.M., Erwin, S.O., Fuller, D.B., Haas, J.D., Ladd, H.L.A., Mestl, G.E., Papoulias, D.M., and Wildhaber, M.L., 2016b, Ecological requirements for pallid sturgeon reproduction and recruitment in the Missouri River: A synthesis of science, 2005-2012: U.S. Geological Survey, Scientific Investigations Report 2015-5145, 224 p. https://pubs.er.usgs.gov/publication/sir20155145

[2] Jacobson, R.B., Annis, M.L., Parsley, M.J., James, D.A., Colvin, M.E., and Welker, T.L., 2016a, Scientific information to support the Missouri River pallid sturgeon effects analysis: U.S. Geological Survey, Open-file Report 2015-1226, 78 p. http://pubs.er.usgs.gov/publication/ofr20151226

Basis for Comment

The required "juxtaposition" of these three features is acknowledged in this section but the quantitative representation of this overlay is not fully developed other than a visualization of flow vectors and depth profiles in Figure 2-4. In particular, invertebrate food production may be challenging to quantify short of physical sampling of the habitat.

Significance

Medium. It is possible that larvae will not successfully develop without all three of these features in sufficient quantity at the same time and place. In addition, while interception of larvae is necessary, the retention of those larvae in the habitat is also needed (i.e., not re-entrained in the main flow) to exploit food and habitat.

Recommendation for Resolution

1. Provide a quantitative approach to linking these three features of IRCs in space and time.
2. Describe the interrelationships among interception/retention, food production, and foraging habitat that result in suitable IRC habitat for larvae. Is there relevant information from the literature for other species or rivers to quantify this relationship?

USACE/PDT Response

Concur with recommendation, clarification provided

Text will be added to the EIS directing the reader to the more-detailed information about quantitative representation in the AM Plan. The recommendations are excellent, and are the focus of intended research at Level 1 under Big Question 3 (see Appendix C, section C.3.3.5). Section 4.2.6.3.2 of the AM Plan includes the following summary of the intended research:

> "Level 1 and 2 activities associated with IRCs focus on: 1) the need for additional IRC habitat, 2) refining the relationship between the habitat components, flow (utilizing current operations), and the biological requirements of each habitat type, 3) the needed habitat characteristics and their spatial and temporal distributions, and 4) determining the effectiveness of various mechanical activities and the potential for flow management actions to contribute to future IRC needs."

In particular, as indicated in the AM Plan (C.3.3.5, components 3-5), areas of suitable food-producing and foraging habitats will be calculated using 2-dimensional hydrodynamic models constructed for each control and treatment IRC. The initial criteria for these habitats are documented in the EA; as IRC age-0 monitoring and IRC science components progress (see AM Plan C.3.3.5, components 3-4) the criteria will be refined.

Particle tracking models will be applied in the design of IRCs (see comment # 10 above). They provide a strong quantitative approach to addressing linkages among habitat elements in time

and space. In addition to evaluating interception, they can be used to estimate the residence time of passive particles and track likely transport pathways from food-producing habitats to foraging habitats. As indicated in the relevant appendices, these models will be updated to reflect the vertical distribution of larvae and improved information on age-specific swimming capabilities.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #13 , Sec 2.6.3, IRC relationship to pallid demographics

The potential importance of IRCs has been well-developed conceptually. Initial IRC habitat modeling and visualization for selected locations has produced informative results concerning the potential efficacy of this management alternative for pallid sturgeon. The remaining challenge lies in translating managed increases in IRC to increased recruitment of early life stage pallid sturgeon and importantly understanding how increased recruitment might help achieve the species objective of a self-sustaining population in the Missouri River.

Basis for Comment

The assumption is that the current availability of IRC constrains the recruitment of early life stage pallid sturgeon and negatively impacts the population dynamics of this species. However, there are currently no quantitative functional relationships that translate acreage (or habitat characteristics) of IRC to any pallid demographic parameter for the Missouri River population.

Significance

Medium/High. Absent management-response relationships for IRC and demographics of pallid sturgeon, it is not possible to estimate how many acres need to be developed or what habitat features (e.g., food producing, foraging, and interception) should be emphasized in implementing IRC across the proposed management alternatives. IRCs might be constructed at insufficient scale to generate a measurable population response for pallid sturgeon.

Recommendation for Resolution

1. Acknowledge that the lack of quantitative functional relationships that translate habitat acreage or habitat characteristics of IRC to any pallid sturgeon demographic parameter for the Missouri River population may hinder determination of how much IRC habitat needs to be constructed in order to generate a measurable population response for pallid sturgeon.

2. Indicate that increased Level 1 and 2 research directed at developing functional relationships that estimate population responses (i.e., changes in demographic parameters) to increased acreage and specific habitat characteristics of IRCs is needed to address this deficiency.

USACE/PDT Response

Concur with recommendations.

Concur, these recommendations are reasonable and will be implemented in both section 2.6.3 and chapter 4 of the AM Plan. Table 42 of the AM Plan (excerpted below) outlines four stages of IRC development, based on USFWS 2016[3]. Note that it is only during Stage 3 (following evidence from the 7-year staircase implementation of IRCs) that the Technical Team will estimate the required rate of Level 3 implementation. Please also note that metrics to be used for assessing implementation of IRCs are not acres, but rather ac-dy/year, calculated using 2D hydrodynamic models to estimate the cumulative days of availability of suitable habitat during the growing season.

IRC excerpt from AM Plan Table 1. Summary of time limits for implementation and scope of actions.

Action Category	Time Limit*	Minimum Scope	Maximum Scope
IRC habitat development (Levels 2 to 4)	Stage 1: study phase (years 1-3 post-ROD)	Build 2 IRC sites per year (paired with control sites), adding 33,000 ac-d/yr of suitable habitat, using staircase design[1]. Assess potential for refurbishing existing SWH sites as IRCs	
	Stage 2 – continue study phase (years 4-6 post-ROD)	Build 2 IRC sites per year (paired with control sites), adding 33,000 ac-d/yr[1] of suitable habitat. Refurbish SWH sites in addition to study sites (rate TBD).	
	Stage 3 - Level 3 implementation (years 7-10 post-ROD)	Continue assessing IRC sites and refurbishing new SWH sites, adding at least 66,000 ac-d/yr[1] of suitable habitat. Determine required rate of Level 3 implementation based on stages 1 and 2.	
	Stage 4 – Level 4 implementation	Remove IRC habitat limitations to pallid sturgeon survival by implementation at Level 4.	

Notes to Table 42
1. Units of ac-dy/year are calculated based on how the flow regime and channel configuration result in cumulative days of availability of suitable habitat during the growing season. Progression through each stage of IRC habitat development is contingent on outcomes and hypothesis tests (USFWS 2016); efforts could be halted if evidence shows IRCs are not successful. Experimental design for IRC sites is described in section 4.2.6.3 and Appendix E. Refurbishment of SWH sites into IRCs is described in section 4.2.6.4.

[3] USFWS. 2016. Planning Aid Letter from Mr. Casey D. Kruse (USFWS) to Ms. April Fitzner (USACE), entitled "Interception Rearing Complex Targets". 4 pp.

Section C.3.3 of the AM Plan appendices address the strategy to move from IRC characteristics to growth and survival demographic parameters. We acknowledge that these will be challenging experiments; feasibility studies are presently underway to develop mesocosm with sufficient size and habitat complexity. In addition section C.4 of the AM Plan appendices discusses the continued development of the collaborative population model to address the linkages from IRC management actions to population responses.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #14, Sec 2.6.4, Level 3 implementation absent supporting science

A progressive AM program is offered as the most effective way to manage risks to the pallid sturgeon. Table 2-6 describes Level 1-4 actions aimed at reducing uncertainties and implementing management actions. However, a progressive AM program that implements Level 3 actions without supporting science will not likely achieve species objectives for pallid sturgeon in the Missouri River.

Basis for Comment

The current AM program calls for timely Level 3 implementation of plausible management actions, regardless of the existence of supporting Level 1 or 2 research and in-river testing.

Significance

High. Absent Level 1 or 2 supporting science, there is minimal to no information upon which to design and implement effective management actions. Even with a progressive AM program, failure to measure a population response of pallid sturgeon to Level 3 implementation could simply result from an insufficiently scaled implementation. Monitoring data, under these circumstances, would provide no useful information for adaptively managing this resource. There would be no way to ascertain whether the implemented action was simply irrelevant to pallid population dynamics or whether a potentially effective management action was simply not implemented at a magnitude required to elicit a population response.

Recommendation for Resolution

1. Acknowledge that near-term focused Level 1 and 2 research should be performed to demonstrate and quantify pallid population responses prior to Level 3 implementation.

USACE/PDT Response

Concur with recommendation, clarification provided.

The point made in the comments is central to the design of the framework developed to guide activities for pallid sturgeon. We are not relying strictly on adaptive management as a mechanism to address critical uncertainties identified in the Effects Analysis. The ***Science and*** Adaptive Management Plan (emphasis added) includes a large number of research activities at Levels 1 and 2 that will be undertaken prior to - and in some cases concurrent with – the Level 3 actions. Generally speaking, the actions at Levels 1 and 2 target decision-relevant uncertainties that can more quickly or effectively be addressed with laboratory or mesocosm studies than by implementing and monitoring.

Adaptive management must operate under the constraints of the Endangered Species Act (Green and Garmestani, 2012). The framework employed seeks to optimize the tradeoffs between development of knowledge in the near-term to inform implementation decisions and the requirements in the Endangered Species Act to implement actions based on the best ***available*** science (again, emphasis added). The intent is that the investment in the research activities (at the expense of action in the near term) will result in improved long-term management and improved prospects for meeting the fundamental objectives.

Some uncertainties can best (or only) be explored through actual implementation, monitoring and assessment because they do not lend themselves to study at laboratory or mesocosm scales. The time limits for the Level 3 implementation in the framework are not inflexible, but are also not arbitrary – they generally reflect an estimate of the time required to execute underpinning Level 1 and 2 studies, represent a point in time when field study using AM is needed to advance understanding on a key uncertainty, or were identified in deliberations between the Corps and USFWS because they provide necessary assurances/commitments on the part of the Corps to take action should the science remain equivocal. In this latter instance, additional effort to arrive at the needed knowledge would become a priority.

The Panel's above recommendation (complete Level 1 and 2 research *prior* to Level 3) appears to contrast in tone to the Panel's statement earlier in their document (pg. 12), which urges implementation at Level 3 as soon as practical:

> "Adaptive management of the species does not start until Level 3 actions are put in place, which requires the timely development and integration of Level 1 and 2 research. The IEPR Panel encourages the MRRMP to assiduously apply learning from research and findings from monitoring to move pallid sturgeon management from scientific study to "scaled implementation," [Level 3] that is, actual adaptive management, as soon as practical."

Section 4.2.2 of the AM Plan outlines the fundamental tradeoffs between different learning strategies:

> "… there is a tradeoff between taking action and decreasing uncertainty. Taking actions at Level 3 or 4 without strong evidence of their effectiveness may be costly, and may use resources which could have been better allocated. On the other hand, there are constraints on how much can be learned from retrospective studies of past data, analyses of the current system, laboratory experiments and mesocosm experiments. Delaying Level 3 or 4 actions that have potential benefits could delay the recovery of pallid sturgeon. The AM strategy needs to find the appropriate balance between three risks: 1) premature implementation of ineffective actions, which wastes resources; 2) excessive delay in implementing actions which would have helped the population; and 3) implementation of multiple concurrent actions without an ability to determine which actions are most effective, which makes future management adjustments more difficult."

As summarized in Tables 40, 43 and 44 and Figure 65 of the AM Plan (section 4.2.4), most of the Level 1 and 2 research would occur *prior* to implementing Level 3 actions, with movement to Level 3 only if certain decision criteria are fulfilled, consistent with the Panel's recommendation. Some Level 1 and Level 2 research will be *concurrent* with implementation of Level 3 actions that are already underway (i.e., augmentation).

In terms of Table 2-6 in the DEIS (drawn from Table 39 of the AM Plan), the staircase design for implementation of 12 IRC sites over 7 years (with paired controls) is a Level 2 test (*in-river testing* sufficient to expect a measurable biological, behavioral, or physiological response in pallid sturgeon, surrogate species, or related habitat response). If this stage 2 implementation is successful enough to generate a meaningful population response, it would then turn out to have been a Level 3 action (*scaled implementation* sufficient to expect a meaningful population response). We won't know until we implement those 12 paired treatment and control sites and monitor the outcomes at both site and population scales. Table 42 of the AM Plan (included as Table 4-1 of the DEIS) describes the staged implementation of IRCs, as summarized above in response to Panel Comment #13, spanning Levels 2 to 4, and only moving to Levels 3 and 4 if certain decision criteria are met. Implementation of spawning habitat is at Level 2 initially; decision criteria for moving to Level 3 are described in section 4.2.6.5.7 of the AM Plan. Implementation of spawning flows would only occur at Level 2 if after 9 years of observational studies (building on data sets collected since 2005) indicate that there is insufficient evidence to evaluate the efficacy of such flows. The evidentiary framework is described in Table 48 of the AM Plan.

We will identify points in the EIS and the SAMP where the stated concepts can be more clearly articulated.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response.

Panel Comment #15, Sec 2.8.2.2, Ramping rates

Ramping rates (the rates at which flow releases from dams are increased or decreased) are not adequately accounted for in the discussion concerning habitat construction flows (DEIS p. 2-55 through 2-59).

Basis for Comment

Ramping rates are critical process connectors between changing water flows and responses in bank stability and channel-edge geomorphology, particularly in sand-bed channels such as the Missouri River. Up-ramp rates accelerate bank erosion if they are too rapid because the flows erode dry, low-cohesion soils. Down-ramping rates are particularly important because if water levels in the channel drop much more quickly than groundwater levels in the banks, excess pore water pressure in the banks results in accelerated bank collapse. The authors propose up-ramp rates for May pulse flows of 6,000 cfs per day, and down-ramp rates of 30% for 2 days followed by 8 daily increments down to non-pulse flows. The primary issue is the down-ramp: rapid at first, then slowly, when more gradual declines over the entire 10 day down-ramp period would be less risky for bank stability.

Significance

Medium. Present ramp rates may increase the risk of bank erosion because increases are rapid, and decreases are rapid in their early phases. The rapid decreases are not consistent with the concept of introducing naturalized flows.

Recommendation for Resolution

1. In Chapter 2 provide greater recognition of the erosive effects of proposed down ramping and up ramping rates.
2. Re-evaluate the possibility of reducing the up-ramp and down-ramp rates to better account for erosion

USACE/PDT Response

Concur with recommendations, clarification provided.

Concerns expressed regarding erosion potential are warranted. However, the ramping rates from Gavins Point for each alternative are generally consistent with the rate of change limits for flood control releases in the Master Manual. Chapter 2 of the Draft EIS presents a description of the alternatives and Chapter 3 presents the environmental consequences of the alternatives. We will add clarifying text regarding erosion to the geomorphology section of Chapter 3.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #16, Sec 2.8.2.2 and 2.8.3.2, SWH relationship to pallid demographics

Alternatives 1 and 2 emphasize the creation or restoration of shallow-water habitat largely as outlined in the 2003 Amended BiOp. Channel widening and off-channel SWH acquisition would add 10,758 acres to meet targets stipulated in the BiOP. However, the most recent evaluations of the effectiveness of SWH in positively affecting pallid population dynamics suggest minimal or no relation between SWH and pallid population sizes or recruitment of early life stages.

Basis for Comment

Recent publications (e.g., Gemeinhardt et al. 2016) that examine the effectiveness of SWH in positively impacting pallid sturgeon (and other fish) populations present study results that indicate minimal to no quantitative relationship between the increases in SWH and measurable responses.

Gemeinhardt,T.R., N.J.C. Gosch, D.M. Morris, M.L. MIller, T.L. Welker, and J.L. Bonneau. 2016. Is shallow water a suitable surrogate for assessing efforts to address pallid sturgeon population declines? River Research and Applications 32:734-743.

Significance

Medium/High. The continued acquisition of SWH done mainly as compliance with the 2003 Amended BiOp might result in the allocation of significant funds with no demonstrable scientific basis for anticipating a measurable population response by pallid sturgeon. Increased acreage of SWH might contribute minimally, if at all, to the pallid species objective concerning a self-sustaining population.

Recommendation for Resolution

1. With regards to Alternative #1 and #2, note that recent research has found minimal effect between creation of SWH and pallid populations.
2. Acknowledge that near-term focused Level 1 and 2 research is needed to quantify pallid sturgeon population responses in relation to the quality, quantity, and distribution of SWH, particularly for the lower Missouri River.

USACE/PDT Response

Concur with Recommendation.

The EIS will be revised to summarize current literature as per Recommendation #1. Level 1 and 2 research is required to help guide SWH habitat conversion to IRCs. These research components are described in the AM Plan. Additional research specific to SWH will be identified if Alternatives 1 or 2 are selected or if the proposed action includes additional SWH

construction. The comment underscores the importance of level 1 and 2 science components in establishing fundamental science information which we acknowledge. Note that Chapter 2 provides a description of the management actions and alternatives and environmental consequences are provided in Chapter 3. We will add clarifying text to the pallid section of Chapter 3.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #17, Sec 2.8.4.2, Spawning cue test

If the Level 1 studies over 9-10 years fail to provide a conclusive answer regarding the importance of a spawning cue, why would a Level 2 test release from Gavins Point be conducted as part of Alternative 3?

Basis for Comment

Section 2.8.4.2 describes implementation of Level 1 and 2 spawning cue research as part of the preferred Alternative 3. The proposal is to perform a test release (Level 2) if Level 1 research fails to provide a basic understanding of spawning cues. The Level 2 studies would conduct in-river testing "at a level sufficient to expect a measurable response." How would this level of testing be determined if Level 1 results were not conclusive after 9-10 years of research?

Significance

Medium/High. Absent Level 1 understanding, the Level 2 implementation as a test release might be incorrectly designed and performed with a result of no measurable response in pallid spawning or reproduction. There would be minimal to no information provided by an improperly scaled test release to support adaptive management.

Recommendation for Resolution

1. Provide an explanation of what would be gained by performing Level 2 studies if Level 1 research over 9-10 years showed no clear answer on whether a spawning cue is important.

USACE/PDT Response

Concur with Recommendation.

A clearer explanation of the reasoning for the test release will be added to the EIS. The Panel is correct. If after 9 years it is still unclear whether a spawning cue is necessary for recruitment, a level 2 one-time spawning cue test would be implemented (when conditions allow) to help

facilitate this determination. A flow pulse with specific timing, rate of rise, rate of fall, duration, and magnitude would provide greater experimental control. The magnitude would be capped at the discharges indicated in alternative 6 and subject to other factors such as water availability and flood-control constraints. The experimental pulse attributes would be informed by the 9 years of opportunistic monitoring. The ability to test the hypothesis during the 9 years, and perhaps demonstrate that pallid sturgeon reproductive behaviors are not related to flow pulses, will depend on the hydroclimatic condition during the 9 years, the number of pallid sturgeon in the telemetry monitoring program, and the intensity of monitoring effort. The value of the intentional pulse release would be that it could provide conditions not observed during the 9 years and could be coordinated with more intensive monitoring by using hatchery conditioned fish as test subjects.

The criterion for pulsed flow magnitude in alternative 6 is the observation cited in the Effects Analysis that reproductive pallids in the Upper River would migrate up the Yellowstone or Missouri in response to flow pulses that were roughly 2 times the background discharge rate or higher. If the flow pulses occurring during the 9 years are not sufficient to test the hypothesis, flow pulses up to the doubled flow values assessed in alternative 6 (61,000 cfs for March and 67,000 cfs for May) could be used for the one-time experiment.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #18, Sec 2.8.4.3, Spawning habitat justification

Alternative 3 specifies construction and monitoring of up to three spawning habitat sites. Yet there is no underlying science to define the features of high-quality spawning sites or justify the designation of three spawning sites as an effective management action for pallid sturgeon.

Basis for Comment

The draft EIS (page 2-67) states that sufficient understanding of necessary habitat characteristics remains to be developed. It is difficult for the Panel to understand why an action to construct spawning habitat is included as part of any management alternative until the fundamental supporting science has been developed. In addition, there is no apparent justification for the number of proposed spawning habitats to be constructed.

Significance

Medium/High. Absent Level 1 or 2 supporting science, there is minimal to no information upon which to design and construct high-quality spawning habitats. While it is quite possible that

spawning might be enhanced by the distribution and availability of quality spawning habitat, up to three sites might fail to produce sufficient increases in early life stage abundance to be measured in realistic monitoring programs. Failure to measure actual success could be interpreted within an AM program to mean that spawning habitat was not a significant factor influencing pallid recruitment, when the situation is simply that insufficient or improperly located sites precludes the observation of a positive management response.

Recommendation for Resolution

1. Provide an explanation of why construction of up to three spawning habitat sites should be pursued prior to Level 1 and 2 research demonstrating and quantifying pallid spawning responses to the availability and quality of spawning habitat.
2. Provide an explanation of the basis for choosing up to three spawning habitat sites.

USACE/PDT Response

Non-concur, clarification provided.

There is a difference in the text on page 2-67 of the DEIS and the text in Chapter 4 of the AMP. The AMP envisions one spawning site constructed in the near term, while the Draft EIS analyzes the impacts of up to 3 sites in the event additional sites are determined by the science and AM process to be needed. The team felt this was prudent given the uncertainty surrounding this hypothesis. Earlier versions of the AMP referred to 3 spawning sites, but this was revised in AM V6 to just one spawning site, for two reasons. First, the intent is to stimulate aggregation of males and females in one location for spawning; three sites would lead to further disaggregation. Second, it makes more sense to develop one site as a pilot project prior to expanding that site if it proves to be effective. We disagree with the Panel's assertion that there is no underlying science. Studies completed by USGS-CERC have documented (presumably underperforming) spawning sites and characteristics on the Lower River and (presumably adequately performing) spawning sites on the Yellowstone River (Appendix I of the EA Integrated Report, Jacobson and others, 2016). These studies have provided quantitative information on hydraulics and substrate associated with both cases. In addition, there are several Level 1 and Level 2 research studies planned in support of the development of a spawning site, as shown in the excerpt below from Table 44 in the AMP. The final row is the Level 2 development of a test spawning site; current thinking is that due to the uncertainty in spawning site selection, this site would provide a range of substrates, and be used as a learning opportunity to see what types of substrates are selected.

Question, Level and Study Components	**Key Metrics**	**Simplified IF - THEN Decision Criteria**	**Degree of Certainty***	**Concurrent / Dependent Components**
Big Question 5: Spawning Habitat. Can channel reconfiguration and spawning substrate construction increase probability of survival of eggs through fertilization, incubation, and hatch?				
Associated Hypotheses: **H16.** Re-engineering of channel morphology in selected reaches will create optimal spawning conditions -- substrate, hydraulics, and geometry -- to increase probability of successful spawning, fertilization, embryo incubation, and free-embryo retention.				
BQ5/L1/C1 –Field study: functional spawning habitat, Yellowstone River	River depth, velocity, substrate, and habitat stability of documented spawning habitat, and reproductive responses of adults and embryos.	IF there is sustained moderate to strong spawning habitat selection that contrasts strongly with Lower Missouri River results, AND the results agree with spawning habitats quantified for other sturgeon species, THEN this provides more support for spawning habitat designs that mimic Yellowstone spawning.	3	C1-C3 concurrent
BQ5/L1/C2 – Retrospective study: habitat condition gradients LMOR	River depth, velocity, substrate, habitat stability of documented spawning habitat, and reproductive responses of adults and embryos.	IF there is sustained moderate to strong spawning habitat selection that contrasts strongly with Yellowstone River results, THEN this provides more support for spawning habitat designs that mimic Lower Missouri spawning.	3	C1-C3 concurrent
BQ5/L1/C3 - Mesocosm studies: spawn conditions, behaviors	Hatch rate as a function of different combinations of depth, velocity, substrate, and hydraulic variables, with water quality and fish behaviors as covariates.	IF results provide quantitative criteria for abiotic (and biotic) variables influencing spawning behavior from aggregation of adults to hatch of embryos, THEN proceed to L2 field experiments.	3	C1-C3 concurrent C3 concurrent w other mesocosm studies
BQ5/L2/C4 - Engineering studies: sustainable design	Design performances, measured as ability to create the hydraulic and substrate conditions developed in components 1-3. Evaluate appropriate segments for spawning habitat using combined advection dispersion and population model	IF designs are judged capable of achieving functional spawning habitat while minimizing adverse effects to other authorized purposes, THEN proceed to C5 manipulative field experiments.	1	Build on learning from L1 C1-C3 studies

BQ5/L2/C5 - Manipulative field experiments: spawning habitat	Use of spawning sites compared to other areas; Hatch rate, as determined by catch per unit effort of free embryos or alternative techniques. See section 4.2.6.3.	IF created spawning patches are functioning as intended to improve spawning success, THEN proceed to L3 implementation	4	Build on learning from L1 C1-C4 studies

Will provide the explanations as suggested in resolution section above, building from the rationale provided in response to #14. The construction of spawning habitat is included in the Pallid Framework as a limited, low cost, low impact activity that provides opportunity for study not possible at the laboratory or mesocosm scale. We have coupled the proposed construction with a variety of antecedent and subsequent studies to address lingering uncertainties regarding the need for spawning habitat, which will address the related hypotheses. Additionally, we do not concur with the assertion that there is ***no*** underlying science to define the features of high-quality spawning sites; we have information suggestive of the needed characteristics, but related uncertainties and associated hypotheses warrant field study to confirm and refine those features.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response.

Panel Comment #19, Sec 2.8.5, Low frequency of management actions

Evaluation of management alternatives (e.g., manipulations of flows, seasonal release from dams) against constraints on river operations determined by human constraints (e.g., flood protection, navigation) in relation to the Period of Record indicate that management actions might only be implemented in 10% or fewer years, assuming the POR realistically represents future conditions. If so, would the infrequent implementation of management actions reduce their likely effectiveness in relation to achieving species goals and objectives, particularly for pallid sturgeon?

Basis for Comment

The absence of management-response functions for pallid sturgeon makes it difficult to assess the likely outcomes of management actions on the population dynamics of this listed fish. Lacking functional descriptions of the anticipated outcomes (e.g., spawning success, recruitment, age+1 survival, fecundity) in relation to the magnitude, timing, and duration of possible management actions, it is difficult to understand how infrequent implementation of management actions might actually benefit the pallid sturgeon.

Significance

Medium. Management alternatives developed in good faith and based on best available science might well be negated by lack of opportunity for implementation because of over-arching human considerations and associated constraints on manipulating the river. Absent reliable management-response functions, infrequent implementation might unknowingly reduce the "signal:noise" ratio of the management action to near zero.

Recommendation for Resolution

1. Discuss the need for derivation of management-response functions for selected management actions as a focus of near-term research, particularly for pallid sturgeon.
2. Discuss the need for quantitative understanding of the trade-offs between conforming to human considerations and the likelihood of meeting species objectives especially if anticipated hydrological conditions are likely to minimize opportunities for implementation of selected management actions.
3. Discuss the importance of Level 1 and 2 research to develop sufficient understanding to manage pallid sturgeon in the Missouri River.

USACE/PDT Response

Concur with recommendation.

We agree that functional relations for management actions – presumably flow actions in this context – are limited. The Level 1 and 2 science components are designed to elucidate those relations and to integrate them into the collaborative population model. For flows, the continuation of telemetry studies of movements and behaviors of reproductive adults will be particularly important. Note that the trade-offs referenced in Recommendation #2 are at least partially addressed in Section 2.9 of the EIS. Text will be added to the EIS to highlight these concepts with references to more-detailed treatment of these subjects in the Science and AM Plan.

The Panel's comments appear to cover a variety of issues that transcend the section of the DEIS referenced, which is a description of Alternative 4 with a focus on the character of the spring flow release. That release targets the development of ESH and is not intended for nor assumed to address pallid sturgeon needs. It is true that the development of management-response functions for a spring flow and pallid sturgeon needs are lacking and would be useful in formulating and evaluating the flows and that, with those response functions, the flows MIGHT be crafted in such a way that they serve the dual purposes of creating ESH and meeting life-cycle needs for the pallid sturgeon.

The comments regarding the frequency of application of some management measures and consequent benefits are also difficult to address without more specific context. Applied to ESH,

these flows are only needed periodically – when the standardized acreage drops below targets. The benefits to the species are independent of whether the habitat is mechanically constructed or created by flows. Construction costs are avoided when flows are employed, but other costs (e.g. flood impacts to some reaches) could occur, depending on the magnitude of the flow. The point is taken when applied to pallid sturgeon and some actions would not be fully effective if applied too infrequently. However, some actions can be valuable at low frequencies; pallid sturgeon do not need successful reproduction in every year, for example, and management actions that help ensure successful spawning could be useful even if applied only a couple times each decade.

For recommendation 1, we concur and note that development of management-response functions is central to the pallid sturgeon framework. Establishment of Level 4 targets is contingent upon said functions, and the activities at Levels 1 through 3 are geared toward that end. Additionally, the proposed monitoring plan includes several activities that should contribute to the development of those functions, including opportunistic assessments of flow-response concerns. However, Section 2.5.3.3 may be a more appropriate place to point out the need for those functions, and Section 4.4 could elaborate upon the means by which the functional understanding could be advanced through monitoring and assessment.

The discussion suggested in recommendation #2 might better be made in other sections of the DEIS (e.g. Sec 2.9). Recommendation #3 is similarly better addressed, we believe, by adding the suggested discussion to Sections 2.6.4 and 2.8, which present the Pallid Framework and the sections common to all alternatives, respectively.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #20, Sec 2.8.6, Effects of flows on deltas

The discussion on page 2-73 (and 3-43) for Alternative 6 focuses on the release of a March pulse and another in the month of May, but the text on these pages does not address the upstream geomorphological effects of these releases on deltas in the reservoirs. Adjustments to hydrology and discharges might be expected to alter sediment erosion, transport, and deposition with effects most obvious in the deltas.

