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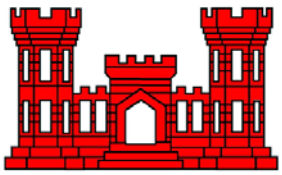

U.S. Army Corps of Engineers
Memphis District

January 13, 2012

Final Panel BackCheck Responses to the Final Evaluator Responses on the Final Panel Comments

Independent External Peer Review of the St. Johns Bayou and New Madrid Floodway Project Draft Environmental Impact Statement (DEIS), Phase 3

Comment: 1

The estimate of current yields is not clearly explained or based on currently accepted agricultural production modeling.

Basis for Comment:

The Panel believes that the yields are calculated using a simple linear regression model and national-level crop output and input indices. The two regression equations conducted for the analysis are reported, but not explained, in the St. Johns Bayou and New Madrid Floodway, Environmental Impact Statement, Phase 3 Preliminary Working Draft IEPR Submittal (hereinafter: DEIS). In addition, the variables (Y and X) in each of two regressions are not defined, nor are the indices. Explaining the nature of the indices allows the reader to discern whether the crop output model includes key variables such as temperature and natural precipitation.

Justification for use of national indices for this region of the United States is not provided, nor is the use of the linear functional form in the regression analysis. National-level indices may be formulated by including regions of the United States that heavily depend on irrigation, and thus may be poorly suited for modeling yields in regions where precipitation is natural.

Standard production analysis begins with use of a non-linear production model of yields that allows for diminishing marginal returns. These can often be transformed into log-linear models. A linear model of yield implies that one may increase inputs as high as desired, and always get a constant yield. This runs counter to conventional production analysis. This is important since the project primarily focuses on the issue of excess water from flooding, and the use of a linear model would correspond to the assumption that there is no such thing as excess water.

The current yields are estimated with a lack of precision, as are all statistical estimates, but confidence intervals are not provided in the report. Underlying assumptions about how current yields are estimated, as well as changes in these yields, are not provided.

Agricultural production under conditions of risk necessarily should be modeled in the presence of such risk. These not only include the usual risk in agricultural prices in the future, but also risks associated with flooding. An expected production or expected utility framework can be used, but the Panel finds no such framework is being used to model yields.

The project's benefits in the agricultural sector involve a large amount of risk. The report does model this using a conventional software program that introduces probability distributions for key random variables, enabling some risk analysis. However, the justification for the assumed form for the probability distribution function (which is normal) is not provided, and there is no justification for the assumed levels of variation (i.e., percentages used in introducing a standard deviation).

Significance: High

The majority of claimed net benefits for the project pertain to changes in agricultural yields that correspond to lower flood risks, but the DEIS does not include the justification to corroborate these findings.

Recommendations for Resolution:

1. Explain the variables used in the regression model, as well as the linear functional form for the model and upon what this is based in theory. Include whether national crop yield models should be used for this region of the United States.
2. Explain the assumptions underlying comparison between "low risk" and "higher risk" land production and why the former can be used to represent the latter after flood risks are reduced by the project.
3. Document actual losses in yields due to large flooding events in past years.
4. Model uncertainties, explain underlying assumptions, and describe how these affect estimates of the benefit-cost ratios. Provide justification for all assumptions using existing literature or data.
5. Present estimates of benefit-cost ratios with their confidence intervals, or present a range of estimated ratios corresponding to various levels of risk.

Final Evaluator Response to FPC1

Concur

Response to Recommendations

1. **Adopt.** More information will be presented in the economic appendix to better explain the process. Further, regional instead of national models were used for this analysis. This will be clarified in the Draft EIS.
2. **Adopt.** This is the process of dividing the flood hazard area into upper and lower zones. The lower zones are impacted more due to the risk of flooding. This process is presented in the economic appendix. The process can be expanded to better explain the assumptions.
3. **Adopt**. Current Corps guidance (ER 1105-2-100) in flood protection studies requires the use of "flood free" yields in evaluating potential projects. These yields can be influenced by the potential risk of flooding. This is taken into account by dividing the flood hazard area into upper and lower flood zones. Although documenting actual losses will not be included in the Benefit:Cost analysis calculations, losses based upon the economic model and specific flood years can be presented in the EIS.
4. **Adopt.** Based on the teleconference, more details would be provided regarding how the yield calculation is made, the time series model, and any other assumptions.
5. **Adopt.** Confidence intervals would be incorporated to account for various levels of risk.

