TO: MRRIC SPA Task Group, Management Plan and Effects Analysis Teams

FROM: Independent Science Advisory Panel (ISAP)

RE: ISAP Evaluation of Science Associated with the Draft Bird AM Cycle Example; Response to Questions for ISAP v4

DATE: June 29, 2015

The Independent Science Advisory Panel (ISAP) has been tasked with reviewing the document *Missouri River Management Plan Adaptive Management – Draft Bird Example* (authored by Kate Buenau and Craig Fischenich, dated 11 May 2015); this memo is the response to that assignment. Operating under the Missouri River Recovery Program (MRRP), the SPA task group provided the questions probing the content of the bird example, which are addressed by the ISAP below. The document is self-described as having been "developed as an accompaniment to the "Pallid Sturgeon Framework," affording a contrast and more complete view of the envisioned AM plan" for the MRRP (page 1). The draft bird example is a transitional document; that is, its essential elements will be integrated into an omnibus adaptive management plan that will address conservation efforts targeting the two federally protected bird species, the piping plover and interior least tern, and the pallid sturgeon. The current document has central importance in the progress of a scientifically defensible Missouri River Recovery Program.

The document intends to convey "the process being used to develop the plover and tern components of the AM plan, discuss general application of the AM cycle to management for these species and their habitat, and describe case studies and scenarios being used to confront the AM process with realistic situations and decision contexts" (page 1). And, while the draft bird example indicates that the "AM plan for the MRRP will detail the criteria, approach, and roles and responsibilities for addressing uncertainty on the Missouri River" (page 1), the bird-example document describes a number of the analyses, process steps, and institutional activities that provide a bridge from the completed effects analysis products for birds and the pending selection of a management-action scenario from among candidate actions. The bird example pragmatically goes further in providing that bridge by articulating some of the obligatory steps and process sequences that must be engaged before and at the point of implementing adaptive management. In rudimentary terms it invokes the monitoring and evaluation stages that lie ahead in conservation planning for the two shorebirds (see Figure 2 on page 6 of the bird example). By outlining steps from the effects analysis to the implementation of a scientifically defensible management scenario, the bird example anticipates certain governance (and personnel) needs under the MRRP and allows inference to be drawn regarding the skill sets of program participants, including resource managers and technical staff with expertise in essential areas of data acquisition and analysis. Importantly, the draft bird example frames more than two dozen questions – largely related to and directly involving assessment of risk in programmatic decision-making – that must be answered for effective implementation of adaptive management. Answers to those questions would benefit from

input from agency management and technical experts, the EA teams, and MRRIC groups, with advice from both the ISAP and ISETR.

The ISAP notes here that it does not expect that the draft bird example itself will be adjusted in response to the assessment below, but that the authors and their Effects Analysis team colleagues will harvest some guidance for incorporation in version 3 of the Adaptive Management Plan, which will absorb most of the explanatory narrative from the current draft bird example document.

1. *The bird example uses the extent (and persistence) of in-channel gravel bars or islands, referred to as "emergent sand bar habitat (ESH)," as surrogate conservation targets. Does the existing information (as highlighted in the example) establish the validity of an ESH-habitat extent-species performance relationship, such that ESH can be used as a legitimate surrogate for bird performance or success?*

A majority of the proposed management actions for the piping plover and least tern are focused on creation or maintenance of suitable sandbar nesting habitat by using either flow releases or mechanical techniques. The bird models use the extent of ESH as a state variable in management scenario testing and, in turn, link ESH to an expected population response. Consequently, the relationship between the amount of available sandbar nesting habitat and plover population performance is central to the conservation planning effort. Moreover, the success of the AM plan for birds will hinge on how well the habitat availability-population size relationship holds true in the future. Monitoring data collected since 1986 show a strong relationship between sandbar habitat extent and bird population performance in the Missouri River, and the previous EA 6 report describing models for plovers, terns, and hydrogeomorphology summarized the available data and did an acceptable job documenting that relationship. The panel previously commented to that effect [*Final ISAP Evaluation of the Effects Analysis Draft Interim Reports (EA #6),* dated 16 January 2015].