Basis for Comment

The deltas in each of the reservoirs are important substrate for riparian vegetation and aquatic habitat, and their sedimentology and geomorphology respond quickly to changes in hydrology of both the releases from the immediate next dam upstream and the reservoir in which they are situated (which is influenced by the immediate downstream dam. The methods chosen for

moving water through the system to supply the pulses may affect the stability of the deltas that are the boundaries between two subsystems in each case. The water might be passed through the system as a surge when the downstream reservoir is close to full in an example delta case (resulting in less instability for the delta) or is close to empty (resulting in greater change to the delta), or something between these extremes.

Significance

Medium. The fate of delta conditions and stability of the features are part of the risk assessment for evaluating alternatives, with the issue being particularly relevant for Alternatives 4, 5, and 6.

Recommendation for Resolution

1. In those parts of the DEIS addressing Alternative 6, address more fully the upstream effects of surge releases, especially to explore the implications for deltas.

USACE/PDT Response

Concur with recommendation.

Text will be added explaining the expected impacts to reservoir deltas to the extent warranted. Note that this subject is at least already partially covered in Section 3.2.2.4. Environmental consequences of management actions are presented in Chapter 3. The mainstem reservoir pool variability, and reservoir releases, are primarily a function of runoff (precipitation and snow melt patterns in the watershed) and operation of the System by USACE. Tributary runoff entering the Missouri River in the open water reaches between the reservoir pools is also affected by these variable hydrologic processes. Hence, this hydrological variability also affects sedimentological and geomorphological processes in the reservoir deltas, including aggradation and streambank erosion. It further affects the biology in the deltas, such as riparian vegetation and aquatic habitat, which after many decades of the existence of the System is expected to have adjusted to such changes to a large extent.

Compared to this primarily natural variability, the potential effects of flow releases under Alternative 6 (and also Alternatives 2, 4, and 5) on water elevations in the upper mainstem reservoirs (and thus on water elevations and associated sedimentological, geomorphological and biological processes in deltas) are considered small. We concur that associated effects on these processes would occur but expect that they would be well within the range of effects that occur already.

Additional text to section 3.2.2.4 will be inserted at the end of subsection “Reservoir Sediment Deposition and Aggradation” (just prior to the following subsection entitled “Shoreline Erosion in Reservoirs”) to clarify:

"Flow releases under Alternatives 2, 4, 5, and 6 would affect sedimentological and geomorphological processes in reservoir deltas, and as a result they would affect the riparian vegetation and aquatic habitat in those deltas. The natural variability in river flows and sediment input occurs normally as watershed runoff fluctuates from hydrologic processes including precipitation, snow melt, infiltration, and other factors. With additional variability contributed from System operations, the effects on sedimentological and geomorphological processes and biological habitats in deltas from flow releases under Alternatives 2, 4, 5, and 6 would be comparatively small and would be expected to be well within the range of effects from natural variability and System operations. "

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #21, Sec 2.8.7, Spawning cue justification

Alternative 6 proposes a spawning cue release every three years with a bimodal pulse in March and May. The proposed releases are based on HEC-ResSim simulations using the available Period of Record. The proposed release of 39-61 kcfs seem defined more by the POR and human considerations, than a demonstrated relation between flow regime and pallid spawning behavior.

Basis for Comment

There is minimal understanding concerning the magnitude, timing and duration of flows required to cue pallid sturgeon to spawn. The proposed releases appear defined mainly by requirements for flood protection and navigation. Previous detailed examination of managed spring spawning cues (e.g., releases from Gavins Point Dam) failed to provide technical justification for such releases (e.g., Doyle at al. 2011).

Significance

Medium/High. Absent Level 1 or 2 supporting science, there is minimal to no information upon which to design and implement effective spring releases to measurably cue pallid spawning. Spring releases might fail to produce a measurable response in spawning behavior simply because insufficient flows are implemented. Historically, pallid sturgeon experienced substantially higher flows than currently permissible under managed operations of the reservoirs.

Recommendation for Resolution

Acknowledge that near-term focused Level 1 and 2 research should be performed to demonstrate and quantify pallid population responses to spring flows prior to implementation under Alternative 6.

USACE/PDT Response

Non-Concur with recommendation.

Alternative 6 implements the spring pulse spawning cue as currently designed, without waiting for additional Level 1 or 2 research.

(From the response to #17) The criterion for pulsed flow magnitude in Alternative 6 is the observation cited in the Effects Analysis that reproductive pallids in the Upper River would migrate up the Yellowstone or Missouri in response to flow pulses that were roughly 2 times the background discharge rate or higher. The impacts to authorized purposes under Alternative 6 coupled with the uncertainty about the effectiveness of the Alternative 6 pulse as currently designed were considerations in not identifying Alternative 6 as the Preferred Alternative.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #22, Sec 2.9, Adequacy of tradeoffs analysis

The tradeoffs analysis used for identifying a preferred alternative is generally clear.

Basis for Comment

MRRIC charge question #1 asks whether the DEIS sufficiently explains the tradeoffs analysis used for identifying a preferred alternative. The explanation provided in Section 2.7, and specifically on pages 2-44, and pages 2-47 to 2-50, including Table 2-10 (page 2-45 to 2-47) and Table 2-11 (pages 2-51 to 2-52)of the DEIS describes the multistep process that was used for generating alternatives.

Page xxviii of the Executive Summary and Section 2.9 (starting on page 2-74) provide an adequate description of how the evaluation of the consequences and tradeoffs was conducted. With exceptions noted in the following two comments, the Panel considers the summary Table 2-31 (page 2-77) of effects and the accompanying text to be sufficient explanation of the process in the context of this programmatic DEIS. The Panel notes that MRRIC was engaged in evaluation of test alternatives and then revised alternatives in two rounds of proxy analyses of

consequences and tradeoffs. Although time constraints and perhaps also agency procedures precluded direct MRRIC engagement in evaluating results of the detailed economic analyses and selecting a preferred alternative, individual MRRIC members and MRRIC as a Committee have opportunity to provide comment or recommendation regarding the process or its outcome. There also will be opportunity for MRRIC to participate in tradeoffs analysis of specific management actions through participation in the adaptive management process as described in Chapters 2 and 5 of the SAMP.

Significance

Minor. The Panel considers issues associated with the process used to date to identify a preferred alternative of minor concern.

Recommendation for Resolution

The Panel urges the Corps to continue active and transparent engagement with MRRIC as it develops or refines a "selected alternative" for the FEIS.

USACE/PDT Response

Concur with recommendation.

Concur, active and transparent engagement with MRRIC will continue to occur as part of this planning effort and as part of the future AM process.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #23, Sec 2.9.1, Table 2-31 ecosystem services score

Table 2-31 Alternatives Summary. Under the EQ account, Alternatives 2-6 provide a score of +1 for ecosystem services compared to Alternative #1. It is not clear what a value of +1 means and how these scores were derived. Assigning the same scores across all alternatives effectively removes ecosystem services from the evaluation of the proposed alternatives.

Basis for Comment

See Table 2-31. The scores for ecosystem services might be expected to vary across the alternatives, particularly for alternatives that include spring and/or fall releases. Also, it is not clear how the score of +1 compared to the no action alternative was determined. Note that the EQ account does rate +2 for fish and wildlife for Alt 2, although the rest of the alternatives score +1.

Significance

Low. The clarity of the EIS would be improved by explaining the basis for which the +1 ratings were arrived at for ecosystem services in Table 2.31.

Recommendation for Resolution

1. Provide an explanation of the derivation of the ecosystem scores across Alternatives 2-6, relative to Alternative #1.

USACE/PDT Response

Concur with recommendation.

The rating system (small change=+/-1; large change=+/-2; 0=no change) is based on the evaluation in the Ecosystem Services section (3.23). This rating is a roll up of three components of the ecosystem services evaluation: carbon sequestration and climate regulation; other cultural services; and non-use values. To further describe how the ratings were determined, we have put together a table with these components and the expert judgement on the applicable rating. The reader will be referred to section 3.23 for additional details on the evaluation.

Ecosystem Service Evaluated	**No Action**	**Alternative 2 (Change from NA)**	**Alternative 3-6 (Change from NA)**
Carbon Sequestration and Climate Regulation	Ref	0	0
Other Cultural Services	Ref	1	0
Non-Use Values			
Improved Ecosystem Functioning	Ref	2	1
Species Objectives	Ref	2	2
Average	**Not Applicable**	**1.25**	**0.75**

Given the analysis in the table above, there is a distinction between Alternative 2 and Alternatives 3 through 6. Additional information will be added to the section 3.23 Ecosystem Services for further clarity on how the rating was determined. The roll-up rating of +1 will remain in Table 2.31 for Alternatives 2 through 6.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

The Panel is satisfied with the USACE response but thinks a broader range scale would be useful to reflect the differences in ecosystem services across the alternatives, especially to distinguish Alternative #2 from the others. A 10 point scale may be appropriate.

Panel Comment #24, Sec 2.9.1, Table 2-31 tribal interests (other) score

In Table 2-31 Alternatives Summary, Tribal Interests (Other) Under the OSE account, all 5 alternatives provide a score of zero compared to Alternative #1 for Tribal Interests. It is not clear to the Panel how these scores were developed?

Basis for Comment

Table 2-31 indicates the Tribal Interests (Other) has a potential range of scores from -2 to +2. The scores of zero across all alternatives suggest to the Panel that the USACE rates Alternatives 2-6 the same as Alternative #1. However, the Panel's review of Table 3-247 suggests that there are increases and decreases in OSE Impacts of Alternatives 2-6 (especially for OSE Impacts—Traditional Cultural Practices and Educational Opportunities). Given the variation across Alternatives in Table 3-247, it is not clear to the Panel what the criteria were for arriving at the scores of zero in Table 2-31.

Significance

Medium. As it currently stands the lack of explicit rating criteria undermines the Tribal Interests (Other) conclusions in the DEIS.

Recommendation for Resolution

1. Describe how the scores of zero for OSE Tribal Interests (Other) in Table 2-31 were arrived at given the OSE Impacts in Table 3-247.

2. Re-evaluate the scoring of OSE Tribal Interests (Other) in Table 2-31 given OSE Impacts Other in Table 3-247.

USACE/PDT Response

Concur with recommendation.

The "Tribal Interests (other)" category is an aggregation of three issues: "Subsistence Hunting and Fishing," "Subsistence Gathering," and "Traditional Cultural Practices and Educational

Opportunities". Each of these components were evaluated separately in the analysis. The findings were that relative to Alternative 1, each Alternative (2 through 6) had at least one beneficial effect on one of these components and at least one adverse effect on another. It was therefore not possible for the PDT to infer which of these differences should be considered an overall benefit or an adverse effect relative to Alternative 1. A score of "0" does not mean that there is no difference from Alt 1, only that the overall direction (i.e. better/worse) is not clear for the overall metric. The footnote to Table 2-31 will be expanded to make this clearer.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

Perhaps more than a footnote is needed to provide the satisfactory explanation provided by the USACE. Consider a more disaggregated summary showing the scores on the each of three individual criteria that went into the Tribal Interests (other) scoring.

Panel Comment #25, Sec 3.2, Sediment budget

The management and decision making for the river and its habitats for listed species, an understanding of management effects on the river, and the use of river resources all depend in part on a keen understanding of the sediment context on a basin-wide scale. The present DEIS in Sec 3.2 outlines calculations for sediment transport through various reaches of the river, but the document does not anywhere provide the context for the results of these calculations – there is no big picture. The document needs a diagram and discussion of the basin-wide sediment budget that identifies the sources, sinks, and transfers of sediment for the entire watershed so that the amounts of sediment stored in reservoirs, used for environmental restoration, excavated for channel maintenance and mining, and aggradation can be represented against the back ground of the larger system that supplies sediment or stores it.

Basis for Comment

The DEIS describes the basin water budget in general terms, and describes its annual fluctuations. Yet sediment, which is not discussed as a basin-wide budget is arguably of equal if not greater importance, and it should be included. The calculations in the DEIS are for limited locations all on the main stem, and do not shed any light on how variable contributions are from place to place. For example, the James River supplies little sediment, while the Niobrara supplies a great deal. The DEIS may mention these in passing, but does not place the quantities in the context of the entire basin.

Significance

Medium. Decision makers, researchers, managers, and stakeholders need a clear picture of how sediment processes are distributed throughout the basin so they can understand the implications for building and maintaining ESH and IRCs. Are the sediment volumes being manipulated large or small when compared to the amount of sediment entering and moving through the river segments of interest? What are habitat maintenance needs, and downstream implications/impacts/costs?

Recommendation for Resolution

Include a diagram and text in the DEIS presenting a spatially correct mean annual sediment budget. Examples may be found in NRC, 2011. Missouri River Planning: Recognizing and Incorporating Sediment Management (Washington, DC: National Academies Press), p. 37, 47. The DEIS could use available annual data to construct a general budget.

USACE/PDT Response

Non-concur with recommendation.

The necessity of conducting a sediment budget was considered during initial study scoping but determined to be unwarranted for the evaluation of study alternatives. This decision was based on the fact that alternatives will not alter the dominant impact on basin sediment processes, the trapping of sediments within the reservoir system. None of the alternatives include sediment management or measures to pass sediments through the reservoir system to the navigation channel downstream of Gavins Point Dam.

IEPR Panel Back-Check Response

Concur with USACE response, further consideration needed in site-specific environmental assessments and/or as adaptive management is implemented

It appears that a general regional sediment budget was considered during planning stages of the DEIS. The Panel thinks that during the process of adaptive management the generation of a general sediment budget may be helpful in designing and assessing effects of individual projects, and more generally in planning and assessing management actions for the listed species in the context of the aggradation/degradation occurring in the river.

Panel Comment #26, Sec 3.2.1.2, Master Manual changes

Section 3.2 in general and Section 3.2.1.2 in particular (as well as other discussions of hydrology and its management) discuss using the main-stem dams to control reservoir levels and

downstream flows through release schedules. These structures are operated according to the specific set of rules outlined in the Master Manual, yet the DEIS contains little explanation and nothing about modification of the rules. Readers would benefit from knowing what options there are for changing release schedules on a temporary or permanent basis.

Basis for Comment

The present Master Manual would be costly to change in response to some alternatives, but short-term adjustments are less difficult and USACE policies are in place for three approaches to minor adjustments that might be called for in an alternative. First, "deviations from present operations "can be established temporarily for three years with the approval of the Corps division commander. Second, "changes in requirements" represent permanent changes in water operations if approved by the Corps division commander. Third, "changes in authorized purposes" require extensive and detailed revisions of operating rules, and requires the approval of Congress. Clearly, deviations are the easiest adjustments to make, and changes in authorized purposes are probably out of bounds for the present work.

Significance

Medium. Readers of the DEIS need to know enough about the Master Manual to understand the implications of various alternatives that involve changes in release rules.

Recommendation for Resolution

Add to the text a brief description of the Master Manual (at about 3-14) with an explanation of how changes are made to such manuals; Figure 3-4 of the DEIS can be used to facilitate the discussion.

USACE/PDT Response

Concur with recommendation.

Add to "System Operation" on page 3-14:

The Master Manual describes the water control plan for the System, which consists of the water control criteria for the management of the System for the full spectrum of anticipated runoff conditions that could be expected to occur. Annual water management plans (Annual Operating Plans, or AOPs) are prepared each year, based on the water control criteria contained in the Master Manual, in order to detail reservoir regulation of the System for the current operating year. Because the System is so large, it can respond to extreme conditions of longer than one-year duration. The AOP document also provides an outlook for planning purposes in future years. (Master Manual Section 1-02.3.)

For a portion of some years, deviations may be made from the specific technical criteria stated in the Master Manual to achieve the operational objectives of the current water control plan or to

comply with other statutory or regulatory obligations such as the ESA. In such circumstances, the AOP will explain the deviation from the specific technical criteria and the rationale for that deviation related to the operational objectives or applicable statutory and regulatory requirements. (Master Manual Section 7-03.5.) All significant deviations from the current water control plan will be coordinated and approved by the Northwestern Division Commander, who may also coordinate with higher authority. All deviations of significance are modeled and presented to the public through the normal coordination procedures involving public press releases and World Wide Web dissemination. Minor deviations are accomplished by the Missouri River Basin Water Management through coordination directly with the affected parties. (Master Manual Section 7-18)

Basin interests can anticipate continued public involvement in the water control management process and any significant water control plan or Master Manual revisions in the future will be processed in accordance with ER 1110-2-240. Minor revisions to the master manual will be the responsibility of the Missouri River Basin Water Management and do not require coordination throughout the basin. In addition, changed circumstances or unforeseen conditions may necessitate short-term deviations from the current water control plans. As stated above, such deviations are reviewed and approved by the Commander, Northwestern Division in accordance with ER 1110-2-1400. (Master Manual Section 1-02.5)

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #27, Sec 3.2.1.3, Channel wood

The description of the historical channel of the river (page 3-15) is important because it represents conditions that the species inhabited before the imposition of engineered structures – a sort of snapshot of "natural geomorphology." The system is described well with one important exception: channel wood materials, or snags. These features should be described here in some detail, along with explanations of the roles played by snags in water and sediment processes and their suspected significance – if any – for habitat for the listed species.

Basis for Comment

Historical descriptions, paintings, and early photographs of the channel show snags as part of the prevailing physical system of the channel, so that the text might include a description of these kinds of structures to help understand the environment where the listed species evolved and to gauge how different the present channel is from that original, even with ESH and IRCs.

Significance

Low. Snags might play a role in managing a restored river in some way. Readers also need to recognize them in the historical image of the river.

Recommendation for Resolution

Add two to three sentences in paragraph 1 on page 3-15 to explain what snags are, their historical role in the river, and their possible implications for biological habitat, organic matter retention, and sediment storage.

USACE/PDT Response

Concur with recommendation.

The below language or similar will be inserted to pg 3-15, section 3.2.1.3, first paragraph:

The prevalence of large wood on the Missouri River has been noted in historic references including the Journals of Lewis and Clark. An 1881 report to Congress noted that the "cavings of the banks precipitates into the river countless trees". USACE has conducted Missouri River snag removal for navigation purposes starting in the 1800's. Wood structures and river snags provide biological diversity and also contribute to channel habitat diversity by altering depth, velocity, and sediment processes. Refer to the *National Large Wood Manual* (Reclamation and USACE, 2016) for further information regarding the role of wood in fluvial aquatic and riparian ecosystems.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #28, Sec 3.2.1.4, Sedimentation in Lewis and Clark Lake

The description of reservoir sediment deposition in Section 3.2.1.4 (page 3-21) states that in the Missouri River reservoirs, sedimentation has reduced available storage space by about 5 percent. The statement is misleading for two reasons. First, it is not clear which reservoirs are included in the statement: main-stem only or all major reservoirs including those on tributaries. Second, there is considerable variation in storage loss in main-stem reservoirs, and 5 percent is not necessarily representative. Lewis and Clark Lake behind Gavins Point Dam has lost about 27 percent of its capacity, so unlike some of the other main-stem dams, sedimentation is becoming a potential limiting factor in operations.

Basis for Comment

Basic available survey data show the amount of sedimentation in various reservoirs to varying degrees of accuracy, but the overall picture is clearly defined. Lewis and Clark Lake is a nationally known example of sedimentation loss of storage, and it is far from 5 percent.

Significance

Medium. Sedimentation reduces the flexibility in managing releases from Gavins Point Dam, a situation that will become increasingly restrictive because of continuing influx from the Niobrara River.

Recommendation for Resolution

Improve the discussion of reservoir sedimentation on page 3-21 by indicating the average of 5 percent is broad and general for the main-stem dams, with an expanded discussion of Lewis and Clark Lake and Gavins Point Dam.

USACE/PDT Response

Concur with recommendation.

The below text or similar will be added to Pg 3-21:

Existing text: sedimentation reduced the originally available total storage capacity in the reservoir by approximately 5 percent.

Revised text with additions after the above sentence:

sedimentation reduced the originally available total storage capacity in the mainstem reservoir system by approximately 5 percent. Sedimentation rates have not been uniform between the reservoirs with the highest rate occurring in Lewis and Clark Lake, formed by Gavins Point Dam, which has lost over 26% of storage volume as of 2011. However, Lewis and Clark storage volume provides extremely minor System flood control capacity. Evaluation of variation between sediment processes for the various alternatives within the mainstem reservoir system deltas, including Lewis and Clark Lake, was not conducted because it was not considered to be relevant for alternative comparison using the parameters of the human considerations analysis.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #29, Sec 3.2.2, Hydrologic small changes/tipping points

Section 3.2.2 explores the potential effects of each alternative on the hydrology (and geomorphology) of the river channel as well as reservoir level effects. It points out that in virtually every case where water level and discharge changes are expected, these changes are small compared to other normal variability. The DEIS therefore concludes that these small changes are not environmentally significant. These small changes are significant, however, when the system is close to a tipping point where small changes cause the system to cross a threshold. For example, in a reservoir where fluctuations are as much as tens of feet per year under ordinary circumstances, a fluctuation of 5 feet resulting from a DEIS alternative is not significant if the reservoir is in the center of its operational range. A fluctuation of 5 feet is critical, however, if the reservoir is at its operational maximum, where an increase of 5 feet puts the system over the top, literally. Thus, small changes from alternatives are usually not significant, but they may be important if the system is near its operational boundaries.

Basis for Comment

The DEIS states often that small changes in hydrology are not significant, but they may be important under some realistic circumstances.

Significance

Medium/Low. The DEIS gives the impression that small changes can be disregarded and therefore do not need consideration in thinking about alternatives. In fact, these changes, though small, should not be dismissed in considering alternatives.

Recommendation for Resolution

Change the text to indicate that the small changes in reservoir levels and discharges are ordinarily insignificant, but they might become important if they occur near the operational boundaries of the system. These potential circumstances should not be disregarded in evaluating the possible environmental consequences of reservoir management.

USACE/PDT Response

Concur with recommendation.

Note that Section 3.1.1 explains that the rules governing system operation for the alternatives are the same when operating near the boundaries of the system. Additional text to section 3.2.2 will be inserted to clarify:

Small changes in reservoir levels and reservoir releases are ordinarily insignificant. In addition, the alternatives follow normal reservoir operating guidance as stated in the Missouri River Master Manual (USACE 2006) when not operating for the special conditions such as an ESH

creation release. The normal operating guidance contains measures to reduce impacts while the System is operating within the flood control pool zones or operating for drought conservation. Refer to the HEC-ResSim Modeling Report which describes the development of the model in detail including scripting rules and calibration for additional details.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #30, Sec 3.2.2.2, Scale of impacts

Section 3.2.2.2 states that "impacts could be large temporally and locally." It may not be clear how to interpret this in the context of other stated environmental consequences of the proposed alternatives.

Basis for Comment

It is stated that hydrological consequences were assessed qualitatively for the most part, and that considering the hydrological variability in the POR, adverse impacts of proposed alternatives to hydrology, geomorphology, river infrastructure, and groundwater would be expected to be small to negligible. This statement seems difficult to reconcile with "impacts could be large locally or temporally."

Significance

Low. It is difficult to interpret what is meant by large impacts locally and temporally. What might be the longer-term and perhaps larger-scale residual impacts of these local events in terms of effective implementation of management actions?

Recommendation for Resolution

To the extent possible, the qualitative hydrological analysis should be augmented by quantitative simulation using an appropriate sample (or all) of the POR, and impacts better explained relative to perspectives of spatial and temporal scale.

USACE/PDT Response

Concur with recommendation.

Additional text to section 3.2.2.2 will be inserted to clarify. Specifically, the last sentence in the first paragraph of Section 3.2.2.2 will read as follows:

"However, impacts could be large locally and would be dependent on variables such as the site-specific channel configuration at the time of flow releases and other hydraulic features. Examples of local impacts could be damage of individual riverine infrastructure components, shoreline erosion, or aggradation. Local impacts are not expected to have longer-term or larger-scale residual impacts on the effective implementation of management actions."

More regional impacts are being modeled using the HEC-RAS and HEC-ResSim models that are coupled with the human considerations analysis. A detailed discussion of model analysis including applicability using these models is provided in the Summary of Hydrologic Analysis Report, the HEC-RAS Calibration Report, and the Mainstem Missouri River Reservoir Simulation Alternatives Technical Report.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #31, Sec 3.3.2, Consider full extent of pallid sturgeon distribution

Section 3.3.2 describes the area of the Missouri River under consideration for assessing environmental consequences of project operations on pallid sturgeon, which is stated as Fort Peck Dam to Lake Sakakawea headwaters (upper river) and Gavins Point Dam to the confluence with the Mississippi River (lower river). These termini warrant some further consideration and discussion in the DEIS.

Basis for Comment

As has been discussed on numerous occasions at MRRIC meetings, the biology, migration, and distribution of pallid sturgeon does not terminate at these upstream and downstream locations. For example, the remnant population of wild pallid sturgeon in the Missouri River upstream of Fort Peck dam may be affected by dam operations, including on larval drift and upstream migration of adults. If so, then project operation can impact these fish. In addition, the confluence of the Missouri River with the Mississippi River does not limit larval drift into the Mississippi River nor upstream migration of juvenile and adult fish. This connection may be vital to sustaining lower river pallid sturgeon populations.

Significance

Medium/Low. Recognizing the operational jurisdiction of the USACE, it remains important to assess the full scope of the distribution and related biology of pallid sturgeon, which historically included the entire Missouri River and its connection with the Mississippi River. The focus on

the two reaches described above, while perhaps justified in a regulatory framework, does not encompass the probable river extent and hydrological connections that influence the biology and recruitment of pallid sturgeon in the Missouri River.

Recommendation for Resolution

Provide a more complete assessment of pallid sturgeon needs from the Missouri River headwaters and into the Mississippi River. Are far-upper river and mid-river populations of little consequence to the pallid sturgeon throughout its range? What about the Mississippi River as a source for recruitment of pallid sturgeon into the Missouri River? What are the projected environmental consequences of the six proposed alternatives to these populations?

USACE/PDT Response

Partially concur with recommendation, clarification provided.

While it is true the full distribution of pallid sturgeon historically included the entire Missouri River and its connection with the Mississippi River, the geographic scope of the effects analysis, including management hypotheses, was constrained in part by decision-making authority of the USACE and in part by the present understanding of the geographic distribution of pallid sturgeon. The effects analysis was limited to the Upper Missouri River main stem from Fort Peck Dam to the headwaters of Lake Sakakawea, the Yellowstone River upstream from the confluence with the Upper Missouri River for an unspecified distance, the lower Missouri River main stem from Gavins Point Dam to the confluence with the Mississippi River at St. Louis, and unspecified distance downstream in the Mississippi River, and various tributaries to these river segments that might be occupied by pallid sturgeon. The reservoirs and inter-reservoir reaches (from Lake Sakakawea to Lewis and Clark Lake) are excluded from the analysis based on the assumption that these habitats are unlikely to support reproductive populations of pallid sturgeon. These assumptions may be revisited if conflicting information arise through the Science and AM process.

Management of the Missouri River pallid sturgeon has historically occurred over four Recovery Priority Management Areas or RPMAs, and is now organized around four Management Units (described in section D.1.3 of AM Plan Appendix D, and Figure D.1). The area upriver of Fort Peck Reservoir (former RPMA 1) is outside the geographic scope of the MRRP. The geographic scope of the MRRP includes those portions of the Missouri River encompassed by the portion of the Great Plains Management Unit (GPMU) below Fort Peck Lake, the Central Lowlands Management Unit (CLMU), and the portion of the Interior Highlands Management Unit (IHMU) above the confluence of the Missouri and Mississippi Rivers. The USACE has responsibilities for pallid sturgeon under the ESA in these three RPMAs. The Yellowstone River is included in the geographic scope due to its importance to pallids in RPMA #2. As occurred during the EA, literature and ongoing research from outside the geographic area defined for the MRRP (e.g. upstream of Fort Peck Dam) may be used where it helps to inform the evaluation of hypotheses

and potential management actions. The treatment of the population upstream of Fort Peck Dam, mid-river populations, and Mississippi River populations will be discussed with the USFWS during the ongoing consultation leading to a new or revised Biological Opinion and the EIS and Science and AM Plan would be adjusted if necessary. To the degree the alternatives in the EIS affect these populations a discussion will be added.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

The Panel urges continued discussion with the USFWS and stakeholders about the role of areas outside of the MRRP and would argue that the logic used to include the Yellowstone River would be applicable to the Mississippi River. Pallid sturgeon responses to Level 1-3 actions in the Missouri River may be best measured in the Mississippi River. That is, pallid sturgeon population responses to actions in the Missouri River may be manifest as recruitment in the Mississippi River given life history characteristics.

Panel Comment #32, Sec 3.4, Estimating ESH

The upper end of the 95% confidence limits for standardized habitat forecasted by the ESH model (Buenau 2015) for the "unregulated" scenario seem physically impossible. This result may undermine the credibility of the linked plover-ESH models (Fischenich et al. 2014, Buenau 2015) for forecasting the effects of management on created sandbar habitat.

Basis for Comment

Table 3 in Buenau (2015) shows that the 97.5 percentile for the unregulated scenario would have 384,393 acres of standardized ESH for both regions (362,331 ac. in the northern, and 29,121 ac. in the southern region). These estimates seem excessive and would require that virtually the entire river channel be comprised of standardized ESH.

Understandably, these results may reflect size limitations of the dataset, or may reflect the fact that river conditions under the unregulated scenario may be outside the domain of the data used to construct the ESH model. In any case, some discussion of the validity of the ESH model would help provide confidence in the results of the ESH model with regards to bird management.

Significance

Medium/Low. This is a fundamental aspect of models that were the basis for designing alternatives to achieve the specified bird objectives.

Recommendation for Resolution

Provide some documentation and discussion concerning the validity of the ESH model. Such documentation may already exist in supporting publications that were not available to the Panel, or that are presently being prepared.

USACE/PDT Response

Non-concur with recommendation, clarification provided

The unregulated scenario was presented with heavy caveats because it was an exploration of modeling an unregulated river with no dams as it may have existed historically—using a model of ESH developed for the period 1998-2014. Sediment budgets, channel form, and a number of other factors differ greatly between the pre-dam era and the 2000's. Additionally, the bird population models are parameterized under modern conditions and the highly regulated summer flows and is not ideal for use for historical conditions. We shared these results in the interest of scientific transparency but with many cautions for their interpretation and use.