Final Panel BackCheck Response – FPC1
Concur

Comment: 2

The project need, which is based on economic losses due to agricultural flood damage, is not quantified.

Basis for Comment:

The DEIS presents the project need by describing a variety of flood impacts; however, these are qualitative descriptions and are not tied to the calculation of the estimated net project benefits. The net benefits estimated for the project are monetized agricultural benefits based on quantified estimated differences between current and expected future yields. The report does not provide an estimate of past and current economic damage due to flooding, which might include economic damage from flooding roadways or homes, as well as the actual past losses in the agricultural sector. Including as many economic damage estimates as possible would demonstrate the need for the project.

Significance: High

The majority of the quantified estimated benefits from the proposed project derive from avoiding flood damage to agriculture. These benefits need to be demonstrated to justify the project need.

Recommendation for Resolution:

1. Provide estimates of past and present economic damage for as many years as is possible, documenting the source of the estimates of this damage and the years in which the damage occurred.

Final Evaluator Response to FPC2

Concur

Response to Recommendation

1. **Adopt.** The purpose and need section will be strengthened by providing estimates economic damages (See FPC#1, Recommendation 3) based upon model output. For example, average annual damages will be presented in the purpose and need section and social hardships would be expanded.

Final Panel BackCheck Response – FPC2

Concur with Comment

The Panel acknowledges that USACE is adopting our recommendations to provide estimates of economic damages based upon model output and expanding discussion of social hardships. To clarify, the Panel suggests that past damages be presented as supporting evidence that the project is needed.

Comment: 3
The economic benefit of the project is unclear because uncertainty is not considered in the analysis.
Basis for Comment:
The assessment of the net benefits of the project is dependent on the estimate of yield variations in the agricultural sector due to lower flood risks. In turn, the assessment of future agricultural production usually incorporates uncertainties regarding future crop prices. The proposed project provides potential benefits 50 years into the future, but does not include uncertainties, such as climate change conditions, the level of mitigation needed, and the costs related to the mitigation. The project analysis does explore the effects of risk by using a standard software package (At Risk), which is applied to the benefits estimates. However, this same procedure is not applied to future mitigation and monitoring costs, which also involve current and future uncertainties. For instance, habitat needed for mitigation cannot be estimated as point estimates with certainty. As both the benefits and costs for this project involve risk, they each involve probability distributions. The benefit-cost ratio itself is not a point estimate, but refers to a ratio that has a distribution of outcomes. The risk outcomes presented in the report might be quite sensitive to assumptions about underlying probability distributions. However, the assumptions do not include justification for the specific underlying distributions, with the exception of the normal distribution for some of the variables. The normal distribution may not be suitable for modeling variables affected by variation in weather, such as temperature or precipitation. For example, the log normal distribution is often used to characterize precipitation. The estimated economic benefits are quantified for the agricultural sector only, which assumes certainty in the calculations; therefore, the justification for the project currently relies on the single point estimates for the benefit-cost ratios for each alternative considered
Significance: High
Uncertainty must be incorporated into the analysis for a full understanding of the project's economic benefits.
Recommendations for Resolution:
1. Document sources of uncertainty for agricultural and other benefits for this project at present and into the future (50 years forward). 2. Develop a model of agricultural production (yield) that demonstrates that such uncertainties are factors in production decisions. Report variation in estimates that depend on the uncertainties using confidence intervals or other documentation of statistical errors.