Given the fundamental importance of the habitat-population relationship, it will be essential for the adaptive management plan to identify the information necessary to document that relationship and describe how monitoring and research data acquired for the adaptive management plan will be analyzed in the evaluation step of the adaptive management process (as illustrated in Figure 2 on page 6 of the draft bird example). The emphasis should be on clarity and simplicity, perhaps based on a graphical presentation of the time sequence of 1) actual habitat extent in a specific year, 2) actual bird numbers (perhaps nesting pairs) in a specific year, 3) predicted habitat extent (predicted from previous years), and 4) predicted bird numbers (predicted from previous years). Discrepancies between predicted and actual habitat extent, and between habitat changes and population changes, will be key to a better understanding of physical system dynamics and biotic responses, and allow for more effective and efficient management responses.

2. *Does the bird example clearly describe how the modeling therein links preceding activities under the effects analysis (i.e., development of conceptual models, identification of reliable data, and construction of hydrodynamic [operations] models)*

and next steps toward implementation of management actions in an adaptive framework? Does the example provide for the EA Team/AM Team to incorporate new knowledge as it is obtained?

The bird models, in conjunction with the hydrogeomorphic models, represent an excellent synthesis of the available data in a useful form for identifying potentially effective management actions, conducting comparative analyses of those actions, and providing guidance for formulation of an initial management plan. The models have been well documented in previous reports and presentations developed by the EA teams (e.g., deliverables *EA #2a, Existing Data and Models for Terns and Plovers*, and *EA#3, Population Model Development for Least Terns and Piping Plovers*) and should continue to be effective tools supporting the development of an initial management plan as well as providing insights for revising management as needed in the future to accomplish program objectives. The Panel provided a previous assessment of the models' adequacy for these tasks (*memo dated 30 May 2014 on deliverable EA #2a*).

The Panel recognizes that no model is perfect for its application in resource management planning. The bird models lack detail in some areas and do not faithfully mimic actual habitat conditions that may occur in the Missouri River ecosystem. The suitability of ESH as it may be affected by changes in landform or vegetation cover may be difficult to model with current capabilities. Predation events are difficult to predict ahead of time and will need to be closely monitored in the field. The bird example document recognizes these model limitations and acknowledges the importance of closely monitoring the system and incorporating new knowledge gained during the AM program to revise the models and appurtenant analyses in support of moving forward with a more effective management strategy.

3. *Does the bird example adequately consider data variability and uncertainties in selecting and applying information used in the example modeling effort?*

As part of the stated approach (see page 3 of the document), the bird example makes use of an array of materials that were produced as part of the Effects Analysis (EA), which includes conceptual models and numerical models. Data variability and uncertainties associated with the modeling activities appear to be usefully addressed in incorporating the bird example into the broader adaptive management program. A more detailed characterization of variability and uncertainty and their implications on bird management outcomes are presented in earlier effects analysis deliverables, which have been previously reviewed by the ISAP. The draft report mentions that workshops were conducted wherein participants examined the implications of variability and uncertainty on decision-making through application of interactive models relevant to AM for the birds.

The report in general and the case studies in particular describe the importance in characterizing variability and reducing uncertainties as part of the overall learning aspects of the bird AM examples. For example, the case studies outline the implications of increasing physical model precision (for example by 30%) on subsequent refined project designs with associated considerable cost savings. The data and inferences that serve as the basis for

such important analyses should be directly referenced in the adaptive management plan, specifically where the bird-example material is incorporated.

4. *Does the existing information, as highlighted in the bird example, provide the background information necessary to establish decision criteria and guide development of implementation timetables, contingency plans, monitoring schema, and other essential elements of adaptive management?*

The draft bird example identifies, in general, necessary supporting information that will be used to conduct the adaptive management effort. Acres of ESH, bird population size, population growth rate, and fledge ratios are discussed as interrelated metrics describing system status and as essential elements of adaptive management. Management metrics are also identified, including ESH, reservoir storage, vegetated habitat, tributary flows, population density, and budget. These metrics are briefly discussed in relation to adaptive management in the main body of the report. Additionally, the system status and management metrics are discussed in substantial detail concerning time frames, contingencies, monitoring, and decision-making in support of the hypothetical ESH case studies.