Documentation of ESH model performance in the contemporary river was provided in Fischenich et al. (2014) the draft Geomorphic Team Integrated Report, which was reviewed by the ISAP. It is currently provided on the same MRRP website as Buenau (2015) www.moriverrecovery.org under the Management Plan tab.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #33, Sec 3.4.1.2, Plover and tern breeding habitat

The plover and tern breeding habitat description in the DEIS (section 3.4.1.2) focuses entirely on emergent sandbar habitat (ESH), and overlooks the fact that across the plover's breeding range, many other habitat types are used.

Basis for Comment

A review of the piping plover literature reveals that plovers nest on a variety of habitat types with sand and gravel substrate that is relatively free of vegetation. River sandbar usage may be in the minority, except in the Missouri River. Even in the Missouri, however, about 40% of plover nesting on average occurs on non-ESH habitats along reservoir shorelines.

The breeding habitat section states that *"Historically, these two species made extensive use of emergent sandbar habitat (ESH) on the Missouri and other large rivers."* This statement needs

substantial modification to support what is known. First, data on plover and tern nesting numbers exist only for recent years, during reservoir operations. During that time, a large segment of the breeding population occurred on reservoirs. Second, a reasonable argument has been made that the pre-dam historic river did not support large numbers of nesting plovers and terns due to peaks in the hydrograph caused by regional and local snowmelt runoff. There are no data to refute this alternative view of the system.

Significance

Medium/High. By itself, this problem is not of major importance because the text can be modified and additional references added to broaden the presentation and present the reader with a more robust view of plover nesting ecology. However, the presentation in this section of the DEIS is indicative of a larger bias that has existed throughout Missouri River planning (and which is expressed in the DEIS in several places), to focus entirely on management of ESH and resist investigating other habitat types that may be shown by science to be equally or more cost effective to create and maintain.

Recommendation for Resolution

1**)** Provide a robust discussion of the various nesting habitats used across the range and within the Missouri River.

2) Delete the sentence on historic use quoted above from the Breeding Habitat section. More accurately, state that not much is known about nesting densities within the river channel from the pre-dam era. Briefly discus the alternative view that the pre-dam river was not particularly productive for plovers and terns, and discuss briefly why this alternative view has been rejected in Missouri River planning.

USACE/PDT Response

Concur with recommendations, clarifications provided.

A discussion of reservoir shoreline habitat will be added to section 3.4.1.2 of the DEIS. Will delete “extensive” from the section on historic use. There is sufficient data to state that there was historic use. Data does not exist for historical *densities* of nesting plovers and terns prior to dam construction but there are numerous historical records of terns and plovers nesting on various parts of the Missouri River, including the current channelized section, prior to the 1950’s (e.g. references in Catlin et al. 2009). Jorgenson (2009) used a very spatially and temporally limited analysis of the Missouri River hydrograph near Sioux City, Iowa in 1938-1939 to conclude that the natural hydrograph of the river limited long-term recruitment of terns and plovers due to the flood frequency during the nesting season. This analysis was challenged by Catlin et al. (2009). While there is no definitive and systematic survey data, there are well-reasoned arguments that birds could use the system widely, if not every single year.

The focus of the MRRMP is on addressing the limitations in riverine habitat. The FWS decided that riverine habitat should be the primary management target (Planning Aid Letter regarding development of the Missouri River Recovery Management Plan/EIS, December 4, 2015, USFWS, provided in Appendix B of the Draft EIS). Reservoir habitat is also considered important, but the difficulty of managing water levels to optimize both riverine and reservoir habitat at the same time led the FWS to indicate the priority is for riverine habitat. Based upon MRRIC's interest in other habitat types, these have been included in the AM plan and EA. Note that the comment admits that other habitat types "may" be shown by science to be equally or more cost effective to maintain; this has not been shown. Rather, prior USACE studies (USACE 2012, Emergent Sandbar Habitat Creation Opportunities) have instead concluded that opportunities for such habitat types are not as plentiful as they are as in other areas such as the Platte and would be costly to develop and maintain for relatively small gains in habitat area and bird population

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #34, Sec 3.5.2, Fish and wildlife habitat

Section 3.5.2 and the background reference (The Fish and Wildlife Environmental Consequences Analysis, Technical Report 4) are unclear concerning inundation-habitat relationships.

Basis for Comment

Quoting from the Fish and Wildlife Environmental Consequences Analysis, Technical Report 4, we find: "For example, in the Garrison to Oahe Reach, modeling assumed upland grassland is represented by areas with one day of inundation, forest is represented by areas with 16 days of inundation, riparian woodland/forested wetland is represented by 36 days of inundation, scrub shrub wetland is represented by 52 days of inundation, emergent wetland is represented by 159 days of inundation, and open water is represented by 365 days of inundation." This quote from text, as well as related tables, begs the question: what habitat would exist on areas with, for example, 3 days of inundation? Would it be something between grassland and forest, but not either?

The main issue here is that each habitat category would be found in areas within a specific range of inundation days, and not occur at just one specific number of inundation days. The DEIS acknowledges this, but it is unclear how the simple relationships inferred in the quote above could be used to perform an accurate relative comparison of alternatives in terms of habitat changes. The DEIS Section 3.20 (Tribal Interests (Other)) indicates that absolute changes in

vegetation cover would not be expected to track changes in the inundation classes. Therefore, what useful information (related to Fish and Wildlife habitat abundance and suitability) is provided by this analysis? Have the inundation-habitat relationships been tested? Do they provide an accurate comparison of changes in vegetation cover among alternatives?

A second issue concerns the entries in Table 4 of the Technical Report. Logically the columns (Alternatives) for change in acreage should sum to zero, because a habitat conversion should show up as both a negative change and the associated positive change in another habitat type. But, Alternative 3 for example, has a sum of -5992 acres. What happened to these 5992 acres? In what "non-habitat" category are they predicted to occur? For purposes of clarity, the Table should indicate the final disposition of missing acreage, not accounted for in the listed habitat types.

Generally, the Fish and Wildlife Consequences Analysis is poorly written, and it provides very incomplete documentation of the process that was used to model fish and wildlife habitat responses to different management alternatives.

Significance

Medium. This is a moderately important issue. The modeling may be defensible, but it is impossible to make that determination based on information presented in the current report.

Recommendation for Resolution

Clarify the inundation relationships, clarify the entire process used to conduct the analysis, and explain how models based on these simple relationships performed when compared to reality.

USACE/PDT Response

Concur with Recommendation.

The text will be clarified to better reflect the habitat class definitions. The classes do represent ranges, not absolute dates. The text should read "no more than X days". The number of days currently referenced in the text is the maximum number of days a class can be inundated for it to be defined as that class. The next "drier" habitat class is then defined by a range from that number of days during the growing season to its maximum inundation days as currently described in text. The text will be modified to clarify this and better explain that habitat classes are defined by a range of days inundated. Inundation relationships will be clarified and articulated more accurately in the text.

In response to the second issue, and after some further evaluation of the results with the H&H team, all alternatives will be normalized to the same upper boundary so that transitions, or "losses and gains", can be accounted for. Currently the upper boundary is the elevation which is flooded annually one day or less based on the 82 years of flow data from the models. Because

each alternative has unique hydrology and in most cases unique geometry, this upper boundary varies slightly from alternative to alternative. Moving forward, the analysis will include a uniform upper boundary that represents the reasonable upper limit of upland prairie habitat and acres will be normalized for better comparison.

Overall the text will be clarified. The technical report will be modified to reflect these changes.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #35, Sec 3.5.2.14, Effects of sport fish stocking

Section 3.5 of the DEIS is overall an informative summary of the Fish and Wildlife Habitat issues of the Missouri River, in particular with regards to native species. Section 3.5.2.14 briefly mentions on p. 3-141 the stocking of sport fishes, primarily in the reservoirs of the Missouri River:

"Some of the Missouri River reservoirs are stocked artificially with various species of fishes, some nonnative, to support sport fisheries (Bureau of Reclamation 2003; USACE 2003c; USACE 2007c; USACE 2008; USACE 2010a). Past fishery stocking and management has caused a reduction in the abundance of native fishes from competition and inadequate amounts of biological resources available to support both [native and non-native] populations; reworking of the food web; and harboring and introducing pathogens."

Is it possible to further elaborate on this statement with respect to potential or known impacts of reservoir stocking for recreational fishing on pallid sturgeon specifically? This issue might very well be considered in more detail elsewhere in the DEIS, in which case a reference to that location would be useful in section 3.5.2.14 of the DEIS.

Basis for Comment

Introduced, as well as invasive species, especially those feeding at a similar trophic level (or levels) as different stages of pallid sturgeon, have the potential to compete for resources used by pallid sturgeon, displace sturgeon from preferred habitat, or even consume young pallid sturgeon. These interactions may be relevant to pallid sturgeon recovery.

Significance

Low. Given potential segregation of habitat use, with introduced sport fish in reservoirs and pallid sturgeon in the main channel, a concern may not be warranted. Regardless, some explicit

consideration of literature or reports on interactions would be useful to see in the DEIS. If no such information exists, then it can simply be reported as such.

Recommendation for Resolution

Provide some additional treatment of the potential for stocking of native (e.g., pallid sturgeon) and non-native (e.g., salmonids, percids) fishes to work at cross-purposes if relevant. If needed, cross-reference appropriate treatments of the issue in the DEIS.

USACE/PDT Response

Concur with recommendation.

A similar discussion to that referenced on page 3-141 is included in Section 3.5.2.14 Pallid Sturgeon Cumulative Impacts (Page 3-82). This discussion will be revised to more explicitly address the recommendations.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #36, Sec 3.8, Air quality

The air quality analysis includes inconsistencies in citations and documentation of statements made. It is also unclear what impact assessment methodology was used to estimate the environmental consequences of changes in air quality

Basis for Comment

On page 3-205 USEPA (2016) is cited in identifying the designated non-attainment and partial non-attainment areas while no document is cited for contributions to air pollution from main transportation corridors of interstates and industrial development in the cities (page 3-205) and for greenhouse gas emissions (page 3-206).

Page 3-207 states “Environmental consequences relative to air quality include localized adverse impacts on air quality from vehicle emissions during mechanical ESH construction and channel reconfiguration for creation of early life stage habitat for pallid sturgeon that would be negligible and limited to construction periods. Greenhouse gas emissions associated with habitat construction would be hard to discern in the regional context.” without explaining what was the impact methodology used to draw these specific conclusions.

Significance

Medium/Low. The robustness of the air quality analysis would be improved if it was readily discernable if the analysis was appropriate for the level of potential impacts identified.

Recommendation for Resolution

1. Provide documentation for contributions to air pollution from main transportation corridors of interstates and industrial development in the cities and for greenhouse gas emissions.

2. Explain the impact assessment methodology used to draw the following conclusions. "Environmental consequences relative to air quality include localized adverse impacts on air quality from vehicle emissions during mechanical ESH construction and channel reconfiguration for creation of early life stage habitat for pallid sturgeon that would be negligible and limited to construction periods. Greenhouse gas emissions associated with habitat construction would be hard to discern in the regional context."

USACE/PDT Response

Concur with recommendation.

A citation for the contributions to air pollution from main transportation corridors will be added to the EIS. The information on the contribution to air pollution from industrial development was referenced from the thermal power and hydropower sections. A reference to these sections will be added. The citation for greenhouse gases is USEPA 2015b cited in the reference section. This will be added to the text on page 3-206.

The impact assessment methodology was done qualitatively based on the impact assessment from previous projects similar in nature and also on the programmatic nature of the EIS. Actual calculations would be part of the site-specific permitting process when detailed information about actual equipment, fuel usage, and construction would be known. Areas where work would be conducted are expected to be rural in nature and it is likely that the existing vegetation would be able to absorb the additional carbon emissions. This discussion will be added to the air quality section in the Final EIS.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #37, Sec 3.9, Cultural resources

There is inadequate level of detail in describing the consequences that the alternatives will have on cultural sites and tribal resources (e.g., subsistence hunting, fishing, collecting), particularly with respect to individual tribes and Native American Reservations

Basis for Comment

Neither the Cultural Resources section (3.9), the Tribal Interests (section 3.20), nor the Fish and Wildlife section on Tribal Resources (Section 3.5.2.12) display impacts of the alternatives in relation to specific Native American Tribes or tribal Reservations

Significance

Medium. The clarity of the document to readers interested in impacts to Tribal resources would be greatly improved if the impact analyses in the Cultural Resources section and Tribal Resources provided more details for individual Tribes and tribal Reservations.

Recommendation for Resolution

1. In Tribal Interests Section 3.20 (or a new separate Technical Report) details of the Cultural Resources of tribal interest and the Other Social Effects (OSE) on Subsistence Hunting/Fishing, Subsistence Gathering and Traditional Cultural Practices and Education Opportunities should display the impacts by major tribes and Native American Reservations.

USACE/PDT Response

Non-concur with recommendation, clarification provided.

The PDT determined that Tribe-specific or reservation-specific impacts should not be displayed in the DEIS; however, it is important to note that results were instead aggregated and displayed in the Draft EIS. The Corps is undergoing Government-to-Government Consultation with the Tribes and will share Tribe-specific and reservation-specific information with individual Tribes to the extent that the information exists / can be determined. This approach was shared with the Tribal representatives on MRRIC prior to release of the DEIS. Text will be added to Section 3.20 to make clear that Government-to-Government Consultation is the avenue by which more-detailed information is being shared with Tribes. For cultural resources specifically, it is not possible for the PDT to definitively ascribe each of the sites in the inventory to a specific Tribe

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #38, Sec 3.10, Land use and ownership

The Land Use and Ownership section of the DEIS overestimates the economic consequences associated with land purchases for habitat construction.

Basis for Comment

Chapter 3, Section 3.10 measures the RED and OSE impacts associated with the removal of crop land from production. However this section ignores ancillary positive impacts that would occur with the conversion of cropland to habitat (Table 3-42, page 3-236). These positive effects include the improvement in water quality and ecosystem services from conversion of cropland to habitat. The DEIS (page 3-234) also ignores the new economic activity associated with habitat construction. The DEIS (Table 3-44, page 3-237; Table 3-46, page 3-240; Table 3-48, page 3-242) provides estimates of property tax losses without adjusting for the Payments in Lieu of Taxes (PILT) from Federal resources. The exclusion of offsetting benefits is inconsistent with other sections of the report such as Flood Risk where benefits and costs are included to arrive at a net amount. Finally, the DEIS uses a price of corn ($5.27 per bushel) that is substantially higher than the current price of corn ($3.30 per bushel).

Significance

Medium. The current analysis overestimates the impacts associated with alternatives requiring significant land acquisition (Alternatives 1-2) relative Alternatives 3-6.

Recommendation for Resolution

1. The USACE should include the PILT payments in order to calculate the **net** loss in property taxes.
2. Acknowledge in Table 3-42 (page 3-236) under "Other Impacts" that water quality and ecosystem services would be improved.
3. Include the economic activity associated with habitat construction. This economic activity will be in the short term (15 years, page 3-235), whereas the lost crop value will be long term, therefore it will be important to present the time periods of each effect.
4. Update the RED analysis of removing cropland from production using updated average prices for corn.

USACE/PDT Response

Concur/Non-Concur

1. Concur with recommendation. The PDT acknowledges that Payment in Lieu of Taxes (PILT) offset the loss in property taxes to local governments. The Land Use and Ownership evaluation will be updated to show an estimate of the PILT payments associated with the acquisition of private lands. The net loss in property tax receipts will

then be estimated. It should be noted that in some states, Federal PILT may be allocated to the state as well as to local governments depending on state legislation.

2. Concur with recommendation. The PDT understands that there are potential ecosystem services, water quality, recreation, and other human benefits from the Federal land acquisition and habitat creation and will indicate that there are potential water quality, ecosystem services, recreation, and other benefits in the Land Use and Ownership section and refer the reader to the appropriate sections (3.7 and 3.23 as well as recreation – 3.16 – for additional details).
3. Concur with recommendation. The PDT agrees that the construction of habitat will have regional economic benefits; these are included in the Regional Economic Effect of Program Expenditures section (3.25). The text in the Land Use and Ownership section will be amended to note the short-term construction benefits and will refer readers to section 3.25 for more information.
4. Non-concur with recommendation. Per USACE guidance, the RED analysis uses normalized crop prices that reflect state-wide 5-year average prices that smooth out the effects of short-run seasonal or cyclical variation. These normalized crop prices are used by USACE and other Federal agencies to evaluate the benefits or effects of resource-related projects affecting agriculture. We will ensure that the most recent normalized prices are used in the analysis. For more information, please see: https://www.ers.usda.gov/data-products/normalized-prices.aspx

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #39, Sec 3.12, Flood risk assessment

Spring and fall releases, as well as spawning cue releases, create an irreversible increase in water levels below the release point. If widespread precipitation results in a rapid increase in inflows from downstream tributaries, the combination of the release and natural inflow may cause flooding before the release can be halted. This “water on water” problem has not been evaluated in a statistically valid way.

Basis for Comment

The flood risk modelling is based exclusively on the 82-year period of record. However, the number of full releases that are included is much lower than 82 observations. The flood risk assessment is based on ten spring releases, seven fall releases, and eleven releases under alternative 6. The small number of simulated releases makes it possible that a low probability,

high cost simulated flood caused by "water on water" has been missed. The ISETR panel was promised a white paper on this potential problem and this was not provided.

The hydro visualization tool shows at least seven events where increased inflows from tributaries greater than 40,000 CFS occurred in a two day period. These events started on April 9th 1945 in Kansas City, April 6th 1951 between Gavins point and Sioux City, March 30th 1960 in the same location, May 3rd 1961 at Hermann Missouri, April 26th 2009 at St Joseph Missouri, and April 14th 2012 at St Joseph Missouri. A similar number of like events occurred during the scheduled fall release period. There is no proof that these events would have caused flooding had they occurred during a release, but the events themselves show that naturally caused, rapid increases in the lower river can occur.

Significance

Medium/High. The preferred alternative does not include a release and there has been some discussion that the problem identified in this comment would be further evaluated if a management action that included a release were to be considered. If this is the case then this is not a major concern. However, the DEIS is vague about the specifics of supplemental analysis. If the plan is to include alternative management actions that include flow releases without supplemental flood risk analysis then this is a major concern.

Recommendation for Resolution

1. Clarify language in the DEIS and SAMP so that it is clear that supplemental flood risk analysis will be completed if an action that includes a release is to be implemented.
2. Use the historic data to identify the joint distributions of downstream precipitation and/or inflows. Generate several thousand draws from these distributions and use this weather data to rerun the flood risk analysis. Use these results to generate a Value at Risk VAR curve that shows the one in one thousand, and one in ten thousand worst-case scenarios. This would be a challenging and time-consuming task, but this does not provide an excuse for ignoring the problem.

The methodology for generating simulations from correlated distributions is provided in Iman, R. L., and W. J. Conover. 1982. "A Distribution-Free Approach to Inducing Rank Correlation among Input Variables." Communication in Statistics: Simulation and Computation 11: 311-34.

USACE/PDT Response

Concur with Recommendation.

Additional HH analyses will be conducted if AM identifies the need for future flow measures. The following text will be inserted within the EIS, section 3.12.2.1, Impacts Assessment Methodology, new paragraph 3 on pg 3-264:

The Missouri River system as currently operated provides substantial flood damage reduction and benefits to the entire basin. Study alternatives include modifying operations of the Missouri River reservoir system with both higher and lower reservoir releases during select periods for species habitat benefits. The current HEC-ResSim and HEC-RAS analysis shows the potential for negative impacts to flood damage reduction for alternatives that include changes in reservoir flow releases. The current study methodology, which employs an 82 year period of record, is suitable for alternative comparison and providing an indication of change in flood risk. However, the methodology does not simulate a sufficient number of events and possible runoff combinations within the large Missouri River basin to evaluate potential change in downstream flood risk. Prior to implementing any management action that alters reservoir operations, a comprehensive flood risk evaluation will be conducted per USACE requirements. The level of additional hydrologic analysis will be based on USACE guidance and requirements and will identify the change in reservoir pool probability, reservoir release frequency, river stage-frequency, and river stage-duration.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #40, Sec 3.13, Hydropower

While the DEIS indicates the RED hydropower impacts are supposed to be based on the NED hydropower analysis, the two analyses yield relatively different magnitudes of losses and even the direction of losses due in part to using different time periods and prices for their respective analyses.

Basis for Comment

The DEIS repeatedly indicates (Pages 3-343 and 3-349, 3-353) that the RED impacts are based on NED analysis. However, the two analyses are based on different time periods and hence yield different magnitudes of impacts and even different directions of losses (Alternative #6). In particular the NED analysis uses the 82 year Period of Record (POR). In contrast the RED analysis uses 2012 as representative of a normal year (page 3-343 and page 3-353). Further the prices used for the RED analysis are different than the NED analysis (page 3-343, 3-353). RED is measuring the financial impacts to Western Area Power Authority (WAPA) using a method provided by WAPA. The importance of adverse financial impacts to WAPA is said to result in higher rates to end users, which include Native American tribes, electric cooperatives and public utility districts. However, page 3-354 indicates that Tribal Impacts would follow the same pattern as the NED results. The hydropower technical appendix does not provide sufficient explanation of the discrepancy between the NED and RED analyses.

Significance

Medium. The disconnect between the NED and RED analysis makes it difficult for the Panel to determine the accuracy of each alternative's regional economic impacts to Missouri River USACE generated power consumers.

Recommendation for Resolution

1. Use the average of the Period of Record for the RED analysis or explain why this is not appropriate for the RED analysis but is for the NED analysis.
2. Explain the difference and/or relationship between the NED least cost approach to valuation of hydropower and the RED recent price approach to valuing the impacts to WAPA and their customers.
3. Explain whether the Tribal impacts would follow the impacts to NED or RED.

USACE/PDT Response

Concur with Recommendations.

The team will consider using the average for the Period of Record in the RED analysis, compared to specific representative years, pending discussions with WAPA to use the data in this manner.

The team will clarify and include an additional description of the relationship between the NED and RED approaches. An additional explanation and rationale will be provided to support the approaches.

The PDT will clarify the Tribal impacts including how they relate to NED and RED.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #41, Sec 3.15, Navigation and Navigation Technical Report

It appears that transportation costs savings are based on 1994 dollars whereas repair, replacement and rehabilitation (R, R, & R) costs are for 2016. Tonnage also appears to be based on two different time periods. Seven drought years were excluded and it is not clear how this might have affected the results. In addition, these sections of the report need to be edited for clarity.

Basis for Comment

1. Need for editing

Technical Report page 6. The sixth bullet point on this page reads as follows.

"While this it cannot list the assumptions used to generate the transportation savings function These transportations savings functions represent the transportation rate savings For additional material discussion on assumptions please review this document."

Note the lack of periods and general incomprehensibility of the prose.

On page 16 the report states that "The change in R, R, & R costs is then subtracted from the transportation savings to estimate the net NED benefits for each alternative."

In reality, simulated transport costs increased and R, R and R costs fell. So the terms "costs" and "savings" in this sentence are used to mean the opposite of what is measured.

On page 17 the report states that "While railroads within the region have capacity for traffic, there is not enough waterway traffic on the Missouri to capture."

2. Apparent inconsistency in inflation adjustment and tonnages

The results are heavily based on a 1998 report which used dollar values from 1994.

Page 6 states that "The Transportation Savings Value (TSV) functions were not indexed to FY 16 values because the analysis assumed that the relative difference between the overland costs and waterway costs has not changed over time."

The savings in R, R, and R costs that are used to offset these transportation savings are described as follows. "To estimate the change in R, R, & R costs for varying season lengths, the numbers presented in "Table 15: Incremental Annual O & M Cost Function ($ Millions / Year)" were updated to FY 16"

The volume flows used for the first term in the transport cost savings apparently come from the early 1990s "the dock-to-dock pairs were primarily drawn from traffic movements in 1992, 1993, and preliminary 1994 data provided by Waterborne Commerce Statistics Center" and "the TSV were converted into dollars per ton by dividing by the Missouri River tonnage for 1994."

The second term is apparently based on 2012 "For this effort, the navigation economic analysis considers traffic levels before and after 2011 as suggested by stakeholders. 2012 WCSC data is used as one representative year for the analysis as it is most recent year of full navigation service and did not experience any interruptions, delays, or shortened navigation season as shown in Table 6."

It is not clear what volumes were used as the basis for the R, R and R values.

3. Exclusion of drought years

Page 16 states that "Seven drought years were not considered since navigation support flows were not provided in these years and the intent of the analysis is to understand how releases for navigation will be impacted by the alternatives."

It is possible that water in storage at the end of one year might have helped alleviate the impact of the drought on navigation in these drought years. Moreover, the reservoir levels will show a discontinuity around the missing year.

Significance

Medium/Low. Clarity and consistency of the analysis of navigation would be significantly improved by revising this analysis and associated text.

Recommendation for Resolution

1. Have the document edited for clarity.
2. Use a consistent inflation adjustment and tonnage.
3. Include drought years in the analysis.

USACE/PDT Response

1. **Have the document edited for clarity**.

Concur with recommendation. The document will be updated and edited for clarity.

Regarding the first comment under #1 above related to transportation savings, this will be updated to clarify that the analysis relies on the transportation savings functions and assumptions from "Table 25: Transportation Savings Value Functions" of the Master Water Control Manual Missouri River Review and Update Study, Volume 6A-R: Economic Studies Navigation Economics (Revised) (1998). For additional discussion on variables considered for these calculations please review this document.

Regarding the second statement under #1 above that comments on "The change in R, R, & R costs is then subtracted from the transportation savings to estimate the net NED benefits for each alternative", per Engineer Regulation 1105-2-100, Planning Guidance Notebook, the basic economic benefit for navigation is reduction in the value of resources required to transport commodities. For this analysis the value of resources was measured by transportation savings and change in non-routine repair, replacement, and rehabilitation (R, R, & R) costs.

The transportation savings represent the difference in the value of resources required to transport commodities between the waterway and overland. Since the resources required to transport commodities overland is greater than the resources required to move

commodities on water, the benefit from moving commodities over water is referred to as a savings. Changes to the waterway can increase the cost of moving on the waterway, but the waterway could still be less expensive than moving the commodity over land. This is why the term savings is used.

The R, R, & R costs represent the costs necessary for repair, replacement, and rehabilitation of river structures, rescues, emergency dredging, and other expenses. As displayed in Table 7, Incremental Annual R, R, & R Cost Function, a year with a full service navigation season for eight months has minimal to no change in R, R, & R costs. A variation in the length of the season or in the level of service can cause a change in R, R, & R costs to be positive or negative. While a negative change in the R, R, & R costs would be considered savings, it is referred to as a "cost" to avoid switching back and forth between terms.

Overall, the statement above is worded to be consistent with structure of equation #1 (net NED calculation) on page 8 of the Navigation Technical Report.

Regarding the third comment under #1 above regarding the railroad statement, the report will be updated to reflect: "While railroads within the region have capacity for traffic, there is little Missouri River waterway traffic that could be captured."

2. Use a consistent inflation adjustment and tonnage.

Concur with recommendation. The Transportation Savings Values will be updated to current values consistent with the R, R, & R costs.

The *Master Water Control Manual Missouri River Review and Update Study, Volume 6A-R: Economic Studies Navigation Economics (Revised) (1998)* presents the transportation savings value functions (Table 25: Transportation Savings Value Function) and R, R, & R costs (Table 15: Incremental Annual O & M Cost Function) in dollar values. These dollar values were transformed into dollar per ton values and then multiplied by 2012 tonnages to generate the estimates for annual transportation savings and R, R, & R costs. The analysis utilized 2012 tonnage levels for consistency across calculations. This will be further clarified in the report.

3. Include drought years in the analysis.

Concur with recommendation and For Informational Purposes. For each alternative, the USACE Hydraulic Engineering Center Reservoir System Simulation (HEC-ResSim) model estimated the daily service level flow for each year between 1931 and 2012 (no drought years removed from the HEC-ResSim model). To clarify, no changes occur to the HH models and their results by removing these drought years from the navigation analysis.

The impact to navigation is the difference in NED benefits between the future without-project condition and future with-project condition. Since the drought years occur in both the future without-project condition and future with-project condition, the ranking of alternatives would not be affected by removing the drought years. The average-annual benefits and relative differences are more accurate (albeit slightly) when including all years, so the analysis for the Final EIS will be updated to include the impacts from all years.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #42, Sec 3.16, Recreation

The section is unclear on some significant details, and assumptions are used when it appears data may be available to avoid the assumption.

Basis for Comment

The overall analysis uses the best available data which is augmented with numerous personal communications with federal, state, local and private recreation providers. However, there remains some ambiguity in the analysis and over-reliance on assumptions.

1. Different years used for different recreational resources. Page 3-422 (Table 3-184) uses the year 2012 for the six reservoirs. Page 3-425 (Table 3-190) presents data for 2009 as visitation data across the Inter-Reservoir River Reaches. Page 4-247, Table 3-192 presents visitation to the Lower River in year 2004. Although these are the years for when the data were collected, having three different base years makes comparison of visitation difficult. Further it is not clear how the visitation in the three different time periods were used in the NED analysis or whether they were somehow brought to a common time period.
2. Page 3-460. Tribal Recreation Resources. While tribal recreation, especially on the reservations by tourists is mentioned, there is no separate break out by reservation. This would seem to be especially important to tribal members for the RED analysis.
3. Technical Report Page 12. An assumption is made that half the sightseers are not affected by lake elevation and half are. Data that back up this assumption appear lacking.
4. Technical report pages 31-32. While the use of a state impact area is well justified, it is not clear if the visitor spending is still within 50 miles of the site, or by non-residents to the state.

Significance

Low. Addressing these issues would improve the clarity and usefulness of the recreation analysis as well as minimize assumptions.

Recommendation for Resolution

1. Put all recreation use estimates to a common base year by adjusting visitation for population changes in the states where the reservoir visitors are coming from and counties where local river visitors are coming from. This could be done using a trend analysis on past data or simply calculating a visits per capita in the year for which you have visitation data (e.g., 2004, 2009, 2012) and applying the 2015 population for these relevant population centers that contribute the majority of visitors.
2. Investigate the possibility of calculating NED and RED analyses for Native American reservations (individually or as a whole) in the four recreation segments used in the analysis.
3. Perform a statistical analysis relating sightseeing visitor use to reservoir elevations (as was done for aggregate visitation) to determine whether sightseeing visitor use is affected by reservoir elevations or not. If visitation is affected by reservoir elevation, describe the relationship.
4. In the Technical Report clarify whether non-local visitor spending is within 50 miles of the recreation site or by state non-residents, since the impact area is at the state level. If the 50 mile radius is used for visitor expenditures but the state is used for the impact area, clarify for the reader why these are not inconsistent.