3. Document uncertainties related to mitigation costs. These arise from both the quantity of mitigation habitat that is needed, and the variation in future expected costs of that mitigation.
4. Report benefit-cost ranges that correspond to the uncertainties for the project using either models that directly incorporate uncertainty, or ex-post risk analysis of point estimates.
5. Allow for other distributions than the normal for some of the random variables. Show the effect that making different assumptions has on estimates of confidence intervals or standard deviations.
6. Explain the robustness of final decisions regarding project implementation to uncertainties. Discuss the range or extent to which the basic assumptions and information supporting the economic analyses can vary without affecting the ultimate conclusions and recommendations of the study.

Final Evaluator Response to FPC3

Concur

Response to Recommendations

1. **Adopt**. A discussion regarding the sources of uncertainty and other benefits of the project will be included in the economic analysis. As previously indicated in the Phase 2 IEPR, global climate change is difficult if not impossible to quantify. Therefore, the period of record is used to make predictions regarding future conditions (i.e., the project area would experience variable flooding and variable precipitation) and will be ultimately used to determine the project's benefit to cost ratio. Based on past discussions with the panel during Phase 1 and 2 IEPR, global climate change would result in significant increases in agricultural prices. Likewise as indicated by Easterling (1993), global climate change models indicate that agricultural areas within the Missouri, Illinois, Nebraska, Kansas (MINK) region would mimic climatic conditions that occurred during the 1930's due to a lack of surface water/rainfall available for irrigation. Although this study looked at the overall region, it did not consider alternative sources of irrigation. The project area also is located in an area where groundwater supplies are plentiful. The majority of irrigated areas within the project area utilize this groundwater source. The project area is also adjacent to the Mississippi River. Therefore, in the event of surface water shortages and groundwater shortages, the Mississippi River would likely be "tapped" for water supply. Thus, it is logical to conclude that the project area is expected to remain an extremely valuable agricultural area even if other areas of the region experience "drought like" conditions as a result of global climate change. Based on this conclusion that the project area would remain a valuable agricultural area and other agricultural areas within the MINK would be sub-optimal areas, agricultural prices would be expected to substantially rise in the future due to climate change. Since USACE policy only allows for the utilization of Current Normalized Prices and not on forecasted prices, the benefit to cost ratio can be considered a very conservative estimate. Global climate change would likely place a greater demand for this project. Although there are limitations, this discussion will be expanded in the EIS and the economic analysis. The results will be presented in the sensitivity analysis.

2. **Adopt.** The current model utilized for this project demonstrates that such uncertainties are factors in production decisions. The economics sections would be revised to expand this discussion.
3. **Adopted.** Risk associated with mitigation is captured with a contingency placed on the cost of mitigation. Cost estimates would be presented in the Draft EIS.
4. **Adopt in Future**. This data is currently presented in the economics appendix. However, more detailed explanations or descriptions will be presented.
5. **Adopt in Future**. The process employed and the distributions chosen for the risk analysis sections will be reviewed and revised.
6. **Adopt in Future**. This section of the appendix will be reviewed and expanded as necessary to better explain the recommendations.

Final Panel BackCheck Response – FPC3

Concur

Comment: 4

The assumptions associated with food availability for waterfowl are not appropriate and provide unreliable estimates of biomass for waterfowl.

Basis for Comment:

In the Phase 2 IEPR and the Duck-use-Days Manual (DUDM) certification review, the Panel stated that the estimates of food availability in moist soil habitat used in modeling the spring migratory period (February and March) and potentially the fall and winter period were inappropriate. The DUDM uses an average of estimates resulting from multiple studies of habitat being managed by professionals with abundant funding, manifesting from multiple regions throughout the fall and winter; the DUDM then models depletion and decomposition to estimate food availability during spring. These estimates are appropriate only if moist soil mitigation is managed by professional wetland ecologists with adequate funding to properly manage hydrology and succession of vegetation. With the current level of ambiguity in the mitigation plan, there is little evidence that management by professional wetland ecologists will occur. In addition, rates of decomposition were estimated from studies conducted primarily from fall until the first of January, making estimates of decomposition into February and March unreliable. More recent studies provide an actual estimate of food availability in moist soil habitat during spring (Pankau 2008, Straub 2008) from a region near the study area. The Panel believes this estimate would be more appropriate for modeling resource loss and mitigation.