The report recognizes the importance of considering such contingencies as budgeting, contracting, advance planning, time to implementation, and opportunity (e.g., managed flows) in developing an effective adaptive management program for shorebirds. Potential implications of approaches to adaptive management of the two birds on pallid sturgeon management are also generally recognized in the report. However, without the specification of a preferred management alternative, these contingencies are difficult to address in any meaningful detail according to the authors. Nevertheless, the comprehensive nature of the discussion and the overall organization of the report suggest that a useful adaptive management program can derive from existing information upon specification of management alternatives.

This adequacy of existing information to support adaptive management of the birds and their habitats is further evidenced by the detailed presentation of the case studies. Although hypothetical, Table 1 (page 14) in the draft report suggests recognition of key information categories needed to support specific management actions, such as ESH construction. The associated discussion of Table 1 and mention of possible management contingencies depending on monitoring results together indicate that the authors understand how to use to good effect existing information in support of bird AM.

5. *Does the example provide confidence that the model applications and outcomes will produce management-ready guidance to the MRRP? Does the bird example describe the appropriate interpretation and potential application of the model outcomes to management planners? Does it provide information that will contribute to the selection of a preferred management action alternative?*

The report does not provide substantial details concerning the model applications and outcomes, although some hypothetical improvements in the physical modeling of ESH are

discussed within the context of decision-making and adaptive management. The report, however, does reference the Effects Analysis for the birds as providing detailed technical support, including modeling and model results, for the more general discussion of bird AM and support for the case studies. Clarifying the role of previously completed analyses, both from the Effects Analysis deliverables or outside-information sources, in the selection of an initial management scenario by reference and citation will be important in the adaptive management plan to come. The modeling approaches, linking bird population dynamics and ESH, in earlier presentations from the EA team support the notion that the model capabilities would be useful in providing guidance to MRRP management and decision-making.

The decision matrix (page 23 of the document) provides detailed guidance concerning management actions for populations of birds that are growing, stable, or declining. While the matrix might be implemented based on the results of monitoring bird populations, presumably the results of model projections of bird population dynamics could be similarly used to explore the implications of alternative management actions outlined in the matrix.

6. *Should adaptive management for the habitat construction hypothesis also contain evaluation of reservoir habitat or creation of potential habitat in chutes and/or other non-channel areas that provide habitat within the basin and if so, why (or why not)?*

The ISAP's understanding is that during recent years of project operations about 40% of piping plover nesting occurs on habitat associated with the system reservoirs. Because of its importance, habitat that occurs in and around reservoirs has been included as a habitat component in the bird models. The models have the ability to forecast the amount of reservoir-associated habitat that would likely result from different management scenarios. It seems essential, therefore, that the adaptive management program include not just monitoring of habitat and birds in Missouri River in-channel circumstances, but monitoring of reservoir-associated habitat and the status of the two bird species in that habitat. Also, for reasons that are not completely clear at this time, the relationship between the extent of habitat and bird population responses may be different in reservoir and riverine circumstances. Understanding the causes of such differences, if they exist, will be critical to the AM program implementation and performance.

Off-channel nesting habitat for the shorebirds is not a recognized component of the models, nor is it explicitly considered in the EA process or in early adaptive management references. Although not common, contemporary cases exist of piping plover and least tern nesting in off-channel habitats in the Missouri River study area. As has been shown for the Platte River, creation and maintenance of off-channel nesting habitat can be much more cost effective than in-channel habitat. Moreover, off-channel habitats can provide a buffer during those years when in-channel habitats are not available due to high river flows. For these reasons, creation and management of off-channel habitats should be included as an integral aspect of future adaptive management planning.