USACE/PDT Response

1. Concur with recommendation. The PDT understands that there may be some confusion on the different baseline visitation years for the different areas of the mainstem river system. Differing data sources required that we use different baseline years for the analysis. Based on the IEPR reviewer's comments and suggestions, the baseline visitation in the reservoirs (2012), inter-reservoir river reaches (2009) and lower river (2004) will be updated to the most current available year. The visitation will likely be indexed to current levels based on visits per capita in the respective years. These updated baseline figures will be used in the NED and RED evaluations.

2. Non-concur with recommendation. The PDT determined that Tribe-specific or reservation-specific impacts should not be displayed in the DEIS. The Corps is undergoing Government-to-Government Consultation with the Tribes and will share Tribe-specific and reservation-specific information with individual Tribes to the extent that the information exists / can be determined. This approach was shared with the Tribal representatives on MRRIC prior to release of the DEIS. In the Tribal recreation section, we have described the RED and NED

impacts that would be most affected (the upper three reservoirs) by the alternatives, indicating that tribal reservations that are located on these lakes would be most affected.

3. Partially Concur with recommendation. The PDT agrees that there needs to be additional description and justification regarding how sightseers are affected by lake elevations. Interviews with the lake managers provide the basis for the assumption that half the sightseers are not affected by lake elevation and half are. Additional detail will be added to the section to clarify the basis for this assumption. These assumptions for visitors affected by lake elevations were applied to the visitation at the lower three reservoirs, where lake elevations are used along with boat ramp operating elevations to assess impacts to visitation. The upper three reservoir recreation evaluation uses a regression approach and evaluates the contributing variables that best predict all visitation (all types of visitors are included). We do not feel that additional statistical analysis is needed on sightseer visitation because the lower three reservoir elevations fluctuate only a small amount as these reservoirs are managed as flow-through reservoirs. As a result, there are minimal changes to visitation, NED and RED across the alternatives in the lower three reservoirs.
4. Concur with recommendation. The PDT will add additional details to the report explaining that the visitor spending to estimate the economic impacts used only non-local visitor spending within the local impact area, defined as counties within 50 miles of the project area. The state results were presented for consistency across the regions and because some of the local impact areas identified in the RECONS model were not accurate (counties were excluded). We did evaluate the local and state impact area results and found them to be very similar, indicating that most of the economic activity (and downstream/multiplier impacts) occurred within the local area region.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #43, Sec 3.17, Thermal power

The presentation of the thermal power environmental consequences of the alternatives is confusing due to over-reliance on jargon and is inconsistent in places with the hydropower analysis.

Basis for Comment

Page 3-472. Estimates of costs for Alternative #1 are generated comparing current operation to an “ideal” condition. However, Alternative #1 is supposed to represent the baseline for the other alternatives which are compared relative to it. This approach to estimating the cost of Alternative #1 seems odd and needs justification.

Table 3-216 (page 3-478) and Table 3-219 (pages 3-482 to 483) are somewhat counter intuitive since the left hand column is labeled Costs, but then the categories listed underneath are

described as Energy Values (which the footnote indicates is really replacement costs of the power) and the last category is Capacity Values which the footnote indicates is replacement cost of the capital needed to replace lost capacity.

For Alternative #3, Table 3-219 (pages 482 -483), it is not clear why power generation is going down relative to Alternative #1, when there is less replacement power needed (Energy Values is lower than Alternative #1).

Page 3-469. Analysis of Other Social Effects for air emissions is to be determined qualitatively. However, the Hydropower Other Social Effects used the EPA eGrid to determine emission factors of replacement power. Page 3-330 also displays the current mix of generating capacity in the Midwest Reliability Organization Region and shows that natural gas is 26% and presumably could be brought on line to fill in lost thermal power in the Missouri River plants which are coal and nuclear.

Significance

Medium/Low.

Recommendation for Resolution

1. Make Alternative #1 the baseline reflecting current operating conditions, without reference to an ideal, thus making replacement costs of energy and replacement capacity costs zero.
2. In Tables 3-216, 3-219, 3-221, 3-224, and 3-226 use the terms energy replacement costs instead of Energy Values, and annualized replacement capital costs rather than Capacity Values (technical/jargon terms can be put in the footnotes).
3. In Table 3-219 (Alternative #3) clarify why power generation is going down relative to Alternative #1, especially given that less replacement power is needed in Alternative #3.
4. Investigate the feasibility of using the EPA eGrid approach used in the hydropower analysis to quantify the change in air emissions with changes in thermal power production.

USACE/PDT Response

1. Partially Concur with Recommendation. The PDT agrees that the terminology and description of Alternative 1 impacts as a change from ideal conditions may be confusing. However, at this point, we do not agree that the replacement costs for energy should be set to zero under No Action because impacts do occur under No Action and are relevant and should be disclosed. Thus, it would be difficult to describe the current benefits of energy generation under Alternative 1 if they were set to zero. Instead, the PDT will consider updating the analysis to describe the amount of power generation and energy values generated/supported under Alternative 1 (the ideal conditions less the adverse

effects of alt 1). This approach is also consistent with the hydropower presentation of No Action results. Alternatives 2 through 6 would then focus on the change in power generation and replacement costs for energy and capacity compared to No Action, as suggested by the reviewer. The current methodology in the DEIS for capacity values describes the replacement capacity compared to No Action and, in essence, sets the capacity value to zero for Alternative 1.

2. Concur with recommendation. The PDT agrees with the reviewer that the terminology may be confusing and agrees to update the terminology in the Final EIS. Given the changes that are suggested above (in response to #1), the terms "power generation" and "energy values" will remain for Alternative 1 because the analysis will present power generated and energy values supported by the power generation under the No Action (ideal conditions less adverse effects of Alt 1). The terms used for the change from No Action for Alternatives 2 through 6 will be consistent with those that have been recommended (and consistent with the hydropower analysis): "replacement energy costs" and "replacement capacity costs."
3. Concur with recommendation. The directionality of power generation in the table is consistent with the energy values (decrease in adverse effects on energy values under Alternative 3) and the PDT understands that this may be confusing to the reader. Under Alternative 3, average annual power generation would increase and the replacement costs of replacement power would decrease relative to No Action; the directionality will be clarified in the Final EIS.
4. Concur with recommendation. The air emissions evaluation will be amended to quantitatively evaluate the impacts to methane, carbon dioxide, and nitrous oxide, consistent with the hydropower eGrid analysis, as suggested by the reviewer. EPA's eGrid has the annual emissions rate for these pollutants for most of the power plants from 2012 and the average emission rates for the eGrid subregions for 2014. We can use these figures to estimate to average replacement power emissions per megawatt-hour and average annual changes in emissions for these three pollutants over the period of analysis.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #44, Sec 3.18, Water supply

The assumption that the fixed capital cost of submersible pumps of the size needed to provide replacement water supply can be calculated on a daily rental basis and permitted at 10% of the capital cost seems unrealistic.

Basis for Comment

Technical Report Page 10, Table 2 provides the capital cost of different capacity submersible pumps to provide replacement water supply. Environmental permitting and regulatory costs are assumed to be 10% of the annual fixed cost.

Technical Report Page 11, indicates that for every day that a pump is used a daily rental cost is applied.

The above observations appear unrealistic in terms of matching the actual situation faced by water utilities. In the face of a fluctuating river and/or reservoir, utilities would have to purchase the pumps outright and incur the fixed cost of environmental permitting and regulatory costs.

The net result is to understate the cost of water supply fluctuations. The actual cost would be a fixed cost of purchase and permitting these submersible pumps every 10 years.

Significance

Medium/Low. While a more realistic calculation would raise the absolute costs of replacement water supply in all alternatives it may not have a large effect on the relative cost across the alternatives. But the accuracy and credibility of the DEIS would be improved by making this change.

Recommendation for Resolution

1. Use the full fixed costs of purchasing the pumps and permitting them, if replacement water supply must be provided.

USACE/PDT Response

1. Partially Concur with recommendation. The PDT will evaluate this comment in conjunction with other public comments received. If this general methodology is followed for the water supply evaluation in the Final EIS (using submersible pumps to adapt to short-term impacts) then the fixed costs used for submersible pumps will be adjusted to evaluate the purchase and permitting costs of the pumps, amortized over ten years and this text will be reflected in the EIS.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #45, Sec 3.20, Tribal interests (general)

The Panel was charged with evaluating whether the coverage of Tribal interests and resources is adequately presented in the DEIS.

Basis for Comment

MRRIC charge questions 8 – 10 request that the Panel evaluate whether the DEIS adequately addresses and assesses current conditions and impacts of the proposed actions on assets and resources important to the tribes and whether the DEIS adequately describes how site specific activities will address legal responsibilities such as Section 106, Programmatic Agreements, and water rights/Winters Doctrine.

The Panel concludes that in general and at the scale of this programmatic DEIS, the document and supporting materials adequately describe resources of concern to the tribes and the nature of the potential impacts to those resources. This is accomplished generally in each of the affected environment/environmental consequences sections of Chapter 3 and more specifically, though still mostly qualitatively, in subsections specifically addressing tribal resources within each relevant Chapter. Section 3.9 on Cultural Resources provides significant quantitative and qualitative assessment of resources of particular concern to the tribes. Section 3.20 does similarly for other tribal interests.

Section 5.2 and Appendix H describe the Corps' tribal scoping, engagement through MRRIC, and government-to-government engagements with the tribes. Sections 6.4 and 6.5 describe in general terms how the Corps will address its legal responsibilities under Section 106 of the National Historic Preservation Act (including Programmatic Agreements), Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, Executive Order 13007 Indian Sacred Sites, and water rights including the Winters Doctrine.

The Panel suggests that the level of treatment of tribal interests and resources is appropriate for this programmatic DEIS. The Panel further notes that Section 4.9 describes how supplemental NEPA assessment will accompany site-specific planning as needed for specific management actions that are implemented under Adaptive Management.

The Panel recognizes that it does not have a member who is expert in assessment of tribal interests and resources. This generally affirmative evaluation of the coverage of tribal interests should not be interpreted by the Corps to overrule or trump well-justified comments or concerns that may be expressed by reviewers outside of the Panel.

Significance

Medium. Consideration of tribal concerns is important for credible planning at programmatic and site specific levels.

Recommendation for Resolution

1) The Panel has provided suggestions for improving text regarding tribal interests in DEIS Sections 2.9.1 and 3.9 above and 3.20 below.

2) Text in Sections 2.3.3.2 (pp 81-83), 2.3.6.6 (p 90), and 2.3.7.2 (pp 93-96) of the SAMP should be enhanced to more explicitly engage interested tribal members in the HC Work Group and HC Team. Tribal interests during AM likely can be addressed most directly and effectively at that level, as opposed to through the more-removed Tribal Interests WG and government-to-government consultation process. Those fora may be better suited to larger-scale and/or higher-level engagement.

3) The Corps should consider well-justified concerns that may be expressed by other reviewers.

4) The Corps and MRRIC may wish to consider further how best to engage an expert or experts in tribal interests in planning and assessment. Possibilities include (but are not limited to): as a member of the ISAP/ISETR, an ad hoc expert or panel of experts who could be engaged as needed, and/or as an Adaptive Management team staff member at some level.

USACE/PDT Response

1) Please see response to Comment #37
2) Concur with the recommendation. Tribal members are encouraged to participate in the HC work group and HC team. Text will be added clarifying that the Tribal Interests WG and government to government consultation are not the only avenues for engagement in the AM process.
3) Concur with recommendation. The USACE fully intends to consider input and concerns expressed by other reviewers.
4) Concur with recommendation. The USACE will engage in discussions with the Tribes, MRRIC and the U.S. Institute for Environmental Conflict Resolution on this topic.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #46, Sec 3.20, Cultural sites and hydrology

The Cultural Resources Technical Report seems to assume that any change in hydrology (e.g., an increase or decrease in reservoir stage, an increase or decrease in frequency of riverine flooding) would result in negative impacts to affected sites. The Panel is interested in learning if there might be types of sites that could potentially be enhanced by proposed changes in hydrology?

Basis for Comment

Enhancements might occur, for instance, on riverine sites that are associated with or dependent on the continued productivity of natural riparian vegetation or wetlands that would benefit from changes in flooding frequency or duration. Such positive changes were addressed in DEIS Section 3.20 (Tribal Interests(other)), but it is not clear how much overlap may exist between tribal resources discussed in Section 3.20 and cultural sites addressed in the Cultural Resources Technical Report. The Technical Report enumerates the number of sites associated with river reaches and reservoirs, but the specific types of sites involved are not identified.

Significance

Medium/Low. Cultural Resources are an important human consideration, and clearly identifying both the negative and positive (if they would occur on some types of sites) would improve the clarity of this analysis.

Recommendation for Resolution

1. Provide additional information on the types of sites considered, as well as additional text that makes a convincing argument that both negative and positive impacts for specific types of sites and hydrological changes were considered.

USACE/PDT Response

Non-Concur with recommendation.

Potential beneficial effects for protection of cultural resource sites due to temporary inundation of the floodplain in riverine reaches (i.e. 'continued productivity of natural riparian vegetation or wetlands') are overwhelmed by the negative effects of that inundation (i.e. increasing risk of erosion). Also, the different 'types' of sites do not vary significantly in terms of their damageability/susceptibility to erosion or vandalism; additional language will be added to the Cultural Resources Technical Report to back up this assumption. Sources cited in support of this assumption will include:

"Lenihan, D.J., Carrell, T.L., Fosberg, S., Murphy, L., Rayl, S.L., and Ware, J.A. (1981). The final Report of the National Reservoir Inundation Study, Volumes I and II. U.S. Department of the Interior, National Park Service, Southwest Reginal Office, Santa Fe, NM.

"Dunn, R.A. (1996). Impacts to Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

"Dunn, R.A., Smith, L.M., Allen, H.H., Taylor, H.M., (1996) Managing Historic Properties in Drawdown Zones at Corps of Engineers Reservoirs: Three Case Studies, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS."

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #47, Sec 3.21, Human health and safety

The Human Health and Safety analysis is exclusively focused "on the potential for increased risk of mosquito-borne diseases as a consequence of implementing any of the MRRMP-EIS alternatives" and it is not clear why and how some cumulative actions (for example, Floodplain Development – Urban, Residential, Commercial, Industrial), USFWS National Wildlife Refuge System Lands Management, NRCS Easement Programs, Comprehensive Wildlife Conservation Plans and Protected Natural Areas) impact Human Health and Safety when other cumulative actions do not.

Basis for Comment

Page 3-553 of Section 3.21 Human Health and Safety is completely focused "on the potential for increased risk of mosquito-borne diseases as a consequence of implementing any of the MRRMP-EIS alternatives."

Pages 3-7, 3-8, 3-9, 3-10, and Table 3.1 Cumulative Actions and Potential Impacts to Resources in the Project Area list human health and safety cumulative actions and potential impacts for Floodplain Development (Urban, Residential, Commercial, Industrial), USFWS National Wildlife Refuge System Lands Management, NRCS Easement Programs, Comprehensive Wildlife Conservation Plans and Protected Natural Areas. It is not made clear why and how these impact Human Health and Safety when other cumulative actions, such as the cumulative action of oil/natural gas production, do not. No definition of what constitutes Human Health and Safety is provided. This is problematic given the narrow focus of Human Health and Safety in Section 3.21 on the potential for increased risk of mosquito-borne diseases is not revealed earlier in the document."

Significance

Medium/low. The discussion of Human Health and Safety would be improved if there was a more well-rounded consideration of the topic and an explanation for the extensive consideration of the risk from mosquito-borne diseases.

Recommendation for Resolution

1. Define what constitutes Human Health and Safety.

2. Explain why the heavy emphasis "on the potential for increased risk of mosquito-borne diseases as a consequence of implementing any of the MRRMP-EIS alternatives" (page 3-553) and the exclusion of other potential human health and safety concerns.
3. Provide a rationale for why cumulative actions and potential impacts are listed for the activities they are and are not listed for the activities they are not.

USACE/PDT Response

Concur with recommendation.

A definition of what constitutes Human Health and Safety will be added.

As stated in Section 3.21.1 more traditional human health and safety issued are discussed in previous USACE NEPA documents that are referenced. At the programmatic level of the EIS it was determined that site specific impacts, such as hazards involved with ESH creation and SWH construction, would not be discussed as they would be considered as part of the process for planning and permitting once sites are selected and detailed information is available about construction or maintenance methods proposed. Clarification will be added to the document to include this discussion.

The analysis focuses on increased risk of mosquito-borne diseases that is directly influenced by the presence of habitat preferable by mosquito species. This issue was raised as a concern by several MRRIC members and it was requested that the USACE provide an analysis in the EIS. Cumulative actions that would contribute to the creation of conditions that meet the breeding habitat requirements of mosquito species were included for analysis. As previously explained the EIS does not include an analysis of effects on other health and safety concerns, such as those associated with the use of construction equipment and other occupational hazards involved in ESH creation and SWH construction, but rather references analyses of these concerns in previous USACE NEPA documents. Clarification will be added to the cumulative impacts section about why the analysis focuses on the actions discussed and not others.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #48, Sec 3.22, Environmental justice (and 3.12.3 OSE of floods)

The Environmental Justice analysis includes inconsistencies (e.g. urging special efforts to reach populations of concern and then lacking documentation that such activities are occurring in the context of MRRIC and Public and Agency Scoping), undocumented assumptions (e.g. a potential

minority environmental justice population exists based on the assumption an affected area has a minority population more than ten percentage points higher than the reference area), undocumented rationales (e.g. missing explanation for what methods were used to conduct the qualitative evaluation), and undefined explanations (e.g. impacts to environmental justice communities in specific areas) and terms (e.g. "small in nature and not disproportional" impacts).

Basis for Comment

Page 3-563 states "Encourage meaningful community representation in the NEPA process through the use of effective public participation strategies and special efforts to reach out to minority and low-income populations." while on page 5-1 there is no mention of "special efforts to reach out to minority and low-income populations" in the Missouri River Recovery Implementation Committee activities and on page 5-5 there is no mention of "special efforts to reach out to minority and low-income populations" in Public and Agency Scoping activities.

Page 3-563. No basis is provided for the assumption made in the following sentence. "It is assumed that if the affected area has a minority population more than ten percentage points higher than the reference area, then a potential minority environmental justice population exist."

Page 3-569. The rationale for the methods employed and a description of the methods used to conduct the qualitative evaluation are not provided in the section on Impacts Assessment Methodology as illustrated in the following. "The environmental justice assessment for the MRRMP-EIS first evaluated the nature and extent of impacts evaluated under the other resource areas addressed in the EIS (including flood risk management, water supply, thermal power, hydropower, land acquisition, irrigation, recreation, navigation, water quality, and others) and then qualitatively evaluated whether these impacts would fall disproportionately on potential environmental justice populations that live within the floodplain."

Page 3-274. It is not stated what are the flood impacts "to populations with potential environmental justice concerns under No Action would occur to a census block group in Woodbury County, IA with a high proportion of minority residents and to census block groups in Jackson and St. Louis counties in Missouri with a high proportion of low-income and minority residents."

Pages 3-281, 3-286, 3-292, 3-298 and 3-304. The undefined term "small in nature and not disproportional impacts" is used in discussions of alternatives 2, 3, 4, 5 and 6.

Significance

Medium/Low. The environmental justice analysis would prove more useful if it better demonstrated the impacts on the populations of concern.

Recommendation for Resolution

1. Describe the special efforts undertaken to reach out to minority and low income populations.
2. Provide the basis for the assumption that a 10% minority population constitutes an environmental justice population.
3. Describe the impacts to minority and low income populations in Woodbury County, IA, Jacks and St. Louis counties in Missouri.
4. Define what is meant by "small in nature and not disproportional impacts" (page 3-281) when discussing the environmental justice impacts in Alternatives 2, 3, 4, 5 and 6.

USACE/PDT Response

1. Concur with recommendation. Additional discussion will be provided in the appropriate chapter (3 or 5) which highlights the efforts of the PDT to encourage meaningful involvement of "minority populations, low-income populations, tribes and indigenous peoples". This includes activities both within the MRRIC setting and numerous meetings, specifically with Tribes, not associated with MRRIC engagement. Tribal engagement has been a significant focus of the PDT due to the potential impacts of the Management Plan on this population. Additional assessments of EJ effects (and outreach associated those effects) would be conducted for site-specific projects implemented under the Management Plan, to the extent applicable.
2. Concur with recommendation. EPA guidance states that "A population is identified as minority in an area affected by a policy action if "either" a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of "geographic analysis" (from "Technical Guidance for Assessing Environmental Justice in Regulatory Analysis" EPA, 2016). Because the EPA does not define what is meant by "meaningfully greater", the PDT defined the threshold as ten percentage points greater than a reference community. This threshold has been used for other NEPA compliance documents and we feel it conservatively identifies the potential for minority populations within the affected area. The PDT will add additional discussion in the section that describes the guidance and the rational.

3. Concur with recommendation. The effects of the alternatives in census blocks where a greater percentage of minority or low-income populations reside will be compared to the effects of the alternatives at the reach level as well as the study area as a whole. The counties for the census blocks with the potentially affected EJ populations will be identified. This comparison will be presented quantitatively in the Chapter 3 Environmental Justice section.

4. Concur with recommendation. Appendix A to the Council of Environmental Quality's (CEQ) *Environmental Justice: Guidance Under the National Environmental Policy Act*

(NEPA) provides guidance on the term "disproportionately high and adverse human *health* effects". The guidance provides several factors that can be used to determine whether human health effects are disproportionately high and adverse including: whether the health effects, which may be measured in risks and rates, are significant (as employed by NEPA), or above generally accepted norms; whether the risk or rate of hazard exposure by a minority population, low-income population, or Indian tribe to an environmental hazard is significant (as employed by NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate population; and whether health effects occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards" (CEQ, 1997).

The PDT followed this guidance in determining that the impacts of the plan would result in "small" impacts (not significant) under relevant resource areas (e.g. water supply, flood risk management, etc.) and that the risk or rate of hazard to minority populations, low-income populations or Indian tribes is also not significant from the plan.

Additional discussion can be added to this section that summarizes this guidance and how it was applied in the EIS.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #49, Sec 3.23, Ecosystem services scoring

The DEIS indicates that the numerical rating for Ecosystem Services is identical across alternatives at +1, yet the text in Chapter 3 indicates there are higher levels of Ecosystem Services associated with Alternative 2 than the other alternatives.

Basis for Comment

Table 2-31 on Page 2-77 indicates that Ecosystem Services of all DEIS alternatives have a rating of +1, indicating "small beneficial change".

However, the discussion in Chapter 3 suggests there are additional ecosystem service benefits associated with Alternative 2 compared to other alternatives. In particular, there would be higher Non-Use Values (Page 3-579, Table 3-261) for Alternative #2, a much larger increase in wetland acres than any of the other alternatives (page 3-580, Table 3-262), "…considerably more acres acquired and restored…under Alternative 2 compared to target acres under Alternative #1…" (Page 3-581), and greater Non-use values (Page 3-581).

As such it is not clear to the Panel how the rating for Ecosystem Services is the same for Alternative 2, as for Alternative 1, and 3-6.

Significance

Low. The clarity of the DEIS qualitative analysis of Ecosystem Services would improve the completeness of the report but may not affect the determination of the Proposed Action regarding recovery of the species.

Recommendation for Resolution

Revisit the determination of the Ecosystem Services ratings in Table 2-31 given the discussion in the text in the Chapter 3 section on Environmental Consequences of Ecosystem Services. Clarify the text to support the scoring.

USACE/PDT Response

Partially concur with recommendation. Please see the response to panel comment #23. Based on the rationale presented in response to panel comment #23, it is recommended that all ratings remain +1 for alternatives 2 through 6. However, further information will be provided to explain the rationale for this rating in section 3.23 Ecosystem Services.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

The Panel Concurs with the USACE response but believes that a broader range of the scale may be necessary to better reflect the differences in the ecosystem services provided by each alternative. A 1-10 scale may have the necessary resolution to reflect the differences in ecosystem services provided across alternatives, especially Alternative #2.

Panel Comment #50, Sec 3.23, Ecosystem services (carbon sequestration)

Carbon sequestration and climate regulation need to be carefully considered in relation to evaluating the planning alternatives. It is rightly concluded that the impacts are anticipated to be negligible. The concern is whether biological sequestration is of any possible significance and whether sequestration can be meaningful within the context of global carbon dynamics and associated impacts on climate.

Basis for Comment

Inclusion of Climate Regulation and Carbon Sequestration as an Ecosystem Service (pages 3-576 to 3-577) and in the impact analysis (Table3-261, and pages 3-579 to 3-580) is warranted but

more complete context is needed. Biological carbon sequestration (from algae to long-lived trees) still retains carbon in the active (recycling) pool in terms of time scales relevant to global carbon (decades to centuries). Short-term reductions in CO2 sequestered by plant growth are added back upon death and decomposition. There might be an increase in some quasi-steady state biomass and sequestered carbon associated with managed plant growth.

Also note that approximately 8 billion metric tons of CO2 must be removed from the atmosphere to reduce global atmospheric CO2 by 1 ppm.

Significance

Low. The clarity of the report would be improved by providing greater context of the net effect on local or regional climate of carbon sequestration associated with the alternatives.

Recommendation for Resolution

1. Provide more complete context of the likely net effects of the DEIS alternatives on long term carbon sequestration.

USACE/PDT Response

Concur with recommendation.

Agree that additional context should be added to this section to show how the impacts of the alternatives are likely to have negligible long term impacts on climate change. If possible, could the reviewers please provide additional sources of information for this section and a reference for the following statement: *Also note that approximately 8 billion metric tons of CO2 must be removed from the atmosphere to reduce global atmospheric CO2 by 1 ppm?*

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

The source for the 8 billion metric tons of required CO2 removal is the web site for the Carbon Dioxide Information and Analysis Center (CDIAC) at the Oak Ridge National Laboratory. (http://cdiac.ornl.gov)

Panel Comment #51, Sec 3.24, Mississippi River impacts

The Mississippi River impacts sections lack clear explanation of why single years rather than a range or a composite were selected for analysis. This analysis can produce misleading graphical presentation. For example, Figure 3-65. Average Planform Width of the Middle Mississippi River from 1817 to 2011 is presented as evenly spaced bars when the time span between

measurements is unequal). Focus on individual years can also result in missing levels of details. For example, only details for -3 Feet Extreme Low Water and -5 Feet Stages are provided in the discussion of Action Levels for Navigation at St. Louis, Missouri. Potentially limiting hydrologic conditions for single years are used for explanation within alternatives rather than a range or an average. Within the section, the explanation of why a single year (2014) was chosen to illustrate "the median monthly stage at Mosenthein, Moro, and Boston side channels, choke point stage, and connectivity status," (page 3-596) missing explanations on which assumptions are based (for example, "that changes in stage can alter or impact the condition and accessibility of side channel habitat. It is assumed that the changes in stage modeled under each alternative at the St. Louis gage is representative of the middle Mississippi River and each of the representative side channels" (page 3-596), missing explanations on which anticipations are based (for example, "that there will be no impacts to biological resources in the middle Mississippi River from management actions common to all alternatives" (page 3-597), and missing explanation for why what appears to be outdated information is used to construct figures (for example, the National Structure Inventory (NSI), HAZUS 2006 and U.S. Census Bureau 2000 information is used to construct Table 3-274. Population and Estimated Structure Value of the Middle Mississippi River Floodplain.

Basis for Comment

Page 3-589. Without explanation in the section, single years were selected rather than a range or a composite given in the context of the discussion that "there would be considerable variability from year to year in response to individual flow alterations, driven by the specific meteorological conditions in the large Missouri River watershed in that year and years prior."

Page 3-589. The time span between measurements are unequal yet are presented as bars evenly spaced apart in Figure 3-65. Average Planform Width of the Middle Mississippi River from 1817 to 2011.

Page 3-590. Table 3-264. No applicable details for levels other than -3 Feet Extreme Low Water and – 5 Feet are provide in Stages with Action Levels for Navigation at St. Louis, Missouri.

Page 3-591. No explanation is provided within the section for why for Alternative 2 the hydrologic condition of year 1966 chosen as an example (Figure 3-66) to illustrate "The spring pallid sturgeon flow releases and summer low flows under Alternative 2 may for short periods affect the stage in the Mississippi River by up to one or two feet, based on the hydrology simulated for individual years of the POR."(3-591)

Page 3-591 - 3-592. No explanation is provided within the section for why for Alternative 4 the hydrologic conditions for the year 1974 (Figure 3-67) were simulated to illustrate, "Although the flow releases under Alternative 4 would be partially attenuated by the time they reach Hermann, MO, the releases still would increase the stage (on the order of 1 to 2 feet) and flow in the Mississippi River at St. Louis compared to the No Action alternative" (3-591 - 3-592).

Page 3-592. No explanation is provided within the section for why for alternative 5 the hydrologic conditions for the year 1974 (Figure 3-68) were simulated to illustrate how flow releases "would be partially attenuated by the time they reach Hermann, MO. However, the releases would still increase the stage (on the order of 1 to 3 feet) and flow in the Mississippi River at St. Louis compared to the No Action alternative" (3-592).

Page 3-592. No explanation is provided within the section for why for alternative 6 the hydrologic conditions for the year 1975 (Figure 3-69) were simulated to illustrate, "Alternative 6 – Pallid Sturgeon Spawning Cue: The spawning cue release simulated over the POR under Alternative 6 would often be largely attenuated by the time it reaches Hermann, MO, but some of the spawning cue releases would still increase the stage (by up to 3 feet) and flow in the middle Mississippi River at St. Louis compared to the No Action alternative".

Page 3-596. No explanation is provided within the section why 2014 (Table 3-266) was the year chosen to illustrate "the median monthly stage at Mosenthein, Moro, and Boston side channels, choke point stage, and connectivity status (i.e., connected to main channel or disconnected from main channel)".

Page 3-596. No explanation is provided for what is involved in the qualitative analysis of impacts "based on stage and flow simulated for each alternative by modeling the alternative operation over the POR".