Similarly, in the DUDM, the estimate of invertebrate biomass in agricultural fields (primarily soybean or corn fields) during February and March is assumed to be the same as for rice fields during fall and winter (5 kg/ha). A recent study (Schultheis et al. in revision) indicates invertebrate biomass during February and March in flooded soybeans and corn is actually 20 kg/ha, 4 times greater than the parameter estimates used in the model based on this assumption. The author of the DUDM used an assumption of food availability based on the best available data at that time; however, use of this now-outdated assumption has led to an underestimate of waterfowl resources provided by flooded agriculture. In turn, the mitigation requirements for waterfowl resources are also underestimated.

Significance: High

The DUDM analysis does not properly account for the natural resources required by waterfowl that are dependent on the natural resources provided by this habitat, likely leading to an underestimate of required mitigation.

Recommendation for Resolution:

1. Reassess the estimates of food availability for February and March, moist soil vegetation, and flooded agriculture using the most recent research (Pankau 2008, Straub 2008, and Schultheis et al. in revision).

Final Evaluator Response to FPC4

Original Comment - Non Concur (Generated revised statement during comment response teleconference.)

While it is true that most of the studies referenced in the Waterfowl Manual were on public wildlife management areas, it is not true that all sites had high levels of intensive management. It is not appropriate to adjust the values from a single study or site (Pankau and Straub MS theses contain only one geographically relevant site in southern Illinois). The body of evidence from many studies of moist soil production in the MAV clearly demonstrates the large variability in production related to species composition, time and type of disturbance, climate, year and season, hydrology, location, etc. The strength of the DUD manual is that it uses all of the data from all studies, not just one site, to calculate an average and captures the range of conditions that occur in a variety of waterfowl habitats. The past and future production of food from seasonal herbaceous habitats in the SJNM was/is affected by these and other variables and will not be a single tight number every year. The statement that decomposition rates were only until the first of Jan is incorrect - e.g., Greer et al. 2007, Batema 1987, Heitmeyer and McGeorge 2009, Nelms and Twedt 1996, White 1985, Kross et al, and many others. Again, the insistence on using estimates from studies on one site in 1-2 years is not appropriate.

1. Adopt.
   The current analysis did use 20 kg/ha as the estimate for invertebrate availability in agricultural fields, stated on page 7, footnote "b". Therefore, it had previously been adopted for the project-specific analysis.

There were other issues discussed regarding FPC#4 during the teleconferences:

Draft Revised Statement (developed during Comment Response teleconference):
Without additional information, it is difficult to reconstitute estimates of DUD provided in Appendix F "Potential impacts of Proposed Flood Control Projects in the St. John's Bayou Basin/New Madrid Floodway" Tables 1 and 2.

Significance: Medium
The reader should be able to recreate the estimates of DUDs for existing conditions, without project, authorized project, and alternative scenarios; however, this is difficult to do without a table providing the acreage by habitat type that is expected to be present under each scenario.

Recommendation for Resolution:
Provide a table with estimates of acreage under each scenario for each habitat type used to estimate DUDs in Tables 1 and 2 of Appendix F.

1. Adopt. Further details regarding how the stage area curve (land use by elevation) was broken down into specific habitat types utilized for the waterfowl analysis will be provided in the Draft EIS to allow the reader to recreate estimates of DUD for each project alternative. Appropriate figures would also be developed.