The potential inclusion of off-channel shorebirds in planning under the MRRP raises the important issue of the geographic bounding of the demographic units of the two birds that

are the targets of MRRP planning efforts. The ongoing modeling effort addresses sandbars as the primary habitat for Missouri River in-channel populations of the two birds. However, those in-channel birds have at least some level of demographic interaction with apparently limited numbers of off-channel birds, and potentially larger numbers of birds supported by habitat beyond the Missouri River. A broader boundary definition of the demographic units that will be affected by MRRP adaptive management efforts – that is, birds on sandbars and on the Missouri River floodplain, plus birds outside the Missouri River – is essential to assessing the performance of management efforts under the MRRP, and to linking program performance to agency expectations under the federal Endangered Species Act. The selection of a management action scenario based on in-channel bird productivity and persistence should consider the likely responses to that management by the metapopulation(s) to which the in-channel birds of both species contribute.

7. *Have the management actions on the Missouri River been defined clearly enough that, if the predicted number of acres of ESH are either not formed or the species do not respond as expected, those actions can be reevaluated and the goal of adaptive management (meeting the MRRMP species objectives) can be achieved by exploring alternative actions?*

The report presents two case studies, along with associated scenario construction in support of adaptive management of the listed birds with a focus on Emergent Sandbar Habitat (ESH) creation and maintenance. Case Study 1 (the simpler case) emphasizes mechanical construction of ESH and the constraints and uncertainties involved in that process. This case asserts that budgetary allocations for ESH construction should be relatively predictable from year to year, whereas natural flow events that create or erode ESH have low predictability from year to year, and therefore can modify the actual ESH available for the birds. Adaptive management would need to respond to this dynamic process to achieve ESH targets (for programmatic species objectives to be met).

Case Study 2 (the more complex case) combines both mechanical construction of ESH with ESH creation attained through flow implementation (from reservoir releases or other means). Mechanical construction is subject to the same constraints as in Case Study 1, but flow releases have additional constraints associated with implementation and performance, although requiring a lesser budgetary allocation. As aptly described on page 18 of the draft bird example, a "decision whether to create habitat through mechanical means or using flows includes consideration of additional constraints and consideration of impacts, values, and tradeoffs." Implementation of flow releases to create ESH would necessarily have a much more narrow window for go–no go decisions based on conditions at that time. Active monitoring would be needed to assess the performance of flows to determine appropriate adaptive management responses in the case of unexpected system functioning with regard to ESH creation or persistence.

As documented in the draft bird example, other system attributes can modify the relationship between ESH quantity and bird population size and nesting success. These features include nestling predation, habitat geomorphology, vegetation dynamics, and access to foraging habitat. When species do not respond as expected, such deviation may be

due to variation in these features, as much as due to the extent of ESH that is available. Therefore, it will be important to monitor these features of bird habitat during the AM process, such that habitat suitability can be assessed from the standpoint of both quantity and quality of ESH.

The report presents the viable management actions for ESH creation in the forms of construction and flows to support (undetermined) target bird population sizes, and builds scenarios for events that can modify total ESH or address unanticipated species responses. The report provides reasonable detail on ESH mechanical construction in terms of acreage, location, and costs. However, relatively little specificity is provided in the case studies or scenarios concerning the magnitude, duration, or spatial extent of flows predicted to achieve different ESH targets. When integrated into the adaptive management plan, the example could draw more explicitly on hydrological modeling to specify flows needed to achieve different ESH outcomes, albeit with significant uncertainty. The bird example should integrate the EA modeling efforts for hydrology and bird population dynamics to identify the flows needed to create and maintain the extent and quality of ESH appropriate to meeting programmatic species objectives. In addition, a consideration of other system attributes that can modify species responses (such as predation, revegetation, ESH landform, and foraging habitat accessibility) is needed, so that quality of habitat along with extent can be managed. Lack of response, or unanticipated response, of the species to management actions also could be caused by factors other than those currently being considered. An effective monitoring, research, and assessment program would facilitate identification of and response to such factors.