Page 3-596. No explanation is provided for the bases for the following assumptions. "It is assumed that changes in stage can alter or impact the condition and accessibility of side channel habitat. It is assumed that the changes in stage modeled under each alternative at the St. Louis gage is representative of the middle Mississippi River and each of the representative side channels.

Page 3-597. No explanation is provided for the following anticipation. "It is anticipated that there will be no impacts to biological resources in the middle Mississippi River from management actions common to all alternatives. "

Page 3-603. No explanation is provided for why the National Structure Inventory (NSI), HAZUS 2006 and U.S. Census Bureau 2000 information is used to construct Table 3-274. Population and Estimated Structure Value of the Middle Mississippi River Floodplain when these numbers are now over a decade old.

Significance

Medium/Low. The robustness of the Mississippi River Impacts analysis would be enhanced if there was appropriate justification for key decisions made in the analysis.

Recommendation for Resolution

1. Explain why single years were selected rather than a range or a composite given "there would be considerable variability from year to year in response to individual flow alterations, driven by the specific meteorological conditions in the large Missouri River watershed in that year and years prior."

2. Present the information in Figure 3-65. Average Planform Width of the Middle Mississippi River from 1817 to 2011 so as represent all the years on the graph, show the existing bars as thin vertical lines of appropriate length, and then connect their tops with lines across the intervening years.

3. Provide applicable details for stages other than -3 Feet Extreme Low Water and -5 Feet Stages with Action Levels for Navigation at St. Louis, Missouri includes details for (Table 3-264).

4. Explain within this section why hydrologic conditions for single years are used for explanation within alternatives rather than for example a range or an average for the following.

a. Alternative 2 the hydrologic condition of year 1966 chosen as an example (Figure 3-66) to illustrate "The spring pallid sturgeon flow releases and summer low flows under Alternative 2 may for short periods affect the stage in the Mississippi River by up to one or two feet, based on the hydrology simulated for individual years of the POR."(3-591).

b. Alternative 4 the hydrologic conditions for the year 1974 (Figure 3-67) were simulated to illustrate, "Although the flow releases under Alternative 4 would be partially attenuated by the time they reach Hermann, MO, the releases still would increase the stage (on the order of 1 to 2 feet) and flow in the Mississippi River at St. Louis compared to the No Action alternative".

c. Alternative 5 the hydrologic conditions for the year 1974 (Figure 3-68) were simulated to illustrate how flow releases "would be partially attenuated by the time they reach Hermann, MO. However, the releases would still increase the stage (on the order of 1 to 3 feet) and flow in the Mississippi River at St. Louis compared to the No Action alternative".

d. Alternative 6 the hydrologic conditions for the year 1975 (Figure 3-69) were simulated to illustrate, "Alternative 6 – Pallid Sturgeon Spawning Cue: The spawning cue release simulated over the POR under Alternative 6 would often be largely attenuated by the time it reaches Hermann, MO, but some of the spawning cue releases would still increase the stage (by up to 3 feet) and flow in the middle Mississippi River at St. Louis compared to the No Action alternative"

5. Explain why 2014 was the year chosen to illustrate "the median monthly stage at Mosenthein, Moro, and Boston side channels, choke point stage, and connectivity status (i.e., connected to main channel or disconnected from main channel)".

6. Explain what is involved in the qualitative analysis of impacts "based on stage and flow simulated for each alternative by modeling the alternative operation over the POR".

7. Explain the bases for the following assumptions. "It is assumed that changes in stage can alter or impact the condition and accessibility of side channel habitat. It is assumed that the changes in stage modeled under each alternative at the St. Louis gage is representative of the middle Mississippi River and each of the representative side channels.

8. Explain the basis for the following anticipation. "It is anticipated that there will be no impacts to biological resources in the middle Mississippi River from management actions common to all alternatives.

9. Employ the most recent data available. If there is no more recent information available explain that. Explain why the National Structure Inventory (NSI), HAZUS 2006 and U.S. Census Bureau 2000 information is used to construct Table 3-274. Population and Estimated Structure Value of the Middle Mississippi River Floodplain.

USACE/PDT Response

1. **Concur with recommendation.** A description of why specific years were chosen for the River Infrastructure and Hydrology Sections is provided in 3.24.2.2 and 3.2.2.1. Text will be re-evaluated to make sure these descriptions are prominent in the discussion.
2. **Concur with recommendation.** If data are available, the figure will be updated to be more chronologically spaced, or averages will be used over blocks of years. The text will be adjusted to reflect the values on the revised figure accordingly.
3. **Concur with recommendation.** The table includes information that was most relevant from USCG (2012). The table will be modified as follows to avoid the impression of missing information.

Table 3-2. Stages with Action Levels for Navigation at St. Louis, Missouri

Trigger Reading	Descriptions
15 feet	Normal Operations
5 feet	Normal Operations with Advisory
0 foot	Low Water (Channel narrows in various sections)
−3 feet	Extreme Low Water (Channel continues to narrow and channel depth decreases)
−5 feet	Minimum Navigation (in many areas of the zone, channel is at best 300-feet wide by 9-feet deep)
−6 feet	Below Minimum Navigation
−7 feet	Historic Low Water

Source: USCG 2012

4. **Concur with Recommendations a-d.** Years 1966, 1974, and 1975 are presented as they are also analyzed for the Missouri River, both in the Upper and Lower River. Thereby, the effect and evolution of a specific flow release can be tracked through the entire Missouri River system to the Mississippi River. This explanation is provided in the second paragraph of Section 3.24.2.2. Explanation of why specific years were chosen for the Missouri River is provided in Section 3.2.1. These explanations will be reviewed and clarified.
5. **Concur with recommendation.** Will provide additional explanation in the DIES. The year 2014 is the most current data representing the current configuration of the river channel as it relates to the height and elevation of the chokepoints at these specific side channels. This most current available data was used to establish the baseline or current condition for which we could compare connectivity under the other alternatives. Past data was available but channel configuration and chokepoint elevation changes over time, so it is only prudent to use the most current data.
6. **Concur with recommendation.** Will provide additional explanation in the DEIS. Example text would be: Known choke point elevation for the 3 side channels were compared to water stages at the St. Louis gage for each of the alternatives. Stages greater than the choke point elevation were assumed to mean the side channel was flowing and the thus providing habitat to native aquatic species. This is considered to be a beneficial condition. A change to a flowing condition is a beneficial impact. If stages at the St. Louis gage were less than the known choke point elevation, the side channel was assumed to not be flowing and thus not providing habitat to native aquatic species. Current condition chokepoints for the side channels were defined by mean monthly choke point elevation for the 3 side channels from the most current data set (2014). The analysis and comparison was then performed for each of the alternatives to compare changes in connectivity and to assess impacts from the alternatives.
7. **Concur with recommendation.** Will provide additional explanation in the DEIS. Changes in stage of the middle Mississippi directly impact the connectivity of the three valuated side channels. If a side channel is currently disconnected and the stage rises to the chokepoint stage, the channel will become connected to the main channel, thus providing habitat to native aquatic species. The St.Louis gage was used to obtain water level stages for this analysis. Each of the side channels do not have their own gage to obtain stages. In order to disclose the assumptions applied to this analysis that fact was stated in the text.
8. **Concur with recommendation.** Will provide additional explanation in DEIS. That is in reference to the management actions common to all alternatives (described in Chapter 2). Those actions do not involve any flow actions or actions that would impact flow or stage at the St. Louis gage, thus not impacting stage which is the basis for the biological resources evaluation. If stage is not impacted on the middle Mississippi by these actions,

then connectivity of these side channels to the main channel will not be changed or impacted by these common to all actions.

9. **Concur with recommendation.** The available data for the National Structure Inventory at the time of the modeling was based on 2006 HAZUS and 2000 Census. However, there is a 2010 version of the NSI now available. For the final EIS, HAZUS and Census data will be updated to the most current available year for inclusion in the NSI.

IEPR Panel Back-Check Response

Concur and Satisfied with USACE response

Panel Comment #52, Sec 3.24.1, Spawning cue test effects

On page 3-585, paragraph 3, the explanation for not modeling the effect of the spawning cue on Mississippi River hydrology is that the river hydrologic conditions at the time of the cue would not be known. However, example conditions could be simulated with assumed parameters to provide some idea of the range of possible effects in relation to river conditions.

Basis for Comment

The fact that these conditions might be unknown at the time of the spawning cue release is not a good reason to give up. It is possible to assume Mississippi River flows (90, 50, and 10 percentile for example) and run the hydrologic models under those conditions. The result would likely demonstrate conclusively that Mississippi River conditions are not a concern in releasing water to cue spawning.

Significance

Medium. Issues that affect whether or not spawning flows should be included in any selected alternative include consequences for the Mississippi River, so the subject should be addressed as completely as possible.

Recommendation for Resolution

Add to section 3.24.1 results of model runs showing the hydrologic effects of the Missouri flow on the Mississippi River for Mississippi River flows at 90, 50, and 10 percentile discharges.

USACE/PDT Response

Non-concur with recommendation.

The current text in section 3.24.1 states "modeling for Alternative 6 simulates reoccurring implementation (Level 3) of this spawning cue over the wide range of hydrologic conditions in the POR. Therefore, the impacts from the potential implementation of a one-time spawning cue test release would be bound by the range of impacts described for individual releases under Alternative 6."

All Human Considerations modeling efforts are structured to use HEC-RAS and HEC-ResSim output from the entire period of record. Simulating a limited set of synthetic Mississippi River events, with no meaningful way of assigning Missouri River coincident frequency for downstream flows, variable spawning cue timing, and an assumed Mississippi River flow frequency, would not be meaningful in the context of alternative analysis comparison. Using a different method for the Mississippi River and running the 90, 50, and 10 percentile flows would not help clarify hydrologic effects of a spawning cue test flow. Statistical combination of flows from one source with a selected single year from another source would most certainly lead to a misleading analysis of potential Mississippi River impacts.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided.

The additional explanation regarding the connection between HC on one hand and river model output on the other is useful and should be included in the DEIS.

Panel Comment #53, Sec 3.24.2, Biological resources of the Mississippi River

The stated objective of Section 3.24.2 of the DEIS is to present information on responses of biota in the middle Mississippi River under the 6 alternatives outlined for the MRRMP. It is helpful to see this integration of the connected Mississippi River in a more holistic view of the total river system, particularly since some pallid sturgeon in the lower Missouri River are known to use the Mississippi River for part of their life history. Overall, this section primarily addresses the hydrologic and geomorphic responses of the Mississippi River to the alternatives, with an emphasis on dynamic (off/on) connections of major sides channels (3 in particular in the middle Mississippi) based on river stage at various times of the years. However, the explicit treatment of 'biological resources' in the middle Mississippi is limited. It would be useful to elaborate on what constitutes these resources, particularly pallid sturgeon and their biological requirements (food, habitat, reproduction), but also other biota as appropriate.

Basis for Comment

Throughout this section, 'biological resources' are lumped into one category without differentiating categories or types of resources (e.g., native versus introduced, trophic level, life stage, etc.). As a result, it is difficult to assess the potential costs and benefits of the alternatives to this potential source of immigrants into the Missouri River. The broad stroke of "no impact to biological resources" used for most alternatives does not seem valid in at least some cases. As an example, what are the implications of connection and disconnection of middle Mississippi side channels to interception of pallid sturgeon larvae produced in the Missouri River? Or on foraging by juvenile sturgeon? What are the potential overlaps between pallid and shovelnose sturgeon in that dynamic habitat? Is food production adequate for both?

Significance

Medium/Low. Given the potential for cross-system movement of pallid sturgeon in the Missouri and Mississippi River, a robust treatment of biological responses in the middle Mississippi River would seem to be important. The useful and detailed treatment of hydrological and geomorphic change inspires many questions about the potential biotic responses to floodplain interactions. For example, the dynamic connection and disconnection of side channels may be quite beneficial to the system, and to pallid sturgeon specifically, depending on timing relative to spawning.

Recommendation for Resolution

A more thorough treatment of what is meant by biological resources and their spatial-temporal responses to the alternatives would be useful. Some consideration of the overlays of physical, chemical, and biological responses of the Mississippi River to water manipulation in the Missouri River could be quite informative.

USACE/PDT Response

Concur with recommendation.

This section is intended to evaluate the impact of the six alternatives on Mississippi River aquatic habitat. Side-channels were chosen as an indicator because their connectivity to the main channel is affected by changing river stages which could be affected by alternatives with a managed flow component. Connectivity of side-channels on the Mississippi River is driven primarily by natural hydrologic variability, the potential effects of flow releases under the Management Plan alternatives on stages in the Middle Mississippi River (and thus side-channel connectivity) are not considered to be significant; however to the extent warranted text will be added elaborating on species and their hypothesized or known associations with side-channel habitat, which is thought to be an important aquatic habitat on the Middle Mississippi River. Also note that the Science and AM Plan contains actions to address interaction between pallid sturgeon on the Missouri and Mississippi Rivers (see response #57).

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

The response is reasonable. Minor note: The third sentence starting with “Connectivity” appears to need a preceding word such as “Because”.

Panel Comment #54, Sec 3.24.21, Sedimentation

On page 3-588, paragraph 2, the sentence beginning "Unlike in the past…" offers an unclear view of two different conditions, one in the past when sediment filled the spaces between structures and one at present when the spaces are filling with vegetation and are becoming part of the floodplain. However, these two cases are not in opposition to each other and both entail the deposition of sediment. The sentence does not offer a clear view of how processes and forms are changing on the river between structures.

Basis for Comment

In the historical case sediment was deposited between the structures, that sediment was often not covered in vegetation, the surface was unstable with sediment being added and subtracted, and the surface acted as an unstable part of the floodplain. In the present case minor amounts of sediment are deposited between the structures with much of the sediment sluiced downstream, the surfaces between the structures are relatively stable and are increasing anchored by vegetation, and the surfaces are stable parts of the floodplain. The result is a channel that is narrower and more capable of transporting sediment downstream, which can reduce the opportunity for naturally constructing ESH (e.g., channel islands and bars).

Significance

Low. The DEIS should present a clear picture of long-term channel changes connected with engineering structures so that readers may make informed decisions about alternatives that may accelerate or adjust the nature of those changes, especially with respect to the influence the changes may have on ESH.

Recommendation for Resolution

Replace the sentence identified above with the two sentences in "Basis for Comment" above or some version of them to expand the description.

USACE/PDT Response

Concur with recommendation.

We appreciate the distinction and concur that a clarification is needed. However, suggested text implies a slightly different view of the historic and current conditions. Revised text in paragraph two:

Remove: Unlike in the past, the area between the structures did not fill with sediment, but instead have been growing vegetation and have been becoming part of the floodplain.

Insert: In the historical case during the establishment of the navigation channel (early 1900's to the 1970's), sediment was deposited between the structures. That sediment was initially not covered in vegetation, and the deposition zone was dynamic with sediment being added and subtracted. Over time, as structures were extended and new structures added, those deposited sediments became vegetated and the channel width was thereby constructed to the current navigation channel geometry. In the present case minor amounts of sediment are deposited between the structures with much of the sediment sluiced downstream. The surfaces between the structures are relatively stable; are increasingly anchored by vegetation, and are stable parts of the floodplain. In addition, the construction of the upstream mainstem dams in the mid-twentieth century drastically altered the river flows and available sediment load. The result is a channel that is narrower and capable of transporting sediment downstream such that the navigation channel is self-scouring and normal maintenance dredging is not required. By design, the occurrence of channel islands and bars is reduced compared to historic conditions in the current navigation channel.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response.

Panel Comment #55, Sec 4.1.1.1, Pallid sturgeon decision criteria

Figure 4-3 portrays the decision criteria in the pallid sturgeon framework that are presented in the SAMP. As conveyed by the ISAP in previous discussions with the federal agencies, the decision to implement an action based on uncertain evidence that the action will result in meeting the objectives and targets seems unsupportable.

Basis for Comment

If there is no evidence that an action will benefit the species then there seems no reason to move forward with that action.

Significance

High.

Recommendation for Resolution

1. Remove the top "Yes" link from Figure 4-3 and discussion throughout the EIS and SAMP. Alternatively, add some discussion to the text about how moving forward with an action that has no evidence of meeting the objectives is a policy decision that may not be an efficient use of resources. That is, the agencies should be transparent that this approach may not be a wise use of resources.

USACE/PDT Response

Non-concur with recommendation.

See response to Comment #14 and #56. The Endangered Species Act requires action based on the best available science. The actions outlined in the pallid framework are those management actions associated with the highest priority hypotheses identified in the Effects Analysis. As such, there is evidence (based on best current science) that these actions can contribute to the objectives. The framework and associated decision criteria are intended to provide a measured approach to the initial implementation of actions, allowing time to conduct studies to address related hypotheses. In many cases, implementation at Level 3 is necessary in order to undertake adaptive management and, while the time limits and other criteria may be influenced by policy decisions, they are also based on other (scientific and practical) factors.

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

We recommend changing the wording in the top right box in Figure 4-3 to "Implement at Level 3 the hypothesis that has the most support." The support can be defined as information from Level 1 and 2 studies or a Delphi process if Level 1 and 2 studies are inconclusive.

Panel Comment #56, Sec 4.2, Recognizing challenges to successful AM

The development and content of the DEIS underscore the management benefits anticipated as a result of embracing adaptive management as a guiding decision framework. At the same time, several challenges, both conceptual and methodological, remain to be usefully addressed in standing up a productive AM program for managing Missouri River resources.

Basis for Comment

Embracing all scientific endeavor under a broadly defined conceptual umbrella and calling it "adaptive management" dilutes the power of adaptive management as a guiding framework. The tone of the DEIS suggests that that generalized concept of AM will ultimately result in successful conservation despite the current absence of management-response capabilities (options to implement an effective management action), particularly for pallid sturgeon. This is a misconception of AM that might result in a failure in its application to Missouri River management – both for the listed species and human considerations.

The lack of management-response capabilities poses potential methodological problems in usefully implementing adaptive management. Absent causal understanding, identifying and developing management alternatives of sufficient scale (e.g., number, size, and location of spawning habitats and IRCs) to generate a measurable and unequivocal response ("treatment effect") remains a challenge. Without a quantitative expected response, imposition of selected management actions on the river could fail to generate information useful for adaptively managing. If an action is undertaken that produces no statistically significant difference (i.e., relative to reference, baseline, control, or BACI), what can be concluded to inform adaptive management? Is there no causal relationship between the management action and the selected response metric? Or, was the management action of insufficient scale to produce an effect measurable given the intensity of the associated monitoring and analysis?

The potential lack of a treatment effect, perhaps further exacerbated by realistic monitoring limitations and associated minimal statistical power, might fail to provide actionable information to AM (or any other decision-making framework). Should the management action be abandoned? Or, should additional resources be directed at increasing the scale – and by how much? Importantly, the intention of AM at least in concept, is to avoid these kinds of equivocal circumstances. Given current and understandable institutional reluctance to embrace AM, presumed failure of a poorly designed and executed "management" program stands the chance of reducing further consideration of adaptive management by management agencies that might benefit the most.

Significance

High.

Recommendation for Resolution

1. More explicitly describe the rationale and approach to developing the necessary supporting science to implement management actions with a specified expected outcome against which to monitor responses in relation to expectations and to compare with specified management goals and objectives. The SAMP should clearly articulate that this concern is warranted and describe how the adaptive management program will address

the concern. The DEIS then could clarify that the decision space for adaptive management is in fact narrow, and how the program will succeed nonetheless. This comment parallels directly Panel Comment # 1 regarding a more explicit statement of the need for the management plan and EIS.

USACE/PDT Response

Concur with recommendation, clarification provided.

See also response to Comments #1, #14 and #55. While we generally agree with the assertions in the comment, the resolution of the underpinning concern is also challenging given the lack of reference to specific sections of the DEIS and SAMP where AM and its likelihood of success may be misrepresented. We propose the following be appended to the end of Section 4.2 as the most direct response:

The Effects Analysis and the Science and Adaptive Management Plan present the key uncertainties that challenge implementation decisions for the MRRP. They also detail the rationale and approach to developing the necessary supporting science so that management actions can be implemented and evaluated against expected outcomes with a reasonable expectation that the knowledge gained will contribute to improved understanding, better implementation decisions, and increased likelihood of achieving the program's goals and objectives.

The AM framework provides a measured approach to implementation, recognizing that causal understanding and the development of management-response functions will be necessary to ensure that the management actions taken will be effective. This strategy acknowledges the tradeoffs between knowledge and action, emphasizing the need for early investment in understanding so that long-term management prospects are improved. This strategy has the added benefits of reducing the risks of taking regrettable and potentially irreversible actions, improving opportunities for collaboration, and ultimately reducing program costs through efficiencies and greater effectiveness.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #57, Sec 4.4, Pallid sturgeon ecology in the Missouri and Mississippi rivers

New information continues to develop regarding the connection between the Missouri River and Mississippi River with respect to pallid sturgeon life-history dynamics. That is, results from

research and monitoring indicate that pallid sturgeon are spawning in the Missouri River, larvae drift into the Mississippi River, and pallid sturgeon > 600 mm in size are returning to the Missouri River. Given these observations, the Mississippi River needs to be explicitly included in the study area for research and monitoring outlined in the DEIS and SAMP because it is possible that environmental conditions in and management actions undertaken in the Mississippi River could mask biological responses to management actions in the Missouri River (or render those management actions unnecessary).

Basis for Comment

For example, Porrecea et al. (2016) states "Three out of five pure pallid sturgeon displayed regular movement between the Missouri and Mississippi rivers before being captured in the middle Mississippi River." They also state "...larvae spawned over much of the swift-flowing lower Missouri River likely drift into the middle Mississippi River (DeLonay et al. 2009)." The Porrecea et al. (2016) paper and discussions with fisheries biologists in the lower basin suggest that artificially disconnecting information exchange between the Missouri River and Mississippi River because of arbitrary federal agency district boundaries could hinder gaining more reliable knowledge about the life history of pallid sturgeon and the efficacy of management actions in the Missouri River. This concern has been expressed previously by the ISAP.

Porreca, A. P., W. D. Hintz, G. W. Whitledge, N. P. Rude, E. J. Heist, and J. E. Garvey. 2016. Establishing ecologically relevant management boundaries: linking movement ecology with the conservation of Scaphirhynchus sturgeon. Canadian Journal of Fisheries and Aquatic Sciences 73:877-884.

Significance

High.

Recommendation for Resolution

1. Better integrate (or at least reference) data and findings from the Mississippi River into real-time assessment and adaptive management deliberations for pallid sturgeon in the lower Missouri River.

USACE/PDT Response

Partially concur with recommendation, clarification provided.

As noted at the end of section 4.1.1.1 in the AM Plan:

> "As occurred during the EA, literature and ongoing research from outside the geographic area defined for the MRRMP-EIS (e.g., upstream of Fort Peck Dam) may be utilized where it helps to inform the evaluation of hypotheses and potential management actions."

This would include information from the Mississippi River. In fact, the MRRP Integrated Science Program has already been supporting the microchemistry and genetics studies that are the basis for understanding relations with the Mississippi. Under Big Question 4 on Drift Dynamics, there is a Level 1 field study (component 5) to assess free embryo transport to the Mississippi River. This field study (described in section C.3.4.5.5 of Appendix C) will estimate the number and survival of age-0 to juveniles hatched in the Missouri that reach the Mississippi River, relative to the number and survival of those that remain in the Missouri River. Additionally, the prospect of extending the Missouri River Pallid Sturgeon Population Assessment Project to include sampling in the Mississippi River (and Platte) is being discussed with partners

IEPR Panel Back-Check Response

Concur with USACE response, clarification provided

See Panel Back-Check Response #31

Panel Comment #58, Sec 4.4.1.1, Harvest bycatch as a contributor to pallid decline

Long-lived, late-maturing fish species, such as the pallid sturgeon, are highly vulnerable to overharvest and subsequent population-level collapse. Harvest bycatch with shovelnose sturgeon in the Mississippi River may have been a contributing factor in the decline in numbers of pallid sturgeon in the lower Missouri River.

Basis for Comment

New information regarding the continued sampling of unmarked pallid sturgeon in the Missouri River below Gavins Point Dam suggests that recruitment is occurring in the lower basin. It is unclear whether that recruitment results from spawning occurring in the Missouri River or Mississippi River. Nevertheless, the continued sampling of relatively large, unmarked pallid sturgeon in the Missouri River is of paramount importance. One hypothesis is that the elimination of harvest of shovelnose sturgeon as a result of the 2010 Similarity of Appearance ruling (75 FR 53598-53606) may be the cause for increased recruitment of larger adult pallid sturgeon into the lower Missouri River "population." The similarity in appearance ruling was predicated on bycatch of pallid sturgeon in the shovelnose sturgeon fishery. Therefore, elimination of the shovelnose sturgeon fishery would ensure that pallid sturgeon is not mistakenly harvested. The appearance of large pallid sturgeon in lower-Missouri River sampling returns aligns with the closure of the fishery and time to reach sexual maturation (albeit a bit early according to DeLonay et al. 2009, but within all values presented by Jordon et al. 2016).

With this information, it is important to assess the potential for population-level response of pallid sturgeon caused by the similarity of appearance ruling. This could perhaps be accomplished by using a simulation model (e.g., age-structured model, such as the one already constructed for pallid sturgeon) to assess overharvest and the response to a commercial fishery closure.

The similarity of appearance ruling, and corresponding cessation of sturgeon harvest, was not identified and evaluated as a management action in the lower Missouri River, but continued evaluations of the management alternatives for pallid sturgeon should address the potential impacts of closing the commercial fishery for shovelnose sturgeon on pallid population viability in the lower Missouri River.

New information, especially information that may influence the selected alternative and its constituent management actions, should be presented as soon as possible and incorporated into the MRRMP and EIS. Enormous cost saving in terms of habitat construction could occur if natural recruitment is actually now occurring in the lower river as a result of closing sturgeon harvest in the greater river system.

Significance

High.

Recommendation for Resolution

1. Use the current population model and/or the Bajer and Wildhaber (2007) model to estimate the abundance of naturally recruited pallid sturgeon as a result of the similarity of appearance ruling.
2. Design a project to evaluate effects of the similarity of appearance management action on pallid sturgeon in the Missouri River.

USACE/PDT Response

Concur with recommendations.

We agree that this is a worthy line of inquiry under the AM plan. The collaborative population model is well suited for addressing sensitivity to harvest, and as a spatially explicit, individual-based model, it can include drift and migration dynamics between the Missouri and Mississippi. Properly parameterizing the model may require additional population-level sampling on the Middle Mississippi River; as indicated in the response to comment 57 the prospect of extending the Missouri River Pallid Sturgeon Population Assessment Project to include sampling in the Mississippi River (and Platte) is being discussed with partners.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #59, Sec 4.4.2, Definition and validation of IRC concept

The DEIS offers an incomplete operational definition of IRC.

Basis for Comment

The operational definition of an IRC and the rules that will be used to define the boundary of an IRC are not presented. The DEIS (Section 4.4.2, including Table 4.1) identifies a Level 1 objective of construction of 33,000 acre-days of IRC. The protocols for measuring the spatial extent of an IRC at a given discharge rate have not been defined. In a river reach, at a given discharge, the spatial extent of the three assumed components of IRC can be mapped using computer models; however, the rules that will be used to integrate spatially the three components into a "site" need to be articulated. Must foraging habitat be within 10 meters, 100 meters, or 1 kilometer from interception and food producing habitat to be usable? Must habitat component (factors) be contiguous or can there be spatial separation between components (that is, must foraging habitat be contiguous with food producing habitat)? These spatial definitions of an IRC site are necessary for consistency before designing, constructing, and evaluating IRC sites.

Even if the operational criteria above were specified, IRCs remain an unproven biological concept. The DEIS does not mention whether there may be existing sites that meet the operational definition and would be labeled an IRC site. Instead, the preferred alternative focuses on the construction of several new IRC sites, followed by monitoring and assessment of these sites compared to selected control sites. If there are existing IRC sites that meet the criteria, however, it may be more epistemologically effective to focus initial studies on those sites to demonstrate the effectiveness of the concept before scaling up IRCs to a larger program.

Significance

Medium.

Recommendation for Resolution

1. The MRRP monitoring program will focus on the interception habitat component that contributes to the overall extent and quality of habitat for pallid sturgeon, whereas the food-producing and foraging habitat components are already being studied under the HAMP effort. It would be valuable to convey how those separate management-support agendas can be integrated for purposes of supporting management actions and monitoring that comprehensively addresses testing of IRC function.
2. The DEIS should include discussion of existing IRC sites and elaborate on the desirability and status of stepped studies that may utilize these existing sites.

USACE/PDT Response

Concur with recommendations.

We agree that the IRC concept is a hypothesis and needs to be tested and improved. Whether HAMP operates in the future to improve the process understanding in IRCs or another science program emerges, the Level 1 and 2 science components described in Appendix C under Lower River Big Question 3 have been designed specifically to address questions raised in this comment. Components 2-6 provide the basis for integrating interception, food, and foraging processes. As that knowledge increases we can anticipate that monitoring requirements will also change. For example, if food is demonstrated not to be a constraint on age-1 recruitment, it can be dropped from monitoring consideration.

We will amend the EIS text to clarify that the standardized 2-dimensional hydrodynamic models to be deployed in IRCs will be used to predict areas of food-producing and foraging habitats (measured in acre-days/year during the growing season) and the transport vectors that provide the potential to a) intercept and transport free embryos to IRC sites and b) transport food items from production areas to foraging areas.

Sites with existing high CPUE of age-0 sturgeon have been identified and analysis to date has failed to produce clear indications of why they are successful. We believe this is because a more detailed look at transport phenomena is needed to understand the process. Expanded assessment of these "hot spots" is within the umbrella of Level 1 and 2 science components and may be pursued if resources are available.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #60, Sec 4.4.2, Accelerating the pace of learning

The long timeline that is estimated for evaluating certain priority hypotheses regarding essential pallid sturgeon-habitat relationships and the roles of specific environmental stressors in determining the species' status and population trends may reflect in part limited reliance in the effects analysis on data, findings, and inferences from other sturgeon in other river systems. Strong inference and lessons learned drawn from other systems might speed the advance toward Level 3 actions in certain management categories.