The teleconference also had a discussion regarding bottomland hardwood restoration and herbaceous wetlands. Bottomland hardwood restoration will include the restoration of micro/macro-topography based upon geomorphologic standards. Therefore, it is likely that bottomland hardwood restoration would likely create herbaceous wetlands in the lowest elevations. However, it would represent a very small percentage of the overall mitigation site(s). With the exception of naturally flooding (precipitation, groundwater, or interior sump elevation) or impounding water during the waterfowl season, USACE does not intend to actively "disturb" these areas to maintain herbaceous vegetation. Since it is not know how many acres of herbaceous wetlands would be restored and there is no guarantee that woody vegetation would be prevented from becoming established on herbaceous areas, compensatory mitigation would not attempt to quantify the benefit to waterfowl from restoring herbaceous wetlands. Since herbaceous wetlands provide a greater amount of food availability than cypress-tupelo or riverfront forest (black willow/cottonwood), the result would be that compensatory mitigation calculations are under valuing the benefit to waterfowl. Therefore, mitigation may be over compensating for waterfowl impacts.

Final Panel BackCheck Response – FPC4

Concur with Comment

The Panel concurs that the areas should not be counted as part of the mitigation for lost waterfowl habitat; however, we do not believe that a) these areas will necessarily provide more food than either cypress-tupelo or river front forest and b) the assumption that waterfowl will be over mitigated. The production of these areas will be completely dependent on the hydrology, which controls what species of vegetation are produced, and which is unknown. These areas may very well produce more food than the aforementioned habitats, but may actually produce little to no food for waterfowl.

Comment: 5

The wetland cover (acreage) and quality are poorly documented.

Basis for Comment:

In the February 2011 Appendix E, Part 1 Report, USEPA identified 149,802 acres of wetlands in the St. Johns/New Madrid Bayou/Floodway. The statistical design of the study that estimated this amount of wetlands included 300 sites above the 5-year flood zone and included farmed (79%) and naturally vegetated (21%) wetlands. The Panel agrees that the Environmental Monitoring and Assessment Procedure (EMAP), which has been a tool used by the USEPA for decades, was used correctly, although there may be arithmetic errors in the tables. The Panel also agrees that it was appropriate for USEPA to include farmed wetlands in their wetland survey.

However, in an April 2011 memorandum, the USEPA acknowledged that the agency was not obligated to estimate wetlands subject to the Clean Water Act regulations. Therefore, there appears to be an unresolved disagreement between the USEPA and USACE on the estimated acreage of affected natural wetlands and wet farmland. This conflict involves up to 117,573 acres of farmed wetlands. The variance and confidence intervals (e.g., 90 or 95%) associated with each estimate needs to be clarified by USEPA in future generations of their report.

Significance: High

Without a firm resolution of the total area of wetlands affected by this project, few of the wetland impact or mitigation estimates are meaningful.

Recommendations for Resolution:

1. Resolve the dispute between the two Federal agencies regarding total wetland acreage. The Panel suggests that the two agencies should contract a third party to estimate wetland area, impacts, and mitigation for this project.
2. Provide additional detail on the wetland estimating methodology used by both agencies.
3. Include the basis of the quantitative assignments of indices to different types of wetlands in the body of the DEIS, along with ecological descriptions of these different types. The wetland "quality" is determined through the use of Functional Capacity Index (FCI) in the HGM technique.

Final Evaluator Response to FPC5

Concur – A firm resolution of the area of wetlands affected by this project is necessary.

Recommendations for Resolution:

1. **Moot Issue.** USACE and EPA have reached resolution on wetlands classified as forested wetlands and farmed wetlands have been clarified. As indicated by EPA, the original estimate did not imply jurisdictional status (*i.e.*, areas subject to regulation by the Clean Water Act). As indicated in the EIS and cited by Mitsch and Gosselink (1993)[1], there are numerous scientific and colloquial definitions of wetlands. To avoid further confusion on an already very confusing subject, the EIS is only utilizing the term

wetlands including farmed wetlands to refer to areas subject to regulation. USACE was originally very concerned with the estimate and the original use of the term "farmed wetlands" that was utilized in EPA's original report. This term caused confusion within USACE. It appears that that this term has caused additional confusion with the panel. Through interagency coordination and to clarify, these lands were designated as farmland*. The * signifies the area has some wetland indicators but should not be synonymous as farmed wetlands and should not indicate jurisdictional status. Based on the GTRS estimate, utilizing the definition of farmed wetlands and prior converted cropland, and the WETSORT analysis, EPA estimates that there are approximately 5,000 acres of farmed wetlands in the project area. Note that this is existing amount and does not mean that they would be impacted.