8. *Do you view this as an effective pathway to defining an adaptive management plan to achieve MRRMP species objectives over time? If not, do changes need to be made and if so, what changes?*

The report, in combination with the Effects Analysis, provides a descriptive pathway for adaptive management for the piping plover and least tern. The level of specificity in terms of potential pathways of decision-making presented in the draft bird example suggests that, with continued time and effort, a more complete AM Plan for the birds will emerge with the necessary analysis and forethought to guide MRRP decision-makers.

An essential missing element at this point is a strategy for data management, data sharing, and reporting or presentation of (annual) findings, recommendations, and actions taken – activities in the "evaluate" circle where it links with the preceding "monitor" circle in Figure 1 (page 5). As has been shown through the relatively simple excel spreadsheet developed by Compass (in collaboration with Corps personnel), multiple stakeholders can engage the data when presented in ways that facilitate and encourage more active interaction (e.g., playing with data and output through simple models and analysis). These types of more active presentations of data provide very useful opportunities to more fully engage MRRIC and other stakeholders.

At a minimum, a plan should be developed for compiling, synthesizing, and presenting the relevant monitoring data each year. Along with this process, a plan should exist for

archiving those data, their analyses, and process steps that were used to make decisions as part of the adaptive management process. While a report would be sufficient to meet this goal, such a report should be considered a minimum requirement. The agencies should think strategically and creatively about how information can be presented in ways that increase the familiarity and realistic expectations for the decisions that are likely to be made by the agencies. In a transparent adaptive management scheme, incoming data are clearly presented and an explicit structured pathway is available so that stakeholders will understand management decisions and the bases for those decisions.

9. *Throughout the example there are a number of questions. As appropriate, please share any observations or thoughts associated with these.*

The draft bird example frames more than two dozen questions – largely related to and directly involving assessment of risk in programmatic decision-making – that must be answered for effective implementation of adaptive management. Those questions strike a number of essential "policy" issues that should be informed by input from agency management and technical experts, the EA teams, and MRRIC groups, with advice from both the ISAP and ISETR. The ISAP understands that the report's authors have conducted sessions with a number of these groups using a scenario approach to better understand what information and decision approaches might be required to answer such questions as they arise in AM implementation. The expert panels can bring their perspectives to discussions of these questions – including the level of confidence required in support of management decisions, levels of acceptable risk, use of learning opportunities, and need for reevaluation of targets, all of which hinge on scientifically appropriate collection, evaluation, and interpretation of monitoring data and research findings – but expert input will often fall outside of the applied context of the perspectives brought to the management planning by others involved. Rather than commenting in the abstract on the questions posed, the ISAP recommends that it be engaged in discussion of such questions in a forum with other groups (e.g., at a MRRIC meeting), as part of the continuing planning process, and later as part of AM evaluation and decision-making stages.

In the discussion above, the ISAP has pointed in numerous places to the need for much more explicit plans for monitoring, data management and sharing, and reporting and presenting syntheses of the monitoring data collected to evaluate the effectiveness of management actions that are implemented. The ISAP recognizes that the authors of the draft bird example have not yet had time to develop plans for these activities, but the panel hopes that version 3 of the AM Plan can begin to address those issues in more detail.

More specifics on what would be monitored and how the resulting data would be evaluated could be presented. Terms are introduced in the draft document such as "system status" and "management conditions"; how these environmental attributes will be monitored and results communicated in run charts (or otherwise) should be fleshed out. Two categories of monitoring are suggested on page 10, but then are not described adequately. The authors mention uncertainty and bias in the existing program on page 14; version 3 of the AM Plan could outline how these program challenges could be best met and improved. "Monitoring for metrics included in fundamental and means objectives" is promised on page 19; the

next iteration of the draft could list these and describe at least briefly how they will be evaluated and reported. Discussion of information needed by managers for decision-making, and by stakeholders for assessing the transparency and acceptability of those decisions, would be enlightened by a more well-developed discussion of how the effects of management actions will be monitored, and how assessments and syntheses along with supporting data will be shared.