Basis for Comment

The Adaptive Management Plan and DEIS acknowledges that analysis and investigations of salient ecological and behavioral information on pallid sturgeon is limited by a paucity of relevant data. As part of the ongoing commitment to generate information that is necessary to guide management decisions, the technical team and research and monitoring agenda for the species needs to creatively engage information from studies of pallid sturgeon in the Mississippi River and draw strong inferences from other sturgeon species in analogous riverine systems worldwide. Such contributions could provide key information necessary to reduce the time to initiation of Level 3 actions by streamlining the process of resolving the uncertainties that confront pallid sturgeon resource managers.

Significance

Medium/High.

Recommendation for Resolution

Publications and reports by AM team participants indicate that the pallid sturgeon experts contributing to the MRRMP already explore and consider reports and studies on sturgeon species from outside the Missouri River basin. The Panel recommends that the pallid sturgeon team be provided adequate direction and support for further such efforts.

USACE/PDT Response

Concur with the recommendation. See response to Comment #57.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #61, Sec 4.4.3, Pallid sturgeon monitoring program targets and priorities

A monitoring program that will effectively measure pallid sturgeon response to management actions is still under-developed in the DEIS and SAMP. The current Pallid Sturgeon Population Assessment Project needs to be redesigned to address the Level 1 and 2 studies, spawning-habitat construction, early life-stage IRC construction, and propagation and augmentation. Assessment questions that fall outside of the current scope of the MRRMP research prioritization schedule should be vetted through the process as outlined in the Governance section. Similarly, new information must be vetted through the process outlined in the Governance section before changes are made to the revised monitoring program. For the MRRMP to be successful and use

reliable knowledge to make decisions, the program must have all aspects of the pallid sturgeon program focused on measuring a response to the management actions as they relate to the species objectives and targets defined in the DEIS. This is especially true given logistic and funding constraints.

Basis for Comment

Special interests can sometimes burden and distract a long-term research and monitoring program, especially one of this scope and magnitude.

Significance

Medium/High.

Recommendation for Resolution

1. Fully develop a monitoring plan this is focused specifically on evaluating management actions that are tied to the objectives and metrics outlined in the DEIS.
2. Ensure the governance process outlined in the SAMP is followed and adjusted if necessary to maintain stability and integrity of the long-term research and monitoring programs.

USACE/PDT Response

Concur with recommendations.

Modifications to the PSPAP are being considered as part of development of the Science and AM Plan. There will likely be tradeoffs among different objectives (i.e., status and trend monitoring, action effectiveness monitoring, ecosystem monitoring), and the team is doing a thorough evaluation of these tradeoffs. It is also important to note that not all actionable information will come from the PSPAP. Process-effectiveness monitoring designed for individual actions will provide additional information and will be supportive with the PSPAP population-level monitoring. We envision cost effective information acquisition to result from a well-planned intersection of research, process-effectiveness monitoring, and population-level monitoring. The AM plan governance process documents that science planning and prioritization will continue to be made in a transparent process with abundant opportunity for stakeholder, agency, and scientist input.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #62, Sec 4.4.3 and 4.4.4, Need reference to objectives and targets

There is no clear connection between the material in the monitoring and evaluation sections (4.4.3 and 4.4.4) and the species objectives and targets outlined in Section 1.5.

Basis for Comment

There is no reference in Section 4.4 to the objectives and targets identified in Section 1.5. The fairly detailed discussion of monitoring and evaluation for adaptive management seems disconnected from the fundamental objectives and targets.

Significance

Medium.

Recommendation for Resolution

1. Make explicit reference in Section 4.4 to how management actions, evaluation, and monitoring relate back to the objectives stated in Section 1.5.

USACE/PDT Response

Concur with Recommendation.

It is not possible to put all of the details contained in the AMP into the DEIS. The connections between management actions, monitoring and evaluation are described in detail in sections 4.2.5 and 4.2.6 of the AM Plan, and can be made more clear in the DEIS.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #63, Sec 4.4.5, Identification and validation of surrogates and proxy measures

At the outset of implementing the research and monitoring features of the MRRMP, a concurrent, focused effort is needed to identify, resolve, and validate indicators or proxy measures that can serve as simple surrogates for environmental changes of concern to resource managers on the Missouri River.

Basis for Comment

Directly measuring pallid sturgeon population dynamics and the extent and quality of its habitat will remain challenging for years to come. Researchers on the Missouri River have frequently used surrogates and have drawn strong inferences, particularly from the ecology and behavior of shovelnose sturgeon, and applied them toward management planning for pallid sturgeon. Proposed research and monitoring for pallid sturgeon should prioritize both research and monitoring that supports timely identification of well-supported proxy environmental metrics that can be used to manage pallid sturgeon in the near term. Resolving the environmental correlates of landscape occupancy by pallid sturgeon needs to be an objective in all studies on the river, by way of identifying particular species-based and habitat-based surrogates that may be non-invasive and effective in assessments of the rare and elusive pallid sturgeon. Such correlates well might provide economical environmental metrics useful in the fish's management.

Significance

Medium/High.

Recommendation for Resolution

1. Draw guidance from a growing literature that presents study designs that have been used to gather data and analyze them for the purpose of identifying and validating surrogates and proxy measures that can be used in an adaptive management framework to create sampling efficiencies and reduce costs of monitoring.

   One example:
   Murphy, DD, PS Weiland and KW Cummins (2011) A critical assessment of the use of surrogate species in conservation planning in the Sacramento-San Joaquin Delta, California (U.S.A.). Conservation Biology 25:873-878.

USACE/PDT Response

Concur with recommendation, clarification provided.

The EA and AM teams are open to such guidance, and will highlight the concept, referencing relevant literature. It is indeed helpful to gradually develop reliable habitat measures as surrogates, which has been done in other AM programs (e.g., the Trinity River Restoration Program uses estimates of the area of suitable habitat for Chinook salmon fry as a key proxy measure, based on measures of depth, velocity, substrate and presence of cover). We would further note that much of habitat surrogates – that is assumed habitat affinities and requirements – have been fundamental to the definition of spawning, interception, food-producing, and foraging habitats.

- For piping plovers, the area of ESH is a proxy performance measure, which builds on published models that incorporate functional relationships between habitat proxy measures and bird population parameters relating to production and survival.
- For pallid sturgeon, there are many proxy habitat performance measures described for monitoring IRCs and spawning habitat, as described in sections 4.2.6.3.5, 4.2.6.4.5, and 4.2.6.5.5 of the AM Plan. These sections will be referenced in the EIS. However, the rarity of pallid sturgeon makes it much more difficult to develop reliable habitat proxies for this species. The definitions of suitable habitat proxies for IRCs rely primarily on observations of shovelnose age-0 fish, as a surrogate for pallid sturgeon age-0 fish. As monitoring proceeds on Level 1 observational studies, Level 2 in-river actions, and PSPAP monitoring, more data will accumulate to develop reliable habitat correlates of population presence for both IRCs and spawning habitat.
- It is not clear what other fish species would be appropriate surrogate species for pallid sturgeon responses to habitat creation. At a recent workshop at MRNRC, forage fish have been mentioned as a possible objective for the PSPAP, but this is more related to other fish management objectives than as a surrogate for pallid sturgeon.

IEPR Panel Back-Check Response

Concur with USACE response, further consideration needed in site-specific environmental assessments and/or as adaptive management is implemented

The fish- and bird-focused technical teams advising the adaptive management program should take on the identification of validated surrogates and proxy measures as a standing task as part of their deliberations and advisory tasking.

Panel Comment #64, Sec 4.5.1, Flows modeling and ESH

With implementation of the *Science and Adaptive Management Plan* as illustrated in Figure 4-7 there is a need to expand on modeling efforts relating hydrology to the availability of Emergent Sandbar Habitat, which was limited to a narrow range of flows.

Basis for Comment

Time pressure on delivery of the effects analysis that supported the *Science and Adaptive Management Plan* limited the hydrological and population demographic modeling efforts that could be carried out to consideration of a rather small subset of useful and reasonable flow parameters. Accordingly, much of the decision space relating flows to emergent sandbar habitat (ESH) has yet to be explored. Initial research and modeling activities relating piping plovers and

least terns, in-channel habitat creation and persistence, and river flows should expand on that previously limited modeling effort.

Significance

Medium/High.

Recommendation for Resolution

1. Additional hydrological and population modeling efforts in the context of adaptive management for the birds could suggest more efficient means of utilizing managed flows for ESH creation and maintenance.

USACE/PDT Response

Concur with recommendation.

Additional hydrological and population modeling will be developed as part of the ongoing EA/AM science processes and will be reported accordingly.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #65, Sec 4.5.4.2, ESH availability and exceedances

Figure 4-8 in Section 4.5.4.2 incorporates more information than can be effectively conveyed, and consequently loses the simplicity and clarity that one desires in a graphic.

Basis for Comment

The figure attempts to demonstrate the concept of exceedance for ESH availability and also incorporates information for standardized ESH using the same graphic components (arrows) to delimit the decision spaces for each habitat category. The two habitat categories and eight arrows are confusing. It might serve clarity to use cross hatching/shading to delimit each of the four two-dimensional decision spaces, and perhaps deal with standardized habitat on a separate graphic.

Significance

Medium.

Recommendation for Resolution

1. Revise the graphic, perhaps using more than one illustration, to clarify the separate concepts of availability, exceedance, and standardized habitat.

USACE/PDT Response

Concur with recommendation.

This graphic is being revised for clarity similar to what is suggested in the above comment

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #66, Sec 4.6, Clarifications relating to governance

Several points made in the Section 4.6, Governance of adaptive management, require clarification

Basis for Comment

1 – on page 4-27 – The relationship between MRRIC recommendations and the work plan are unclear. For example, if MRRIC provides a recommendation at a June meeting one year, will that recommendation be incorporated into the work plan that begins October 1 of the same year? By when and in what forum will MRRIC learn if a recommendation will or will not be incorporated into the work plan?

2 – page 4-29 – It is unclear what "the System" refers in the following sentence, "Reporting will include annual reporting of the state of the System." Is it the hydrological and ecological conditions of the Missouri River ecosystems within the defined MRRMP planning area?

3 – page 4 -29 – The pathway to realize this intent – "The annual reports would be made available to the management team, agency leadership, MRRIC, and the Independent Science Advisory Panel for their review and recommendations" – is unclear. Explain how long each of these groups would have to make their review and recommendations, in what form, and to whom.

Significance

Medium.

Recommendation for Resolution

1. Clarify the relationship between MRRIC recommendations and the work plan.
2. Clarify the sentence on Page 4-29 regarding the use of the word "system".
3. Explain how long each of the various groups would have to undertake their review and provide recommendations and to whom these would be transmitted.

USACE/PDT Response

Concur with Recommendation.

1. Section 2.4.4 of the AMP describes the Work Plan as a 5 year strategic Plan that is focused on strategic planning for FY+2 and beyond. We will add clarifying language and Figure 19 from the AMP to Chapter 4 of the EIS.
2. Clarification of sentence will be made. See section 6.2.3 of AMP: System status refers to conditions of the reservoir system, riverine segments, and affected resources. Status measures include primary measures such as tributary inflows, reservoir storage levels, outflows (discharges and stages), channel condition, sediment transport, and water quality parameters…
3. We will provide a summary of this in the EIS, but refer the reader to the AMP for details. The Annual Strategic Review process described in the AMP (Section 2.4.3.3) explains the focus of the Work Plan (FY+2…). The timing of meetings and documents is under development, but the current Process Map carries the timing and details developed to date.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #67, Sec 4.6, Administrator and staff skills and expertise

The *Science and Adaptive Management Plan* needs to describe the multiple forms of technical support in administration and staffing, especially areas of expertise of participants at the level of technical and species teams.

Basis for Comment

The institutional governance structure offered in the MRRMP-EIS and supporting adaptive management documents constitutes a substantive departure from the Corps' command-and control decision process, and is likely to stress and even confound the organization. As reviews of the effects analysis and supporting documents previously advised, adaptive management

under the MRRMP needs a champion at the highest administrative level in the Corps in the Missouri River basin. Successful adaptive management also needs program managers who are committed students of adaptive management approaches and structured decision-making, and just as important, technical staff who are quantitatively competent in issues of sampling design, data collection, and data interpretation. Simply adopting new decision-making constructs and proposing information transfer routes is insufficient for the effective implementation of the MRRMP. The infusion of adaptive management thinking into all organizational levels is required to successfully employ structured decision-making for managing resources at the scale and complexity of the Missouri River.

Significance

Medium/High.

Recommendation for Resolution

1. The SAMP should describe in greater detail the more detailed skill sets and expertise that should be expected of administrators and staff serving essential roles in the governance and implementation of the MRRMP.

USACE/PDT Response

Concur with recommendation.

Section 2.3 of the SAMP will be updated to expand upon the skillsets and technical competencies needed for the Implementation-level teams (2.3.2) and Technical Team (2.3.3). It also will describe a plan to expand the District capabilities in these areas. Similar descriptions and details will be added for the Science Panels (2.3.7.3) and the technical skills and demands of the MRRIC Bird, Fish and HC WGs will be revised.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #68, Sec 4.6.1, Regarding data management

The data management system (DMS) described in the DEIS and SAMP suggests that substantial progress has been made in addressing the data needs for implementing a complex adaptive management program.

Basis for Comment

SAMP Figure 96 and Table 56, as well as the supporting discussion of the proposed DMS in the DEIS, underscore the progress made in this key component of the adaptive management program

for the Missouri River. Working backwards from an insightful analysis of user needs, the design of the DMS reflects a system that appears to effectively address concerns expressed in reviews of previous versions of the DMS chapter in the *Science and Adaptive Management Plan*. Table 56 appears particularly useful in describing specific user needs and accommodating DMS activities, from data analysis, to documentation, and reporting.

The success of the AM program for the Missouri River will be largely determined by the nature, sophistication, and execution of the DMS and supporting data management activities.

Significance

Medium/High.

Recommendation for Resolution

Explain what processes will be put in place to implement the DMS that is detailed in Chapter 6 of the *Science and Adaptive Management Plan.*

USACE/PDT Response

Concur with Recommendation

The Data Management System described in Chapter 6 is in draft form and will likely continue to be shaped by user need discussions. Text elaborating processes that would be put in place to implement the DMS will be added to the AMP.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #69, Sec 4.7, The decision space available after human considerations

Regarding management opportunities under adaptive management, the *Science and Adaptive Management Plan* well describes a potentially useful and effective adaptive management program. However, there remains a concern that complying with mandates for human considerations (which are not particularly flexible or adaptable) will leave little opportunity for meaningful implementation of management actions selected to benefit the listed species and Missouri River ecosystems.

Basis for Comment

Demands and mandates regarding flood control, commercial navigation, recreation, commercial dredging, and other human use considerations have contributed to the current status and trends of the listed species, particularly the pallid sturgeon. The AM Plan credibly addresses these constraints as they influence the design and implementation of possible management actions undertaken to benefit the species. Yet there remains the need for more detailed analysis that demonstrates the possibility (better, the likelihood) of achieving the listed species goals and objectives, while simultaneously complying with human use considerations.

If the solution space of this multi-dimensional optimization problem is effectively the null set, it would be good to know this before significant resources are directed towards standing up an AM program for the Missouri River. It might well prove that despite the existence of scientifically defensible and well-intentioned management actions, current institutional constraints will preclude meaningful implementation of adaptive management.

Significance

High.

Recommendation for Resolution

1. The DEIS should clearly state and support with explicit reference in the SAMP that implementation of adaptive management is institutionally feasible, given current obligations concerning human considerations.

USACE/PDT Response

Non-Concur with Recommendation.

The concerns stated by the Panel are legitimate. The structure of the AM Plan allows for revisions of actions, and new actions if those specified in the DEIS are insufficient. It is true that obligations regarding human considerations must be considered in decisions whether to implement management actions aimed at benefiting endangered species, and this limits the set of management options. It has yet to be shown, however, that adaptive management is not feasible because of human considerations. The agencies believe that adaptive management is institutionally feasible and the best path forward for endangered species management on the Missouri River – hence the high level of effort the agencies (and MRRIC) have expended in designing a progressive Science and Adaptive Management Plan for the MRRP.

IEPR Panel Back-Check Response

Concur with USACE response, further consideration needed in site-specific environmental assessments and/or as adaptive management is implemented

It would seem that the major concerns lie with proposed management actions that involve alterations of flows. It remains unclear whether the timing, frequency, magnitudes, and durations of flow events constrained by human considerations (e.g., flood protection, navigation, hydropower, etc.) permit implementation of flow regimes sufficient to elicit a species response, particularly for pallid sturgeon.

Panel Comment #70, Sec 4.7, Monitoring for human considerations

It is not clear how the high- and medium-priority ratings for Human Considerations monitoring were determined in the SAMP.

Basis for Comment

In the SAMP in Figure 90 (on page 445) high-priority ratings with an Overall Study Value/Cost of .03 are shown, but there are medium-priority ratings with the same .03 Overall Study Value/Cost. There is another column with Overall Importance that suggests perhaps that is the variable that is the deciding factor. There is a "Look up Table" (Figure 89) in which the Overall Importance and Study Effectiveness are combined into another value. It is not clear which of these factors or combination of factors is used to set the final column, Priority for HC monitoring.

Significance

Medium. The reasonableness and clarity of the Figure 90 and the justification for what is to be a priority Human Consideration to monitor would be improved by a clear explanation of what factors led to the Priority rating.

Recommendation for Resolution

1. Provide an explanation in the text prior to Figure 90 explaining how the Priority rating was determined.

USACE/PDT Response

Concur with recommendation.

The Relative Value of Information column is calculated as the ratio of Overall Study Value to cost, as described in the SAMP. The priority in the final column is strongly influenced by this

ratio, but incorporates other considerations as well, including the number of sectors affected by the consideration, the degree of interest in the topic expressed by stakeholders, and sequencing of studies to optimize learning opportunities. The authors applied subjective judgement to arrive at the proposed classification in the final column. This adjustment should have been more clearly explained and justified in the text, and will be explained in the final version of the SAMP.

The methodology is imperfect and needs further development. In particular, it does not handle well the differences between the proposals for the Preferred Alternative and those for situations outside it. The methodology was intended to be a *starting point for discussion* between the USACE and the HC Team. As noted in Section 5.5.3 (page 443), "This initial screening exercise was executed by the AM Team with input from the 12 technical specialists working on the EIS and that developed the EA. It is intended to provide the HC Team with a starting point for their efforts and to provide the agencies with an early estimate of monitoring needs and costs for planning and budgeting purposes. It is understood that the HC Team will revisit and revise/refine this list using more complete information and with broader input so that they can make sound recommendations to the Management Team."

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #71, H&H Technical Report, Model verification

H&H Tech Report, p. 10: "flows were corrected to current level depletions….comparison of model results …to observed conditions is not possible." It is not clear what this means in terms of absolute model accuracy and implications for interpreting results of hydrologic simulations of POR in relation to management alternatives.

Basis for Comment

There has been considerable interest and possible confusion concerning the verification and "validation" of the ResSim and RAS models.

Significance

Medium. It is not clear how to evaluate the H&H model results in relation to the management alternatives.

Recommendation for Resolution

Incorporate selected and key calibration/verification/validation results into revised EIS and/or H&H Tech Document.

USACE/PDT Response

Concur with recommendation.

The referenced text is accurate and is, to the best of our knowledge, stated consistently in multiple locations within the EIS report (e.g. Executive Summary pg xiii, etc.). Extensive calibration was performed of both the HEC-RAS and HEC-ResSim models prior to model simulation for alternative analysis. Calibration information is contained in the HEC-RAS and HEC-ResSim Calibration Reports that were provided as supporting reports. To better convey this effort, the last sentence of section 2.4.1, pg 2-11 will be removed and replaced with:

Refer to the collection of supporting Hydrology and Hydraulics Technical Reports, previously listed on page xxxviii of the executive summary, for additional information (available online at www.moriverrecovery.org). The Summary of Hydrologic Analysis Report provides an overview of technical analysis efforts. The Time Series Development for Hydrologic Modeling report provides details regarding the assembly of model flow data. The HEC-ResSim Modeling Report describes the development of the model in detail including scripting rules and calibration. The Mainstem Missouri River Reservoir Simulation Alternatives Technical Report describes the modeling of the alternatives with HEC-ResSim. The Climate Change Assessment – Missouri River Basin report provides details regarding how climate change may affect future hydrologic conditions and an overview of potential affects.

The following will be inserted at the end of section 2.4.2, pg 2-12:

Refer to the collection of supporting Hydrology and Hydraulics Technical Reports, previously listed on page xxxviii of the Executive Summary, for additional information (available online at www.moriverrecovery.org). The Summary of Hydrologic Analysis Report provides an overview of technical analysis efforts. The HEC-RAS Calibration Report provides details regarding HEC-RAS model construction and calibration for all model locations. The HEC-RAS Alternatives Report provides details regarding simulation of alternatives with all HEC-RAS models.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #72, H&H Technical Report, Model improvement

H&H Tech Report, p. 24: Quality Control. The overall discussion of H&H model strengths and limitations, with the emphasis on using the model to characterize differences between No Action and other proposed alternatives, lends confidence that the models were developed, evaluated, and

applied using best available science. However, it would be useful to summarize at least some of the details concerning ResSim and HecRas model calibrations within the main text of the DEIS.

Basis for Comment

Overall, within recognized limitations outlined in Appendix D, the H&H models appear to reflect state of the science. Nevertheless, considerable efforts devoted to model construction, calibration, and evaluation are provided in USACE reports (e.g., USACE 2015a), as cited in Appendix D. The results of this considerable effort are not readily apparent in the DEIS.

Significance

Medium. The H&H models, as described in the DEIS, should provide for useful evaluations of the outcomes of the proposed management alternatives compared to the No Action alternative. Yet, it would prove useful to have ready access in the DEIS to a summary of model performance evaluations that underscore the accuracy and precision of model results used to characterize differences among management alternatives.

Recommendation for Resolution

Continued development and improvement of the models as needs change and opportunities arise. Provide a summary table or description of model performance (e.g., calibration success) and corresponding model accuracy and precision.

USACE/PDT Response

Non-concur with recommendation.

Calibration information is contained in the HEC-RAS and HEC-ResSim Calibration Reports that were provided, see additional text that will be inserted into the document as described in comment #71. Due to the large number of HEC-RAS and ResSim models, it is not feasible to provide a condensed summary of calibration results within the confines of reasonable EIS content. While model calibration is of interest to H&H specialists, the typical EIS reader does not have interest in those technical details. For that reason, the EIS document was structured to maintain all of the technical H&H documentation in a separate suite of documents. This structure provides an H&H technical focus rather than diluted within the large EIS document.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Comment #73, Appendix D

The information presented in the DEIS, including Appendix D, is unclear regarding how the data from the 82 yr. POR were used to perform simulations of the 6 alternatives.

Basis for Comment

Appendix D goes into detail about how the specific 82 years were decided upon, as well as how some statistics characterizing the POR (i.e., the 10th, 50th, and 90th percentiles) were computed and used. However, some key details concerning how the POR data were actually used in simulations to compare alternatives are missing. Specifically:

1) Were the same POR data, from the same years, selected in the same sequence, used to analyze and compare all alternatives?

2) Were all 82 years of data used in the simulations?

3) Were the stage and flow data for a given year in the simulation selected randomly from a frequency distribution, or did the simulation use the POR data in the same sequence as they occurred (e.g., beginning with year 1931, then continuing in sequence through all years until 2012?

4) Was temporal autocorrelation among years adequately represented in the POR data used for simulations?

Significance

Medium/Low. The use of observed POR data to form the basis of simulations is a fundamental aspect of the environmental assessment and should be clearly described.

Recommendation for Resolution

Add additional explanations in the appropriate sections of the DEIS to address the questions above.

USACE/PDT Response

Concur with recommendation.

The title of the appendix is confusing with other H&H documents that are separate reports. The appendix will be renamed to “Summary of Hydrologic Statistics for Alternatives.” Within the Appendix D text (Vol 4 DEIS, pg. 1), the following will be inserted at the end of the first paragraph:

All presented results were derived from HEC-RAS and HEC-ResSim modeling results. This appendix provides only a summary of alternative analysis hydrologic statistics. Refer to the

following reports for more information on the development of the period of record flows that were used in the HEC-ResSim and HEC-RAS analysis: Summary of Hydrologic Analysis and Time Series Development for Hydrologic Modeling.

IEPR Panel Back-Check Response

Concur and satisfied with USACE response

Panel Minor Comments

The IEPR Panel offers these "minor comments" that do not rise to the level of four-part comments, but that may be helpful to the USACE in improving the DEIS. USACE response to these comments is not expected.

1) Exec. Summary, Pages xii – xiii: Explain how the 2012 cross sections were revised, or what decision rules guided the revisions; include a brief overview of this explanation here in the executive summary.
2) Exec. Summary, Page xiii: Paragraph 5, last sentence, meaning of projected water use from 1931 is unclear – what does this sentence mean? Add an explanation.
3) Exec. Summary, Page xvi, Paragraph 2: The generation of methane as an air quality concern is substantial in tropical lakes, much less so in higher latitudes. Address where the Missouri River lakes fall on this continuum, especially if methane production is not an issue.
4) Exec. Summary, Page xix, Paragraph 3: Explain how much of the irrigated cropland receives water from the river as separate from groundwater? The answer gives a useful view of the background for the DEIS.
5) Exec. Summary, Page xix, Paragraph 2: It is unclear how reservoir operations are simulated over the period of record (POR). Did the simulations assume that all dams were in place during the entire POR, or did the simulations operate with historically correct influence of dams (no dams in the early 1930s, with new dams added to the simulation at the dates when they were completed. Add a clear statement.
6) Exec. Summary, Page xxiv, Paragraph 3: "A total of 13 levee systems comprised of 20 levee districts protect over 310,000 acres of floodplain. Nineteen of these levees were federally constructed." Nineteen of what levees? We do not know how many levees there are since the initial sentence focuses only on systems and districts. Include the total number of levees in the first sentence.

7) Section 1.0, Purpose need and problem definition - Page 1-12: There is some potential for confusion about Figure 1-6. Simplified Depiction of the Adaptive Management Process. Intuitively one would expect the last step “Complete” be the highest number 5B and not 5A. It is not uncommon for the adaptive management process to be depicted as a continuous loop.
8) Section 1.3.2, Page 1-17, last sentences: Surely reduced sediment supply is a major issue in the loss of sandbars and complexes since we know sediment supply from many tributaries has declined and much has been trapped behind dams on the main stem. What sediment is in the lower river also is less useful because of reduced sediment transport related to reduced peak flows of water to accomplish the transport. Add "reduced sediment supply" to the sentence.
9) Page 2-4: (Figure 2-2) Why not use the CEMs and models developed in the documents that are directly related to this process?
10) Section Page 2-12, second para: The stated purpose of the HEC-RAS models is to closely represent current conditions -- how close is "close?" Do we want the models to predict specific conditions on a given day, or do we want the frequency distributions of predictions of certain variables (say, velocity) to duplicate the observed frequency distributions? Add statements to explain how the models would be used to represent current conditions.
11) Section 2.4.2, Page 2-14, next to last sentence on the page: The amount of habitat is said here to be a function of flow releases and area of ambient ESH. Availability of new sediment would also be a factor, with additions from a large flood event or from tributaries. Add more commentary on sediment influxes.
12) Section 2.5.1.1, Pages 2-15 and 2-16: Information on these two pages is helpful, but section 2.5.1.2 on river reaches contains no cost information while section 2.5.1.3 on reservoir shorelines does have such data. The DEIS would be more consistent if the same approach were used in both sections. Add cost information to section 2.5.1.2, or explain why it is not available.
13) Section 2.5.1.13, Page 2-21, last paragraph: Widening channels would also have significant implications for the maintenance of the navigation channel because increased width would result in decreased depth of flows and reduced sediment transport capacity. These results would impinge on the authorized use of the channel for navigation.
14) Section 2.5.2.1, Page 2-25, Paragraph 2: This discussion of retention of embryos would be more complete if it were to include a discussion of the channel bed sediments and their role in interstitial trapping.
15) Section 2.5.2.3, Page 2-27: currently, The Bozeman Fish Technology Center does not raise pallid sturgeon for stocking.
16) Section 2.8 Plan alternatives - Page 2-54. Should it be complementary rather than complimentary in the following sentence? Under all plan alternatives, USACE would conduct the monitoring and assessment complimentary of that for which the Bureau of

Reclamation has responsibility to determine if modifications for fish passage at Intake Diversion Dam are meeting pallid sturgeon objectives.

17) Section 3.5.3.1, Page 2-28, Paragraph 2, and page 2-33, table 2-4, column 3: Use of the term "limiting" is inconsistent. On page 2-28, limiting factors are described by positive terms (such as conducive to attraction, provide for, promote) with respect to functioning and productive habitats. On page 2-33, limiting factors are described in negative terms (such as insufficient, inappropriate). If factors are limiting, they are negative, so the style used in the table is also correct for the text and bullet points on page 2-28, which might better read "lack of coarse substrate," absence of fine substrate areas," "inappropriate combinations of depth and velocity," "hydraulics that do not promote."
18) Section 2.8.1.1, Page 2-49, last para: It is unclear if the entire period of record is used for the calculations reported here, though the reader would assume so. Add a sentence indicating the period of data used for ESH estimates for alternatives.
19) Page 2-54. Should it be complementary rather than complimentary in the following sentence? Under all plan alternatives, USACE would conduct the monitoring and assessment complimentary of that for which the Bureau of Reclamation has responsibility to determine if modifications for fish passage at Intake Diversion Dam are meeting pallid sturgeon objectives.
20) Section 2.10.1.2, Page 2-91: Suggest having level 1 study of Yellowstone in upper river section as well.
21) Section 3.1.1, Page 3-4, next to last para: It is correct that the reservoir elevations fluctuate in response to alternatives, and that as stated here those fluctuations are smaller than changes caused by extreme hydrologic events. However, the text should also indicate that it is possible that alternatives may introduce changes that occur more frequently and with different ramping rates than what we see in natural events.
22) Section 3.1.3, Table 3-1, page 3-7: The cell in the table that is the intersection between the column "Water Supply" and the line "Groundwater Withdrawal Practices" does not contain an "X" but it should. The affected resource might be affected by cumulative action under some extreme hydroclimatic conditions by decreased streamflow that stimulates changes in groundwater use. Add an "X" to the table here.
23) Section 3.2.1.1, Figure 3-2, page 3-12: The figure has labels indicating "historic drought" periods. The label should simply read "drought" to avoid the label "historic" that makes the reader believe the drought in question is somehow special – an extreme "historic" event. The whole diagram is historic in any case, so drop that word from the label.
24) Section 3.2.1.1, Page 3-12, Paragraph 3: The evaporation rates are given in terms of feet of water lost from reservoir surfaces, typical for evaporation numbers. However, it is impossible to compare evaporation losses to the quantities of water stored in the system or to the amount that flows through the system. Add to the text translations of the evaporation numbers into MAF and compare these volumes to storage and mean annual flows.