Usually the NRCS is the lead Federal agency in determining farmed wetland status. This is especially true in the project area. This is the main reason why the Project Work Plan stated that NRCS would be consulted with and lands that meet the definition of prior converted cropland would be removed from the potential wetland scene. NRCS estimates that there are 520 acres of farmed wetlands in the project area. The NRCS estimate involved transects across the project area with those familiar with the differences between farmed wetlands and prior converted cropland. USACE regulatory staff (not biologists assigned to this project) indicated that they did not observe any reason to question the NRCS estimate while they were in the field conducting the GTRS surveys. Although USACE would usually rely on the NRCS call, pursuant to the Clean Water Act, EPA is the final authority on determining what is or is not a farmed wetland. EPA has not made a jurisdictional call to date.

To maintain consistency in the manner in which the project area is regulated and to adhere to the methodology that was reviewed in the Project Work Plan, USACE is utilizing the EPA determination for forested wetlands and the NRCS determination for farmed wetlands. Although USACE would likely support a third party designee to resolve the disagreement between the NRCS and EPA, it is a moot issue due to mitigation required to compensate for other ecological resources (most notably fish). The HGM analysis was only conducted on areas that were determined to be jurisdictional wetlands. Other ecological models (EnviroFish, waterfowl, shorebirds) were run on functional floodplain habitat regardless of jurisdictional status. Therefore, any functions provided by non-jurisdictional areas were quantified by these models. Compensatory mitigation for fish requires a large amount of reforestation that includes the reestablishment of microtopography and hydrological restoration (plugging farm ditches, levee degradation, etc.). This type of mitigation would also compensate for impacts to wetlands, as long as the mitigation results in jurisdictional wetlands. Therefore, by providing the necessary compensation for fish, wetlands are over-compensated for either the NRCS estimate or the EPA estimate. This will be clarified in the EIS.

2. **Adopt.** Both the EPA and NRCS methodology will be included in an appendix with the appropriate level of detail so one could duplicate the effort.

3. **Adopt Clarification.** The Draft EIS will include a discussion with greater detail to demonstrate how wetlands were identified, divided into different HGM sub-classes, impacts quantified, and compensatory mitigation calculated. The discussion will be written in a fashion that would allow for duplication.

   In addition, the HGM appendix would be revised and text inserted into the main body of the EIS that better explains the different HGM wetland subclasses and how they provide different wetland functions.

[1]As previously indicated by the panel, this is an old citation. However, it is the version that we currently have.

Final Panel BackCheck Response – FPC5

Concur with Comment

The Panel agrees that with multiple agencies managing wetlands in the USA, cross-communication among agencies continues to be difficult. The Panel remains concerned about wetlands that fall under the category "jurisdictional" but we also recognize that non-jurisdictional wetlands such as some farmed wetlands and most bottomland hardwood forests provide many ecosystem functions and habitats that should be included in an EIS, regardless of their legal standing.

Comment: 6

The HGM methodology lacks the appropriate detail to validate the analysis results.

Basis for Comment:

The Panel appreciates that the HGM analysis in Appendix E, Part 2, is an important document for estimating the impacts of the project on wetlands and determining how much mitigation for those losses is needed. The HGM model concludes that the minimum wetland impact for the project occurs with Alternative 3.1. Functional losses and mitigation gains are estimated for detaining floodwater, detaining precipitation, cycling nutrients, exporting organic carbon, maintaining plant communities, and providing habitat. However, some of the functions not included in this study include nutrient retention and carbon sequestration.

The Panel believes that there are several assumptions of the HGM analysis that lead to uncertainty in the validity of the results.

- The Panel understands that the analysis is a working draft, not a complete report as it appears that it is waiting for USEPA to finalize estimates of wetland area. A completed estimate of study area wetlands by wetland hydrogeomorphic type is essential for HGM to provide valid results.
- The assignment of Functional Capacity Indices (FCIs) for the various wetland types within the study area seems to have a large amount of uncertainty. For instance, the Panel questions the FCI value of 0.97 for a riverine overbank wetland, but only 0.25 for agricultural wetlands. In addition, agricultural wetlands are given FCIs of 0.0 for providing plant communities and fish and wildlife support, a fact that concerns the Panel. Furthermore, ranges or probabilities are not assigned to these indices and the report contains little justification of the numbers, other than reference to other DEIS reports. For example, FCI assumptions allow conclusions that the project will have economic benefits to farmers by reducing agricultural flooding and that the same hydraulic modification will have little impact on the function of the wetlands.
- The report gives the Panel little information to determine the validity of the FCI values.
- The Panel strongly believes that the HGM report, while exhaustive in detail, is difficult to read and interpret. There are 50 or more tables of results (counting the often divided sub tables) that have poor table legends, far too many abbreviations that are poorly defined in the tables (e.g. LGRB, RGRO, UCD) and poor use of significant figures (e.g. 75.981% should be 76%) in all of these tables. The FCIs contain too many significant figures as well. This is not an indication that less information is needed in the report, but the report needs to better emphasize the pertinent information so it does not get lost in all the details. The report should have enough detail for someone to duplicate the analysis and results that provide the FCI values. Referral to yet other reports is not appropriate for such an important analysis. Overall, presentation of all the calculation details does not add rigor to the report conclusions.

Significance: High

The lack of detail in the HGM methodology leads to uncertainty in the validity and application of the results, and thus in the calculations for mitigation of the project

Recommendations for Resolution:

1. Revise the draft HGM report to further condense the material.
2. Provide additional documentation of the assignment of FCI indices and their variability.
3. Include detailed methods and results from field work that provided data used in the development of the FCIs and a list of all implicit and explicit assumptions regarding the FCIs.
4. Consider using an alternative method to complement the HGM analysis to better describe the effects of the alternatives on the ecosystem services of wetlands. The USACE could collaborate with the USEPA and other agencies on this effort.

Final Evaluator Response to FPC6

Concur

Response to Basis for Comments

It's true that carbon sequestration and nutrient retention are not functions that are addressed by the HGM models that were approved for this study. Nutrient cycling, which is a function that was addressed by the study, includes the cycling of carbon through the system, and the cycling of other nutrients. Sequestration (long-term retention) is part of that cycling, and a mature forest stores carbon and other nutrients in each of the ecological compartments specified in the model: trees, shrubs, ground cover, soil, snags, and woody debris. Rates of cycling are difficult to address in a rapid assessment, so the model uses indicators (the presence and structure of the various storage compartments) to evaluate the extent to which nutrient storage and cycling processes are intact.

The FCIs were calculated based on the models presented in the Delta Guidebook (Klimas et al. 2011) and the data collected at sites within the project area. They are no more uncertain than any sample data or model. The FCIs for each subclass are calibrated to data for that subclass only. The agricultural wetlands are in the subclass Riverine Backwater. They receive a 0.25 FCI, indicating that they are providing the Floodwater Detention function at only 25% of their potential. The model for that function (Klimas et al. 2011) combines flood frequency, which is the same for agricultural and other Riverine Backwater wetlands, and variables that make up a roughness term. Since roughness is vastly reduced at agricultural sites, the 0.25 FCI is reasonable (and again comes directly from entering site data into the model). On the other hand, the Riverine Overbank sites sampled often had fully intact roughness, meaning that they were performing the function of slowing floodwaters nearly at their maximum capacity. Comparing these indices *across* subclasses is inappropriate, since the models and reference data are only consistent within subclasses. The HGM analysis shows the changes in function within each subclass, or the conversion from one subclass to another. At no point does it try to indicate that the functions of one subclass are linearly relatable to functions in another subclass.