25) Section 3.2.1.2, Page 3-13, first bullet para: The parenthetical phrase at the end that reads "(…flood control)" but it should read "(flood control zone)."
26) Section 3.2.1.3, Page 3-15, Paragraph 1: The next to final sentence incorrectly uses the terms "thalweg" and "primary flow channel." The thalweg is a line that connects each of the lowest points on successive downstream cross sections. Because the thalweg is a line, it has no width. The channel referred to in the text is the low flow channel. Therefore the next to last sentence should read "The low flow channel was narrow with highly variable location and depth.
27) Section 3.2.1.3, Figure 3-5, page 3-17: The figure caption indicates the location of the image as "17 miles upstream of Lewis and Clark Lake." It should read "17 miles upstream from Gavins Point Dam."
28) Section 3.2.1.4, Page 3-21, Paragraph 5: The statement that sediment eroded from deltas to be deposited further downstream in the reservoir is true, as far as it goes for coarse materials, but fine sediments are also significant. The text should be changed to indicate that fine sediments in suspension as wash load move all the way to the dam.
29) Section 3.2.1.4, Page 3-21, Paragraph 6: The text indicates that tributary deltas form when the Missouri River is insufficiently high to remove the delta materials. In fact, sediment moves from tributary deltas to the main river whenever there is flow in the tributary. The main river aggrades when the main stream flow is not great enough to remove the added sediments. Rewrite this part of the text clearly separating tributary and main stream processes.
30) Section 3.2.1.4, Page 3-22, final para: Coastal geomorphology recognizes "beach slope" as a specific landform component as part of the beach where wave swash forms the surface that has a slope determined by wave energy. Therefore, the second sentence of the Paragraph should read "The majority of eroded material usually remains immediately off shore, forming a flat shelf."
31) Section 3.2.1.4, Page 3-23, first para: The first sentence refers to the "size of the ice cover." This phrase should be more precise, and should read "depth and extent of ice cover."
32) Section 3.2.2.1, Page 3-24: Paragraph 3: This statistical discussion is helpful, but it mixes up the ideas of "average" and "median." The 50th percentile is the median that is a proxy for the idea of "average." Rewrite the sentence to include the idea of median, and point out that the median is rarely the same as the average in hydrologic measures.
33) Section 3.2.2.4, Page 3-43: The third bullet contains an explanation based on the connections whereby a lowering stage results in erosion. The section should remind readers at this point that such erosion is also a hazard for the continuation of constructed ESH.
34) Section 3.2.2.4, Page 3-45, Paragraph 1: This paragraph does not address variation in precipitation as a result of climate variation (not climate change) and 5 to 10 year cycles of the precipitation regime of the basin.

35) Section 3.2.2.5, Page 3-47, Paragraph 1 of section 3.2.2.6: This paragraph discusses the link between higher river stages and higher groundwater levels, and is correct as far as it goes. The paragraph is incomplete, however, because it does not mention that river stages are higher in part because of channel projects that have restricted channel width. When width declines by constriction, stage height increases. Add a sentence to the paragraph to add this point.
36) Section 3.2.2.6, Page 3-53, Paragraph 2: This paragraph discusses aggradation and degradation in the river channel as influenced by dams and reservoirs. In the discussion of degradation downstream of Gavins Point Dam and its role as sediment transporter is correct, but it should include a statement indicating that the influence of the dam is greatest close to the dam, and as distance downstream increases, the influence of the dam declines. Add such a statement to the end of the paragraph.
37) Page 3-58: (Table 3-6) Sexual maturity values seem a bit off, especially for pallid sturgeon in the upper Missouri River.
38) Page 3-59: (Adult Life Stage, first paragraph) The Keenlyne and Jenkins (1993) work is outdated, refer to DeLonay or Webb.
39) Page 3-59: (Adult Life Stage, first paragraph) Pallid sturgeon do not have consistent upstream migration before spawning in the upper Missouri River.
40) Page 3-63: (Food-Producing Habitat) Chironomidae are also found in sand habitat.
41) Table 3-8: (Alternative 3) Suggest having text after spawning sites that refers to the uncertainty like that presented for SWH in Alternative 2.
42) Page 3-68: (Monitoring and evaluation of recruitment) Seems odd that this only refers to actions at Intake, why not for the entire Missouri River given the overall objectives are related to recruitment.
43) Page 3-76: "Construction of IRC is anticipated to result in long-term benefits to pallid sturgeon; however, the benefits of IRCs to age-0 pallid sturgeon are uncertain, compared to other habitats or management actions." This sentence seems odd because the global hypothesis is that the bottleneck is at the age-0 life stage and that is what limits population growth. Thus, how can IRCs benefit sturgeon long-term if they don't address the early life-history bottleneck? The first part of this sentence is similar to what has been done for decades, that is, it must be good for something so continue to build it. Similar wording to the highlighted sentence here is found in other sections.
44) Page 3-79: (Fall Reservoir Release for ESH Creation) "Specific impacts on pallid sturgeon from a fall reservoir release for ESH creation are not known. Increased flows during the fall would be contrary to the pattern of the natural hydrograph; however, no evidence exists to suggest a fall reservoir release would adversely affect pallid sturgeon." This logic in this sentence is not parallel with the logic regarding spring pulse and floodplain connectivity. That is, you use historical conditions to support the need for spring pulse and floodplain connectivity, but here you ignore historical conditions. It

seems you are subjectively picking when to argue for or against historical conditions that influence pallid sturgeon life-history needs.

45) Section 3.8 Air Quality - On page 3-207 the word "in" should appear between increases and emissions in the following sentence. “The increases emissions would not be expected to be high enough to result in any areas entering non-attainment for any NAAQS parameters and would contribute no or negligible impacts in areas that are currently designated as non-attainment for any NAAQS parameters.”
46) Page 4-10: I still struggle with the terminology “Implementation monitoring.”
47) Page 4-11: “Survival of hatchery-reared first-feeding pallid sturgeon larvae in IRCs, refurbished SWH, thalweg, and to age-1” Are larvae going to be stocked in the river? This statement is a bit confusing to me.
48) Page 4-11: “Mesocosm and field-inferred benefit of achieved pulse” I don’t follow this and am not convinced mesocosm studies can be used to evaluate a response by pallid sturgeon to a pulse.
49) Figure 4-6 (on page 4-16) of a decision workflow plan appears to be new and warrants some fine-tuning (re-mapping of confusing back-crossing arrows, etc.). The chart could be useful if it is made more straightforward and intuitive.
50) Section 5 Tribal agencies and public involvement - Page 5-1. The header for this section does not completely cover the content of the section. More accurately the section header should be MRRIC, Tribal, Agency, and Public Involvement
51) Section 6.0 Compliance with other environmental laws - There is uneven treatment of the various environmental laws. For example relevant dates are provided for some acts and not others. The date of legislation is provided for The American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996) (page 6-4), The Rivers and Harbors Appropriation Act of 1899 (page 6-6), salient federal laws related to tribal water rights relating to 1908 and 1963 court cases (page 6-4 to 6-5), Executive Order 12898 Federal Actions to Address Environmental Justice in Minority and Low Income Populations Executive Order 12898, passed in 1994, (page 6-5), the 1977 and 1990 Amendments to the Clean Air Act (page 6-6), and the designation in 1978 and 1991 respectively of The Missouri River National Recreational River (MNRR) 59-mile and 39-mile reaches under the Wild and Scenic Rivers Act (page 6-6). No date is provided for all of the legislation, including the original passage of the Wild and Scenic Rivers Act and Clean Air Act.

Addendum

During the question and answer session following the Panel's presentation of the draft IEPR Report on May 23, 2017, as well as during the remainder of the May 23-25 MRRIC Plenary meeting, comments or questions were raised by MRRIC members regarding several of the Panel's conclusions in the draft Report. This addendum reflects the Panel's responses to those comments for which it thought clarification or additional comment would be helpful. The addendum also includes a new 4-part comment on impacts to navigation based on comments received at the MRRIC meeting and a follow-up call that one Panel member had with the Corps on June 2. This is followed by a Corps response and Panel back-check on the new comment.

1. What the comment significance level indicates. The significance level of Panel comments does not indicate how important the Panel felt the *resource* was. Rather, the significance level indicates what the Panel judged the importance of the issue is to assuring achievement of the goals of the DEIS and the SAMP (avoiding jeopardy to the three listed species while minimizing the impact on human considerations). See also the table defining significance levels at the end of the Work Plan, Appendix A of this report.

2. Consistency with NEPA requirements. The Panel stated that the DEIS was consistent with the requirements of the National Environmental Policy Act (NEPA). This conclusion was based on several Panel members' experience with peer reviewing other EISs for agencies including the USACE, or serving as participants in preparing other EISs and reviewing the Council on Environmental Quality's (CEQ) checklist. The Panel's conclusion of consistency should not to be interpreted as a legal opinion.

3. Alternatives Development. MRRIC charge question #1 asked whether the DEIS sufficiently explained the tradeoffs analysis used to construct management alternatives and select a preferred alternative. In response to the IEPR assessment of this charge, a MRRIC member questioned the characterization of MRRIC's participation in defining the alternatives presented in the DEIS, including the preferred alternative. The Panel acknowledged in its Comment #22 that MRRIC was not directly engaged in formulating the specific alternatives described in the DEIS or evaluating tradeoffs among them. The Panel, however, did observe that MRRIC actively participated in evaluating test alternatives and subsequent revisions thereof during proxy analyses of consequences and tradeoffs at formal MRRIC meetings. MRRIC as a whole and its individual members had multiple opportunities and took them to critique or recommend alternatives as part of the tradeoff analyses at those meetings. Nevertheless, the Panel respects the member's assertion that opportunities to directly influence the final design of the alternatives presented in the DEIS could be characterized as minimal. Going forward, the Panel recommends that MRRIC take advantage of opportunities afforded during adaptive

management implementation to influence further formulation and then evaluation of management alternatives as they are implemented in the adaptive management process.

4. Navigation on the Missouri River. See new four-part comment below.

5. Navigation on the Mississippi River. The Mississippi navigation section does not follow formal NED or RED protocols and, in particular, it omits any measurement of water compelled rates. The Panel recognizes that the simulated impacts of the various management alternatives on flows in the Mississippi are extremely small and that staff time is limited. However, it is possible that a low-flow scenario coupled with low flows from tributaries could impact Mississippi navigation. Given the limited number of flow scenarios that were modelled, this outcome may have been missed from the simulated results. The Corps has agreed to conduct a more rigorous flood risk analysis in the event that it considers high flows in the future. The Panel recommends that impacts on Mississippi navigation similarly be re-evaluated should low flows become a serious consideration.

6. Interior Drainage. A MRRIC member suggested that the DEIS current economic analysis estimates of dollar values for each of just four sites understated the total impacts throughout the study area of the DEIS alternatives. The Panel suggests that these dollar value results for the four sites be presented on a per acre basis and that the average per acre amount across each of the four selected areas be multiplied by the total number of acres in the basin that may be impacted. This should give a better sense of the economic importance of this issue.

7. Connection of Interior Drainage and Land Use. A MRRIC member commented that there was a link between impacts to the interior drainage and land use. He also provided his written comments (on the DEIS) which delivered more detail; in particular, he observed that high river flows impede interior drainage and as such may delay planting of crops, alter which crop is planted, reduce yields, and/or delay harvesting of crops. Since agriculture is the major land use of the project area, this could affect the amounts generated by several taxes, including local sales tax. The Panel agrees that lack of interior drainage could affect crop production, and hence local economic activity derived from agricultural operations (e.g., purchases of seed, fertilizer). The Panel suggests that this potential effect should at least be acknowledged in the EIS analysis. The Corps should use the results of the calculations of total economic effects identified in the interior drainage comment above (dollar value per acre from the four sites, times the total number of acres of cropland) to perform a sensitivity analysis of associated potential losses in local sales tax revenue and state income tax revenue for the relevant states in the basin that are affected.

8. Land Use. MRRIC members suggested that the loss of property taxes was not fully compensated for by PILT. Furthermore, the losses in property taxes had a disproportionately large impact in counties with small populations. Accordingly, the Panel suggests that the land use property tax impacts also should be expressed on a per capita basis for the counties or areas that are modeled.

Additional Panel Comment, Economic impacts of high/low flows on navigation

Impacts of high or low flows on river transportation savings are estimated (from Section 2.3, pp 8-15 of the Navigation Technical Report) as follows. Commodity-specific transportation savings from the early 1990s are used as a proxy for the difference between land and river rates. These savings are expressed in dollars per ton using dollar values from the same period. These dollars-per-ton values are then multiplied by the tonnage of that commodity transported on the river in 2012. The year 2012 is taken as an optimal year for navigation and has an index value of 100 for all months. This commodity-specific 2012 savings is then multiplied by the percent navigation days in each month in the historical period. The percent navigation days serves as a proxy for the quality of navigation in that month. The use of a savings proxy from the early 1990s coupled with monthly 2012 tonnage and the percent navigation days proxy would seem to provide results that allow only a coarse comparison of DEIS alternatives. This estimate would seem not to differentiate well the impacts of flow variability in the period of record from the impacts of controlled high or low flows as outlined in the alternatives, and would not account for changes in transportation caused by business decisions resulting from plans for such flows.

Basis for Comment

1. The transportation savings are supposed to capture the difference between land and river transportation rates. It seems unlikely that a number estimated in 1992 will capture the dynamics of rail, road, and river rates in 2017.

2. The transportation rate savings are not adjusted for inflation because the analysis assumes that “the relative difference between the overland costs and waterway costs has not changed over time.” Suppose barge rates were $1 per ton mile in 1992 and that rail rates were $1.50 in that year. Now suppose these rates have increased to $2 for barges and $3 for rail. The relative difference has not changed but the savings per ton has doubled. This assumption will impact the dollar values of each alternative and the comparison of the flow alternative with 2016 mechanical construction costs.

3. The only shipping volumes used in this report are volumes for 2012. The use of a fixed volume prohibits any discussion or measurement of the effects of flow changes on volumes shipped. A river that provides reliable navigation will experience more transport

volumes than one that is unreliable. This volume impact is missed when fixed 2012 volumes are used.

4. The proxy percent navigation days at each service level may not capture the full positive or negative economic impacts caused by flows. For example, for businesses that rely on the river for key inputs for their production, occasional low flows that last two days once per month may be an inconvenience, but low flows that last an entire month might be catastrophic and require shutting down production.

5. The use of a proxy for transportation savings multiplied by a proxy for navigation will result in a compounding of errors. This will impact the accuracy of comparisons of alternatives 2, 4, and 5 with alternative 3.

Significance

Low/Medium

Recommendations for Resolution

1. Develop a forward-looking analysis where the volumes on the river depend on the reliability of the river. Use 2016 as the base year for volumes.

2. Use the difference between road, rail, and barge rates in 2017 to capture the transportation rate savings.

3. Discuss the use of percent navigation days with stakeholders and ask if there is a better way to capture the economic impacts associated with low or high flows.

USACE/PDT Response

Basis for Comment

1. The USACE made the decision to use the transportation savings functions that were originally published in the Master Manual in 1998. The team felt that these functions would provide a reasonable measure of transportation savings needed to evaluate the Management Plan alternatives. In addition, the team felt that the transportation savings estimated in the Master Manual likely were more conservative than the actual savings achieved today along the Missouri River given the significantly higher volumes that moved along the river in the 1990s. The USACE understands the concerns regarding the use of savings functions that are over twenty years old and will further investigate whether or not the transportation differential between water and land movements is still reasonable. This will be accomplished by reviewing other transportation rate studies that have been completed within the last five years for the Mississippi River or other comparable water ways.

2. The USACE has agreed to adjust the transportation rates savings to account for inflation in the FEIS.

3. The analysis did evaluate the impacts of flows on the movement of goods along the Missouri River. In the analysis, the tonnage is tied to the level of service that occurs each month on the river, based on outputs from the H&H models. If flows are low such that the USACE cannot provide navigation service, the tonnage will move off the river to alternative modes of transportation or cease sand and gravel production. These tonnages are then applied to different savings rates depending on the level of service (e.g. $6.00 for full service and $4.00 for minimum service). The USACE has agreed to update the technical report to make it more clear how this analysis was conducted.

   The issue of how shipping volumes change with a change in reliability (apart from changes attributable to service level and/or season length) is a separate issue and one that would be difficult to measure, especially across the alternatives. To measure changes in reliability across the alternatives, the USACE would need to separate management actions that affect reliability (guarantee 300-ft wide channel at full service) from natural events that affect service levels and season length (e.g. drought conditions). However, the USACE acknowledges that reliability is an important issue for navigators and will address it qualitatively in the FEIS.

4. The USACE acknowledges that the navigation analysis may not capture the full extent of economic impacts that can occur from changes in navigation. However, given the types and volumes of commodities that are shipped on the Missouri River, it is likely that the inputs into production (e.g., fertilizer) would be available through other modes of transportation and/or final goods (e.g., crops) could be shipped through alternative transportation modes. While producers may have to pay higher costs for these inputs or to ship their products, they would likely still be available and not cause a shut down in production. If public comments indicate the contrary, this issue will be further evaluated. In addition, the RED evaluation assumes that when commercial sand and gravel "moves off the river," there is a loss in production and sales to the sand and gravel industry (and supporting sectors).

5. USACE will incorporate the following to the navigation evaluation:

   - further research be conducted and justification and rationale be provided for the "conservative" estimates of the transportation rates savings;
   - additional description be added about how the flows affect the volumes of commodities shipped; and
   - additional evaluation and interviews be undertaken to estimate the impacts of changes in flows on the commercial sand and gravel dredging industry.

Given these improvements and clarifications to the evaluation, the USACE believes that the navigation evaluation will be able to provide a sufficient comparison of the management plan alternatives.

Recommendations

1. Concur. As already mentioned, it would be very difficult to model specific effects of reliability (apart from service level and season length) across alternatives. However, the analysis will be expanded to qualitatively discuss the importance of reliability and how increases and decreases can drive the amount of tonnage that is moved along the river. Updates to the analysis will consider the most recent data available from the Waterborne Commerce Statistics Center (WCSC) database. One potential approach would be use an average tonnage over years (2010 – 2015) that experienced full service.

2. Concur. USACE will further evaluate the appropriateness of the transportation savings rates used in the DEIS and update them if necessary. Further justification for using these rates will be provided in the FEIS.

3. Concur. The USACE will update the navigation analysis as it relates to sand and gravel transportation. Because barges transporting sand and gravel can operate at lower drafts, materials would not "move off the water" but would likely incur higher costs due to light loading. The USACE will conduct additional interviews as necessary with dredgers or barge operators to understand these cost implications and other operating considerations that are unique to sand and gravel.

IEPR Panel Back-Check Response

The Panel is generally satisfied with the PDT response to the recommendations. However, the response to Item 3 of the Basis for Comment is confusing. The response reads, "The analysis did evaluate the impacts of flows on the movement of goods along the Missouri River. In the analysis, the tonnage is tied to the level of service that occurs each month on the river, based on outputs from the H&H models."

This response would seem to suggest that monthly and annual volumes were used in the analysis. This is confusing because on the June 2 call the Corps indicated that it did not have historical information on volumes. This lack of data was used to justify the simplified analysis.

Equation 2 of the technical report can be written as follows:

Transportation savings per year = savings/tons*percent navigation days*tons

Notice that the term "tons" is present in the numerator and denominator. The denominator contains tons measured in 1994 and the numerator contains tons measured in 2012. This means

that the equation simplifies to 2012 tons/1994 tons * percent navigation days. This index is not measured in tons. For each commodity, it is a constant multiplied by the percent navigation days.

The Panel requests that the Corps clarify the description of this analysis to indicate whether it has or does not have historic information on the tonnage moved in the historic period.

Appendix A: Final Work Plan for IEPR of the MRRMP DEIS

Missouri River Recovery Program
Independent Science Advisory Panel and
Independent Social Economic Technical Review Panel

Final Work Plan

for the

Independent External Peer Review

of the

Draft Missouri River Recovery Management Plan and Environmental Impact Statement

February 7, 2017

Prepared for:
U.S. Institute for Environmental Conflict Resolution
and Missouri River Recovery Implementation Committee

Prepared by:
Missouri River Independent Science Advisory Panel,
Independent Social Economic Technical Review Panel,
and Oak Ridge Associated Universities, Third Party Science Neutral

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Final Work Plan
for the
Independent External Peer Review
of the
Draft Missouri River Recovery Management Plan and Environmental Impact Statement

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Draft Missouri River Recovery Management Plan and Environmental Impact Statement

Background

The United States Army Corps of Engineers (USACE), in cooperation with the United States Fish and Wildlife Service, has prepared a draft environmental impact statement for the Missouri River Recovery Management Plan (MRRMP-DEIS). The purpose of the MRRMP-DEIS is to develop a suite of actions that meets Endangered Species Act (ESA) responsibilities for the piping plover, the interior least tern, and the pallid sturgeon. The agencies have been advised in the plan development process by the 70+ member Missouri River Recovery Implementation Committee (MRRIC; representing various interests, tribes, states, and agencies from within the Missouri River basin) and its external review panels, the Independent Science Advisory Panel (ISAP) and the Independent Social Economic Technical Review (ISETR) Panel.

The USACE has determined that a formal Independent External Peer Review (IEPR) is not technically required for this plan, but the agencies and MRRIC desire such a review as a "best practice" to ensure the quality of this milestone in their planning and assessment process. Recognizing that the standing panels may not be strictly considered "external" to the process at this point, USACE decided that the benefits of the panelists' knowledge of the planning process to date outweigh the costs of educating new panelists concerning the complexities described in the nearly 5000 pages of the DEIS and its supporting documents. The standing panel members originally were selected according to criteria in the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (December 16, 2004), and each member has committed to contributing to an independent review.

Scope of Work

The IEPR generally will follow the procedures described in the Department of the Army, U.S. Army Corps of Engineers (USACE), Water Resources Policies and Authorities' *Civil Works Review* (Engineer Circular [EC] 1165-2-214, December 15, 2012) and as outlined in the work plan below. Some modifications have been made to accommodate review questions offered by MRRIC and an additional review report draft and engagement with MRRIC before finalization of the IEPR panel report.

The IEPR has been assigned to the two panels as Subtasks 1a(1) – 1a(5) of Call Orders 10 and 11 from the US Institute for Environmental Conflict Resolution (USIECR) to ORAU as the Third Party Science Neutral (TPSN) for the ISAP and ISETR respectively. For this review, members of the ISAP and ISETR will work together as a single IEPR panel and produce a single IEPR report. The TPSN will coordinate the IEPR with assistance from three panel co-chairs.

IEPR Panel Members

Panelists along with their affiliations and general areas of expertise include the following:

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Agricultural economics, risk assessment

Gary Lamberti, Ph.D.
University of Notre Dame
Aquatic/riverine ecology, community assemblages and dynamics

John Loomis, Ph.D. **(Co-chair)**
Colorado State University
Resource economics, assessment

Sarah Michaels, Ph.D.
University of Nebraska
Water policy planning, natural resources management and governance

Dennis Murphy, Ph.D. **(Co-chair)**
University of Nevada, Reno
Conservation biology, Endangered Species Act, adaptive management

Additional information describing the TPSN, ISAP, ISETR, and panelists can be accessed using the following link: http://projects.ecr.gov/moriversciencepanel/default.aspx.

Review Documents

Links to the DEIS and supporting documents are available under the "Management Plan" tab on the MRRP website: www.moriverrecovery.org. They also are available on the EPA NEPA website at https://cdxnodengn.epa.gov/cdx-enepa-II/public/action/eis/details?eisId=224657.

Documents included in the scope of the IEPR are:

- Draft Environmental Impact Statement (1184 pp)
  - Volume 1 (Abstract, Executive Summary, Chapter 1, Chapter 2) (190 pp, 6.0 MB)
  - Volume 2 (Chapter 3 part a) (264 pp, 8.3 MB)
  - Volume 3 (Chapter 3 part b) (386 pp, 6.8 MB)
  - Volume 4 (Chapters 4-9, Index, Appendices) (344 pp, 24.3 MB)
- Draft Science and Adaptive Management Plan (1135 pp)
  - Main Document (597 pp, 14.0 MB)
  - Appendices (538 pp, 15.3 MB)
- Human Considerations Technical Reports (614 pp)
  - Commercial Sand and Gravel Dredging (18 pp, 1.6 MB)
  - Irrigation (60 pp, 1.9 MB)
  - Land Use and Ownership (32 pp, 1.5 MB)
  - Fish and Wildlife (62 pp, 2.2 MB)
  - Flood Risk Management (72 pp, 1.9MB)
  - Hydropower (50 pp, 2.1 MB)
  - Agriculture and Interior Drainage (28 pp, 1.5 MB)
  - Recreation (82 pp, 2.4 MB)
  - Thermal Power (62 pp, 2.1 MB)
  - Water Supply (46 pp, 2.9 MB)
  - Navigation (72 pp, 2.5 MB)
  - Cultural Resources (30 pp, 2.3 MB)
- Hydrology and Hydraulics Technical Reports (1973 pp)
  - Hydrology and Hydraulics Summary Report (25 pp, 1.7 MB)
  - Period of Record Development (161 pp, 11.5 MB)
  - HEC-ResSim Alternatives Report 171 pp, 5.1 MB)
  - HEC-RAS Alternatives Report 483 pp, 33.4 MB)

  - HEC-ResSim Modeling Report 358 pp, 24.0 MB)
  - HEC-RAS Calibration Report 598 pp, 25.9 MB)
  - Climate Change Assessment - Missouri River Basin (67 pp, 6.7 MB)
  - Water Quality (110 pp, 5.3 MB)

Related documents (background, not intended for review) include:

- Notice of Availability
- Scoping Summary Report
- Missouri River Effects Analysis Reports
  - Missouri River Pallid Sturgeon Effects Analysis - Integrative Report
  - Science Information to Support Missouri River Pallid Sturgeon Effects Analysis
  - Development of Conceptual Ecological Models Linking Management of the Missouri River to Population Dynamics of Pallid Sturgeon
  - Development of Working Hypotheses Linking Management of the Missouri River to Population Dynamics of Pallid Sturgeon
  - Conceptual Ecological Models and Hypotheses for Piping Plovers and Interior Least Terns on the Missouri River
  - Science Information to Support Missouri River Piping Plover and Least Tern Effects Analysis
  - Modeling to Support the Development of Habitat Targets for Piping Plovers on the Missouri River
  - Interim Missouri River Effects Analysis Integrated Report: Piping Plovers and Least Terns
  - Models, Data, and Literature to Support Habitat Analyses for the Missouri River Effects Analysis

Charge to the IEPR Panel and Review Process

The IEPR charge guidance along with questions received from USACE and MRRIC are included in Appendix 1 of this Work Plan. Panel members will sufficiently familiarize themselves with all parts of the DEIS documentation to understand the structure of the materials and where each component of the DEIS and related supporting materials are located.

Participating panelists will review Chapters 1, 2, 4, 5, and 6 of the DEIS. Panelists will additionally review sections of Chapter 3 and supporting documentation including appendices and technical reports which are relevant to their particular areas of technical expertise. Tentative lead-reviewer chapter/section assignments are identified in Appendix 2. The IEPR co-chairs and TPSN will ensure that all sections of the DEIS are reviewed by at least one panel member.

During the review of the DEIS, panelists will identify and describe areas of technical concern and pay particular attention to the charge questions and topic areas specified for evaluation of adequacy or acceptability for the DEIS. For sections for which they are individually responsible, panelists will document their concerns using the specified four-part IEPR comment format (see Appendix 3). For sections with multiple reviewers, panelists will share their written concerns with the other panelists. The co-chairs and TPSN will review areas of common concern and assign lead- or co-authorship to appropriate panelists to develop as necessary those shared concerns into single four-part comments. Based on agreement during the January 17 IEPR kick-off call, some comments that do not rise to the import of a four-part comment may be listed as additional comments that could be helpful to the USACE in revising the DEIS.

The panel will not provide question-by-question "answers" to the charge, but the co-chairs and TPSN will ensure that all key elements of the charge questions have been considered and addressed during the review process. Some comments may reference specific charge questions as appropriate, to help MRRIC see where their questions were addressed.

Prior to producing a draft report, all panelists will review all written four-part comments and suggest revisions to the lead authors. Co-chairs and TPSN will coordinate this process via electronic correspondence and teleconference. Topic areas of disagreement between or among panelists will also be noted, as required by the overall IEPR process.

Communication with USACE

Communications between the IEPR review panel and USACE will be coordinated by the TPSN through the USIECR. Scheduled teleconferences, to be facilitated by the USIECR, include:

- Kick-off call to review the schedule, discuss the IEPR process, and harmonize expectations regarding scope, charge questions, etc.;
- Mid-review check-in call for clarification of questions from the panel; and
- Briefing call regarding USACE response to the panel's draft IEPR review comments.

Additional calls will be scheduled as needed, and coordinated by the TPSN through the USIECR. Ad hoc communications between USACE technical staff and IEPR panel members may be arranged through the TPSN to address questions or to request additional supporting or clarifying information. All such communications (e.g., calls/meetings, including ad hoc contacts) will be documented in the final IEPR report.

Communication with MRRIC

Panelists will listen remotely to DEIS/AMP-related sessions of the Jan 31 - Feb 2 MRRIC plenary meeting. They will have opportunity to ask questions or comment via the chat room or via email through the TPSN. Correspondingly, MRRIC members will have the opportunity to ask questions or direct comments to the panel.

After USACE has responded to the initial panel review comments and the panel has considered those responses, the panel will subsequently produce a draft report for MRRIC. The Panel is scheduled to present its report at the May MRRIC plenary meeting, at which time MRRIC will have the opportunity to ask clarifying questions or make comments for the Panel to consider before finalizing its IEPR report.

Any additional communications or interactions between the Panel and MRRIC would be coordinated through USIECR and the TPSN.

Schedule for the IEPR

- Dec 29, 2016 – Call Orders 10 and 11 between USIECR/IBC and ORAU finalized
- Jan 5, 2017 – Project kickoff call (USACE, ORAU, USIECR)
- Jan 6 – Subcontract releases between ORAU and Panelists finalized
- Jan 6 – IEPR Charge and links to Review Documents officially delivered to ORAU and Panelists
- Jan 17 – IEPR kickoff call (USACE, ORAU, Panelists, USIECR)
- Jan 18 – Draft Work Plan from ORAU to USIECR for transmittal to MRRIC
- Jan 27 – Use the Agencies Updates Webinar to share information and allow for clarifying feedback on Draft Work Plan
- Jan 31-Feb 2 MRRIC Plenary Meeting – Panelists listen in to DEIS/AMP-related sessions for context – additional opportunity for the Panel and MRRIC to seek clarifications on IEPR process
- Feb 7 – Final Work Plan from ORAU to USIECR (subtask 1a(1) deliverable)
- Feb 28 – Check-in call for clarifications (USACE, ORAU, Panelists, USIECR)

- Apr 7 – Consolidated comments from ORAU to USIECR and USACE (subtasks 1a(2) and 1a(3) deliverables)
- Apr 21 [Apr 26 actual] – USACE responses to Panel comments transmitted to ORAU
- Apr 13, May 2 – Debrief Check-in/Comment Resolution calls (USACE, ORAU, Panelists, USIECR) [actual check-in call dates updated from final Work Plan]
- May 8 – Draft IEPR Report from ORAU to USIECR for transmittal to MRRIC (subtask 1a(4) deliverable)
- May 23-25 – Presentation/discussion at MRRIC Plenary Meeting
- June 16 [June 21 actual] – Final Report from ORAU to USIECR (subtask 1a(5) deliverable)

Quality Control and Quality Assurance

The TPSN will monitor the IEPR process for conflicts of interest that might develop and for any inappropriate communications that might compromise the integrity of the review.

It is ORAU policy and practice to ensure that every review it performs is technically sound, communicated well, and meets or exceeds customer expectations. The TPSN will work with USIECR, the MRRIC Leadership and Facilitation Team, the IEPR panelists, and appropriate other ORAU staff to ensure that the IEPR process and its deliverables are monitored, technically reviewed, and edited for quality suitable to draft or final products prior to delivery.

Compilation and Dissemination of Panel Reports

The TPSN will coordinate compilation of draft and final panel reports with the co-chairs and other panelists, and engage others to assist with editing and QA as needed. Email, teleconferences, and a secure ORAU collaboration SharePoint site will be used to assist this process.

The TPSN will provide all reports in Word and PDF formatted files to USIECR for dissemination to others as appropriate. The TPSN will include others in report distribution as directed by USIECR.

Appendix 1: MRRIC MRRMP DEIS – Independent External Peer Review Charge Guidance to the Panel

From file entitled "MRRMP DEIS IEPR Charge – FINAL" and dated December 19, 2016

MRRMP DEIS – Independent External Peer Review Charge Guidance

Introduction/Context:

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 charge guidance contains instructions to this Independent External Peer Review (IEPR) Panel (which consists of the members of ISAP, ISETR, and potentially ad hoc members) regarding the objective of the IEPR and the input sought. The charge guidance also requests that the Panel members respond to the specific charge questions and directives regarding individual sections of the document. Unlike a standard IEPR, this effort has been modified to allow Missouri River Recovery Implementation Committee (MRRIC) members to address questions directly to the Panel who they have been able to engage with during development of the DEIS and the AM Plan.

Objective:

The objective of this IEPR is to obtain an external (to USACE) evaluation of whether the interpretations of the analyses and the conclusions based on the analyses in the DEIS are reasonable. The Panel is requested to offer a broad evaluation of the DEIS, and the supporting documents including the AM Plan, in addition to addressing the specific technical and scientific questions included in the Review Charge. The Panel has the flexibility to bring important issues to the attention of decision makers, including positive feedback or issues outside those detailed areas outlined in the Review Charge.

The Panel review is to focus on scientific and technical matters, leaving policy determinations for USACE. The Panel should not make recommendations on whether a particular alternative should be implemented.

The Panel members will prepare the Final Panel Comments using the following format: 1) a clear statement of the comment; 2) the basis for the comment; 3) the significance of the comment; and 4) recommendations on how to resolve the comment (including additional research or analysis that may influence the conclusions).

Review Charge:

The Panel is asked to consider the following items as part of its review of the DEIS and Science and AM Plan (including supporting materials such as technical reports and appendices).

Broad Evaluation Review Charge Questions:

1. Is the need for and intent of the DEIS clear?
2. Does the DEIS adequately address the stated need and intent relative to scientific and technical issues?

Given the need for and intent of the DEIS, assess the adequacy and acceptability of the following:

3. Evaluation data used in the study analyses;
4. Economic, environmental, and engineering assumptions that underlie the study analyses;
5. Economic, environmental, and engineering methodologies, analyses, and projections;
6. Models used in the evaluation of economic or environmental impacts of alternatives;
7. Methods for integrating risk and uncertainty, especially as related to identification of a preferred alternative and adaptive management;
8. Formulation of alternative plans and the range of alternative plans considered;
9. Overall assessment of significant economic or environmental impacts;

Further,

10. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable;
11. Assess the considered and preferred alternative from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change, and;
12. Please evaluate the Science and AM Plan and determine if it is consistent with accepted best practices in the field of Adaptive Management and if there are any key missing pieces or deficiencies that are likely to inhibit success in meeting its goals as stated in the AM Plan. Please consider the following in your evaluation:
    - Governance Process
    - Strategy for Plovers and Terns
    - Strategy for Pallid Sturgeon
    - Incorporation of Human Considerations
    - Data Acquisition, Management, Reporting and Communication

Specific Technical and Scientific Review Charge Questions (Additional MRRIC Direction/Priority Areas/Priority Concerns):

1. Does the DEIS sufficiently explain the tradeoffs analyses used for identifying a preferred alternative [*see Broad Question 8; assuming Preferred Alternative is a "conclusion" then see Broad Question 10 as well*]?

2. Assess the ability of the Adaptive Management Plan (AMP) to account for future changes in projected impacts to human considerations resulting from future river conditions, as altered by project implementation, and future flow releases (such as a potential spawning cue) [*See Broad Question 12*].

3. Is the role of MRRIC adequately described in the AMP? Are there any AM best practices related to engaging stakeholders missing from the AMP that could be implemented? If the answer is yes, please give examples. [*see Broad Question 12*]

4. Does the AM Plan provide the ability and process to explore additional actions not included in the DEIS or AM Plan? Does the AM Plan provide an effective avenue for the implementation of non-ESH habitat for the piping plover? [*See Broad Question 12*]

5. Do the considered pallid and plover management actions evaluated in the DEIS offer the best approaches to meeting the objectives or are there other scientifically credible management actions that should be considered? Does the DEIS evaluate all the potential management actions to avoid jeopardy for the plovers or does the DEIS only evaluate different ways to build habitat in the river?

6. Have the best practices in structured decision making been adequately applied to include MRRIC in designing and vetting the considered and preferred alternatives? [*See Broad Question 8*]

7. Does the DEIS adequately address any impacts of the proposed management actions for one species on other species (including the listed species) and their habitats?

8. Please evaluate the DEIS and its supporting documentation and determine whether it clearly and concisely communicates specific tribal interests and adequately assesses and addresses them, including:

- Cultural Resources
- Tribes' Water Intakes
- Long Term Water Quality
- Floodplain Habitat of Cultural Significance (e.g., cottonwoods, willows)
- Legal history and responsibilities and current situation of tribes (e.g., water rights and access, Winter's Doctrine)

9. Is Section 106 adequately addressed in the DEIS? Does the document adequately describe how the site specific activities will address legal responsibilities, such as Section 106 and the Programmatic Agreements?

10. Does the Affected Environment chapter of the DEIS adequately identify and address the following for each of the tribes in the Missouri River Basin: current conditions; trends; and the potential effects of the alternatives on each tribes' physical resources (e.g. Trust Assets such as oil and gas resources, water intakes, irrigation infrastructure, etc.) and the management of those impacts?

Appendix 2: Lead-Reviewer Chapter/Section Assignments

Tentative IEPR Reviewer Assignments	# DEIS Table of Contents
All review with co-chairs lead	Executive Summary
All review and send thoughts to Dennis as lead	1.0 Purpose, Need, and Problem Definition ..... 1-1 1.1 Background ..... 1-1 1.1.1 Missouri River Mainstem Reservoir System ..... 1-2 1.1.2 Kansas River Reservoir System ..... 1-3 1.1.3 Missouri River Bank Stabilization and Navigation Project ..... 1-4 1.1.4 Endangered Species Act Compliance ..... 1-5 1.1.5 BSNP Fish and Wildlife Mitigation Project ..... 1-7 1.1.6 Missouri River Recovery Program and the Missouri River Recovery Implementation Committee ..... 1-8 1.1.7 Effects Analysis ..... 1-9 1.1.8 Adaptive Management ..... 1-10 1.2 PrOACT Process ..... 1-12 1.2.1 Problem Definition ..... 1-13 1.3 Need for the Plan ..... 1-14 1.3.1 Pallid Sturgeon ..... 1-15 1.3.2 Interior Least Tern and Piping Plover ..... 1-17 1.4 Purpose of the Plan ..... 1-21 1.5 Plan Objectives ..... 1-22 1.5.1 Pallid Sturgeon Objectives ..... 1-22 1.5.2 Piping Plover Objectives ..... 1-23 1.5.3 Interior Least Tern Objectives ..... 1-25 1.6 Scope of the Plan and Environmental Impact Statement ..... 1-25 1.6.1 Geographic, Temporal, and Substantive Scope ..... 1-25 1.6.2 Adaptive Management and National Environmental Policy Act ..... 1-26 1.6.3 Tiering and Future National Environmental Policy Act Compliance 1-27
All review and send thoughts to Steve as lead	2.0 Alternatives ..... 2-1 2.1 Overview of Alternative Development Process ..... 2-1 2.2 Effects Analysis Products and Results ..... 2-2 2.3 Identification of Management Hypotheses ..... 2-5 2.4 Models Supporting Alternatives Development 2-10

Adrian Chris	
Gary Chris	
Adrian	
All with Steve lead	

All with Steve lead	
Dermot, John, Steve, Will	
Will	
Chris	
Adrian	
Gary	
Gary	
Sarah	
Sarah	

John	
Dermot	
Dermot	
Dermot	
John	
Dermot	
Dermot	
John	
John	
John	

John	
John	
Sarah	
Sarah	
John	
Sarah with help from others Will Gary Dermot Dermot John	
John	
Dermot	
Dermot	
Dermot	
All provide input	

to Dennis as lead	
Chris and Gary	
Adrian	
Sarah	
John, Dermot	
John	
John, Dermot	
John as lead with input from others	

Sarah as lead with input from others

Appendices

	Appendix C: Cumulative Actions Descriptions Appendix D: Hydrologic Period of Record Analysis of Alternatives Appendix E: Other Special-Status Species Appendix F: Missouri River Recovery Management Plan-EIS Alternatives – Cost Estimates Appendix G: MRRIC Recommendations Appendix H: Tribal Engagement Appendix I: Endangered Species Act Correspondence

Notes:

Reviewers of DEIS sections that reference Appendices, the AMP, and/or supporting Technical Reports are responsible also for review of relevant sections of those referenced documents.

Reviewers will coordinate with co-chairs and the TPSN to engage additional expertise for sections as they determine that it is needed.

Appendix 3: Four-Part Comment Template

Four-part Comment Template

IEPR Panel Comment # _

One or two sentence summary statement of the concern or issue.

Basis for Comment

Text describing the cause for concern including references to relevant location(s) in DEIS and/or charge question.

Significance

Concise text describing the implications, consequences, or seriousness of the concern for implementation of the MRRMP. Use High to Low scale shown below if applicable to the comment.

Recommendation for Resolution

Text describing one or more suggestions for resolving or mitigating the concern.

USACE/PDT Response

Concur/Non-Concur

Text elaborating how the concern has been/is to be resolved or why a change is not needed.

IEPR Panel Back-Check Response

Concur/Non-Concur

Text elaborating.

Significance definitions are as follows:
• **High:** Describes a fundamental issue with the project that affects the current recommendation or

justification of the project, and which will affect its future success, if the project moves forward without the issue being addressed. Comments rated as high indicate that the Panel determined that the current methods, models, and/or analyses contain a "showstopper" issue.
• **Medium/High:** Describes a potential fundamental issue with the project, which has not been evaluated at a level appropriate to this stage in the planning process. Comments rated as medium/high indicate that the Panel analyzed or assessed the methods, models, and/or analyses available at this stage in the planning process and has determined that if the issue is not addressed, it could lead to a "showstopper" issue.
• **Medium:** Describes an issue with the project, which does not align with the currently assessed level of risk assigned at this stage in the planning process. Comments rated as medium indicate that, based on the information provided, the Panel identified an issue that would raise the risk level if the issue is not appropriately addressed.
• **Medium/Low:** Affects the completeness of the report at this time in describing the project, but will not affect the recommendation or justification of the project. Comments rated as medium/low indicate that the Panel does not currently have sufficient information to analyze or assess the methods, models, or analyses.
• **Low:** Affects the understanding or accuracy of the project as described in the report, but will not affect the recommendation or justification of the project. Comments rated as low indicate that the Panel identified information that was mislabeled or incorrect or that certain data or report section(s) were not clearly described or presented.

Appendix B: IEPR Check-in Call Notes

MRRIC Independent External Peer Review Check-In Call #1
Call Summary
Tuesday, February 28, 2017

Welcome and Introductions – Robb Turner, TPSN

Robb Turner, TPSN, welcomed members and provided an overview of the purpose of the call, noting that Carrie Thompson from the U.S. Institute had asked him to facilitate the call in her absence.

Discussion of Panel Questions

The group discussed many of the questions that Robb sent in advance by email on February 26th. Questions that were discussed are highlighted below in bold and italics, and key response points follow.

How were the four unidentified sites that are used to assess interior drainage selected? How large are they? Why four? How was their representativeness determined (and where is that described)?

- Panel member elaboration:
  - The question revolves around why representative sites were picked in the first place, and if representative sites are going to be used, it seems that there is a need to explain why using those sites.

- USACE response:
  - Information on sites is included in Interior Drainage Reports. The team looked at seven different master manual locations and picked most relevant from those. Jeff Tripe will forward the interior drainage study (Volume 11 of the EIS that was completed for the Master Manual) to Robb for dispersal to panel members.
  - Figure 6.2 is in the HEC-RAS modelling alternatives report.

HEC-RAS and ResSim models were used to assess climate change effects on alternatives. The supporting documents show how these and other linked models were calibrated, but how were the models verified in tests against partial data sets from the POR? Were other verification tests used?

- Panel member elaboration:
  - Panel had trouble tracking down an approach that included verification (e.g. developing a model, calibrating, and then applying it to a dataset that was not part of the original construction of the model.) Was that ever done in this process?

- USACE response:
  - Verification was done. There are specific HEC-RAS and ResSim technical reports, including one HEC-RAS report that is 1200 pages.

- After the models were initially calibrated, various alternatives were run through the models using an 82-year period of record. Errors were fixed and adjustments were made where appropriate.
- The no-action alternative is a requirement of the DEIS.
- Using an 82-year period of record simulates a variety of flows that are known to have occurred.
- If there was a desire to look at synthetic hydrological experiences that did not occur in the period of record, a synthetic period of record would need to be developed that added in synthetic data to the existing data.
- Mike Swenson from the Water Management Office would be a good resource for additional information on this topic.
- Information about the period of record is in multiple locations in the document. Technical folks can provide more information on the location of data in the EIS about the period of record, calibration, and assumptions/risks.
- The feasibility of a Monte Carlo analysis was explored but would have taken significant resources on the order of millions of dollars and at least a year timeframe to complete.

There does not appear to be mention of a basin-wide sediment budget for the Missouri in the DEIS or supporting documents. Documentation on ResSim and HEC-RAS do show that sediment transport was built into the model set using stage-rating curves to connect water discharge to sediment transport on an instantaneous basis. Model runs are designed to compare alternatives rather than real historical conditions or projected future ones. Has there been a constructed basin-wide sediment budget based on observed actual conditions, and could it or an approximation to it be included in the DEIS to provide context for the document?

- Panel member elaboration:
  - The panel is wondering about the context for sediment and if there is an overall descriptive budget for the basin that could paint the background picture.
  - The DEIS talked about so much of the construction of habitat dependent on sediment but the discussion took place in somewhat of a vacuum. It would be helpful to set the stage and further context, perhaps with a diagram or descriptive sentence.

- USACE response:
  - A description of sediment conditions in the reservoir and river reaches and the alternative's effects was included in Section 3.2 of Chapter 3 of the EIS. A description of the alternatives' effects on sediment accumulation rates in the river reaches downstream of Gavins Point was included in Section 3.11 of Chapter 3 of the EIS. Sediment transport models are being developed to assist in addressing the panel's question further. The status of developing these models was sent out by e-mail by Mark Harberg in response to an action item from the January MRRIC meeting.
  - According to the technical folks, an initial assessment has shown that there is not a huge difference between sediment models for different alternatives in the DEIS.

How might a hybrid alternative be developed from the alternatives analyzed in the DEIS?

- Panel member elaboration:
  - The panel has some thoughts on the different actions that have been proposed over the years. How can the panel be helpful in putting together an alternative?
  - To what extent is the information that USACE has on hand sufficient for developing different alternatives?
  - What criteria would USACE use to explore different hybrid alternatives?

- USACE response:
  - DEIS comments on how things could have been structured differently are reasonable and are anticipated.
  - Whether or not information on hand is sufficient to develop hybrid alternatives depends on what the hybrid alternative consists of. Between 30 and 40 different alternatives were pre-screened (e.g. scripted in the ResSim and ran to outputs in HEC-RAS) that led to the narrowed list of six alternatives currently in the DEIS. If a hybrid has already been explored, USACE has the data now. If it's a hybrid alternative that hasn't been modelled, an effort to find potentially new and different effects would be required.
  - Appendix A details the formulation of alternatives as well as the different magnitudes and frequencies that were explored.
  - There are no specific criteria for when a hybrid alternative would be explored. Chapter 2 of the DEIS includes reasoning of why USACE did not carry certain actions forward and why other actions were carried forward.
  - The Habitat Analysis Report also led to the determination that at some point more water doesn't necessarily equal more sand. The alternatives that were developed were a result of trial and error of overshooting and undershooting until desired results were obtained.

Robb Turner, TPSN, thanked participants and noted that any additional questions for USACE should be sent to him to pass along to USACE.

Call Participants:

Aaron Quinn, USACE
Adrian Farmer, ISAP
Chris Guy, ISAP
Craig Fleming, USACE
Dan Pridal, USACE
Dennis Murphy, ISAP
Gary Lamberti, ISAP
Jeff Tripe, USACE
John Loomis, ISETR
Lisa Rabbe, USACE
Mark Harberg, USACE
Mary Roth, USACE
Robb Turner, TPSN
Ryan Larsen, USACE
Sarah Michaels, ISETR
Steve Bartell, ISAP
Will Graf, ISAP

Facilitation Team
Melanie Knapp, USIECR

MRRIC Independent External Peer Review Check-In Call "#1.5"
Call Summary
Thursday, April 13, 2017

Background

This call was added to the two initially planned IEPR "check-in" calls and was requested by USACE to allow the IEPR Panel to clarify comments, as needed.

The call also provided an opportunity for informal USACE feedback to TPSN regarding format and additional content needed (appendices, etc.)

Welcome and Introductions – Carrie Thompson, USIECR

Overview of Aggregated Comments Submitted to USACE April 7, 2017 – Robb Turner, TPSN

The Panel submitted over 100 pages of comments, including 73 four-part comments that the Panel thought merited a response from USACE and many minor comments that might also be helpful to USACE in revising the draft.

USACE shared that, overall, they found the aggregated comments to be useful feedback and that structure lends itself well to getting specific responses back from USACE. USACE appreciated the opportunity to ask the following clarifying questions, and anticipates that there may be additional questions as they complete their review.

Review of Comments and Requested Clarifications from USACE

Comments #4 – 6: USACE asked that this since this information is covered in the AMP and EA report, are the comments concerned only with that the information is not explained well enough in DEIS, or not well enough in general? Also, is the Panel questioning any of the methodology or more concerned with the adequacy of the explanations?

Panel Member(s) Response(s):

- Language in the charge questions asking if "the DEIS adequately explains…" prompted some of the comments about content that may be sufficiently explained in the AMP, but that is not technically present in the DEIS. It may be important to parse out the AMP and DEIS, but that may take too much time/length to justify the effort.

- Regarding #4, the results of the modeling don't align numerically with the targets presented and the explanation is insufficient. This could be addressed in a short amount of additional text.

- Regarding #5, there was a challenge in making the connection between ESH and geomorphology, which could be corrected with additional explanatory text. Suggest adding a

sentence or two to make the connection between flows and cross-sections clear and ensure that the reader understands the origin and frequency of cross-sections.

- Regarding #6, suggested that USACE specify numbers for what is expected regarding reservoir birds, similar to treatment given to ESH targets in the document. (USACE mentioned that some of this in the AM plan and it could be brought forward to DEIS. Should be a simple fix.)

Comments #14, #55, and Intro on pages 11-12: USACE asked for an explanation of what seemed to be conflicting Panel comments – the suggestion that USACE move to Level 3 quickly but also to do more Level 1 and 2 before moving to Level 3. Is panel saying that they recognize need for Level 1 and 2, but should move to 3 quickly?

Panel Member(s) Response(s):

- The Panel dedicated a lot of discussion on this before submitting their comments and several Panelists weighed in.

- There is a danger in defining AM so broadly that any scientific inquiry falls under that umbrella. AM should be defined more narrowly. Unless you have sufficient Level 1 and 2 actions, you could be in peril of providing data that doesn't inform management, resulting in irrelevant management actions for species or lacking sufficient understanding necessary to create a design that can statistically tie the action's outcomes back to the design. It is important that the DEIS and AM Plan better discriminate between activities that are carried out under Levels 1 and 2 (research, monitoring or modeling) and Level 3 (initial steps in true AM).

USACE asked that given the way in which IRCs, etc., are designed as Level 2 in the document, what Level 3 actions is the Panel concerned might be implemented prematurely?

Panel Member(s) Response(s):

- Additional clarification is needed in the DEIS as to whether IRCs/spawning habitat are considered Level 2 or 3. Could be interpreted as Level 3 as written.

- Level 3 actions should only occur when you have good solid Level 1 and 2 justification to do so, not just because action is scheduled. For example, one of the Level 3 actions has to do with flows out of Gavins Point Dam in Year 9, which would happen regardless of whether there were results from Level 1 or 2. (USACE clarified that this would be based on Level 1 or 2 information, and if none existed, a Level 2 test would be fashioned). There may be need for better clarity of how the different described actions would be categorized (as Level 2 or 3).

USACE noted that they have an obligation under ESA to implement actions for species recovery and they are trying to balance this obligation with AM.

Panel Member(s) Response(s):

- FWS shouldn't require action in the absence of a solid foundation for that action.

Comment #29: USACE asked for clarification regarding the "tipping point" concept in this comment.

Panel Member(s) Response(s):

- In many cases, the evaluations in the DEIS suggest small hydrological changes under different circumstances, but if the system is close to "threshold", a small change can become significant. Consider what happens at bankfull discharge. If the river stage rises 5 feet at bankfull conditions, we see floodplain reconnection, etc., as a result of a relatively small adjustment. If under low flow conditions, a 5 foot rise doesn't necessarily mean much. Document should be careful about suggesting that small changes are unimportant.

Comment #37: USACE asked for more information regarding the comment that more information should be displayed related to impacts to specific Tribes and/or Reservations. USACE explained that they had received explicit feedback from some tribes who did not want this information displayed at a specific-tribe level. The comment does support the concept of USACE presenting this level of information during individual tribal Consultations, however.

Panel Member(s) Response(s):

- This was a "MRRIC"-generated question, and the Panel felt that the USACE explanation above justified USACE approach and satisfies any concern. It was suggested that USACE may consider adding this explanation to the document.

Comment #41: The comment refers to "water retained for future pulses"; USACE clarified that water is not retained for the purpose of providing a pulse.

Panel Member(s) Response(s):

- Panel felt that this clarification satisfied the comment and suggested that this also be clarified in the DEIS/AMP.

Comment #63: USACE asked the Panel if they had specific suggestions for surrogates/proxies or if they were just suggesting that USACE further investigate the proxy approach?

Panel Member(s) Response(s):

- The comment wasn't specific to examples in the AMP, but more to address the concept. Surrogates proxies and indicators that might serve as monitoring targets are best informed by data collection. Field people and proponents should be gathering environmental data associated with the most productive habitats. If there are opportunities to use proxies, you should, just for the sake of efficiency (versus intensive assessment costs of counting nests, eggs, capture of elusive sturgeon, etc.) Coming up with habitat characteristics associated with success is important to do to assess the merits of the program. For purposes of efficiency of implementation, this program should be identifying metrics that cause the least disruption of the species and can most easily be monitored.

Outstanding Questions Regarding Process and Content

- USACE will be working with the file sent and incorporating responses into that document. Some comments will be incomplete due to extended comment period, and need to consider comments from the public and other agencies before finalizing their responses. There shouldn't be a lot of these, but there will likely be some.
- The Work Plan already is included as an appendix; the group concurred that the notes from the "IEPR Check-In Calls" should also be included for added transparency.
- There was a discussion regarding the need for Panelist signatures on the Final Report. This is specified in the Call Order, but is not standard practice for all IEPRs. The Corps will check to see whether a signature page is needed/desired.
- USACE plans to have the bulk of their responses (with some incomplete as noted above) to the Institute and Panel on the 21st.
- An additional call may be scheduled to allow for more thorough discussion of the definitions used for Level 2 and 3 in the DEIS and AMP.
- An additional IEPR Check-In Call is scheduled for May 2 at noon CT.

Call Participants

Aaron Quinn, USACE
Adrian Farmer, ISAP
Chris Guy, ISAP
Craig Fischenich, USACE
Craig Fleming, USACE
Dave Marmorek, ESSA
Dennis Murphy, ISAP
Dermot Hayes, ISETR
Gary Lamberti, ISAP
John Loomis, ISETR
Kate Buenau, PNNL
Lisa Rabbe, USACE
Mary Roth, USACE
Robb Turner, TPSN
Sarah Michaels, ISETR
Steve Bartell, ISAP
Will Graf, ISAP
Carol Smith, USFWS
Thomas Topi, USACE
Tiffany Vanosdall, USACE
Wayne Nelson-Stastny, USFWS

Facilitation Team
Carrie Thompson, USIECR

MRRIC Independent External Peer Review Check-In Call #2
Call Summary
Tuesday, May 2, 2017

Welcome and Introductions – Carrie Thompson, U.S. Institute

The purpose of this IEPR call (Check-In Call #2) is to allow for any necessary clarifications regarding USACE's responses to the IEPR Panel's comments and to touch base regarding next steps and remaining needs.

Overview of USACE Response to Draft Aggregated Comments submitted April 7, 2017 – Aaron Quinn, USACE

USACE has received approximately 450 public comments on the DEIS. Individual comments are up to 60-70 pages. We have not yet finished reviewing all the comments we received during the public comment period so caveat language has been added to the report to address the possibility that additions or corrections may be necessary in response to Tribal, public and/or agency comments on the DEIS.

Review of Responses and Outstanding Panel Needs

USACE offered details and suggested text for many of the responses, but for some suggested resolutions that will take additional time to work through they indicated our concurrence and a more general path forward.

Robb Turner, TPSN, noted that the IEPR panel has reviewed USACE's responses and discussed them by phone. The panel members found the USACE responses related to the DEIS to be clear, but highlighted some uncertainties related to the AM plan and AM process. Example areas of uncertainty include treatment of reservoir and other non-ESH bird habitat and the criteria to be used for moving to level 3 fish actions if cause-effect relationships are not clear, and how those processes should be described. Some comments the IEPR panel makes will be in regards to the lack of clarity it perceives in relation to these topics.

Overall, the panel is satisfied with the responses from USACE related to the IEPR. The panel is in the process of adding back-check comments into its internal SharePoint website and ensuring consistency between comments and panel agreement on all comments, after which the final draft report will be distributed to MRRIC by Carrie Thompson once she receives it on Monday or Tuesday of next week (May 8th or 9th). USACE confirmed that there will be no need for a signature page. Final summaries from the previous calls are needed from the report and will be sent to the group for inclusion.

The group discussed the upcoming IEPR report out presentation planned for the May MRRIC plenary and agreed that a call to solidify the details would be useful. The Institute will send out a schedule request.

Call Participants:

Aaron Quinn, USACE
Adrian Farmer, ISAP
Chris Guy, ISAP
Dennis Murphy, ISAP
Gary Lamberti, ISAP
Kara Reeves, USACE
Mary Roth, USACE
Robb Turner, TPSN
Sarah Michaels, ISETR
Steve Bartell, ISAP
Tiffany Vanosdall, USACE

Facilitation Team

Carrie Thompson, U.S. Institute
Melanie Knapp, U.S. Institute

Appendix C: USACE PDT Response Authors

The following Product Delivery Team authors provided input to the USACE responses to the IEPR Panel four-part comments.

- Phil Alig
- Chris Bouqout
- Mark Harberg
- Drew Minert
- Dan Pridal
- Aaron Quinn
- Kara Reeves
- Margaret Ryan
- Mary Roth
- Elizabeth Samson
- Mike Snyder
- Thomas Topi
- Cathi Warren
- Joe Bonneau
- Kate Buenau
- Craig Fischenich
- Craig Fleming
- Robb Jacobson
- Graham Long
- David Marmorek
- Holly Bender
- Bernward Hay
- Michael Mayer
- Lisa McDonald
- Laura Totten