For all FCIs, including that for Fish and Wildlife Support, the top index (of 1.0) is derived from reference data collected in mature bottomland hardwood forested stands that have a relatively stable composition and structure. In other words, they are no longer going through succession, they are experiencing single-tree mortality and gap regeneration, and the young trees coming up in the gap are a similar composition to those that died. The Delta Guidebook (and other

guidebooks developed for the region) explicitly states that the wildlife models are designed to reflect the habitat needs of species associated with large tracts and mature forest conditions, because those are the species that have suffered the greatest habitat loss, such as the Louisiana black bear, the Ivory-billed woodpecker, and neotropical migrant bird species. Therefore that is the type of habitat that has the highest index value. Of course, other animals are supported during other successional stages, but other models are addressing those (i.e. shorebirds, waterfowl, fish).

The HGM analysis clearly shows impacts to wetlands associated with the hydraulic (and hydrologic) modifications of the project. The vast majority of these involve a change in flood frequency that it actually changes the subclass of the wetland from a river connected subclass (typically Riverine Backwater) to an unconnected subclass (Flat), and a loss of the riverine backwater functions associated with shift in subclass. This functional loss was addressed in the mitigation requirements, despite the fact that in most cases the wetlands are still present on the ground, and there was a gain in functions associated with the increase in acreage in the Flats subclass. These shifts, as well as other project impacts (direct clearing/filling) were used to calculate mitigation requirements. The remaining Riverine Backwater wetlands were also subject to a more modest decrease in FCIs. These are the Riverine Backwater wetlands closest to the channel, where the impacts of the project were least severe. This modest drop in FCI is the smaller impact of the project; the majority of the wetland functional loss in the New Madrid Floodway is due to the shift of large acreages of wetlands completely out of the Riverine Backwater subclass. River-dependant functions, such as the ability to Detain Floodwater, were completely lost for these wetlands. Since the Corps calculated mitigation for wetlands based on the greatest functional loss, all of these wetlands were treated as if they were completely converted to non-wetland, despite the fact that they are still in the landscape, and providing some functions. Therefore, most wetland functions are over compensated and the overall project (with mitigation) results in a greater acreage of wetlands than what currently exists. So the statement that the HGM analysis indicates that "the project will have economic benefits to farmers by reducing agricultural flooding and that the same hydraulic modification will have little impact on the function of the wetlands" is not correct. The panel appears to have overlooked the losses due to shift in subclass, and focused only on the drop in FCI for the remaining Riverine Backwater wetlands.

The FCI values are based on reference data collected in the field, and models presented in the "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Functions of Forested Wetlands in the Delta Region of Arkansas, Lower Mississippi River Alluvial Valley, Version 2.0 (Klimas et al. 2011). This Guidebook was approved for use on the project, and has since been published and is available from the Corps. It is more than 200 pages, covering models for each function, for each subclass, methods for collected variable data, all assumptions used in the development of the models and justifications for use of both the models and the variables they use. The analysis for the St. Johns New Madrid project involved 5 subclasses (Riverine Overbank, Riverine Backwater, Connected Depression, Unconnected Depression, and Flat) and up to 6 functions for each; a total of 30 models. It was deemed excessive to present all of those models and their justifications in this analysis when it is all available in the Guidebook. However, based on the IEPR teleconferences, additional detail would be provided in the Draft EIS and the wetland appendix would be revised accordingly

The HGM report was completed at the level of detail needed for the District to make determinations on the alternative with the least impacts, and the flexibility to adjust the calculations as either the alternatives were altered, or the wetland acreages changed, both of which were in flux as the analysis was being completed. The tables included in the report were part of the Excel spreadsheet calculating impacts. Because the acreages being provided by EPA were reported to the nearest acre, and the District wanted the math in the tables to sum correctly, unreasonably detailed percentages (e.g., 75.981%) were used to divide the wetland acreages among the subclasses in order to get a final acreage that remained constant to the nearest acre. When the acreages are finalized, and more reasonable rounding of those percentages will be possible. The use of expanded significant figures in the FCIs was to ensure that any change in function associated with the project would be captured and reflected in the mitigation requirements. Even small changes in FCI can have large impacts on mitigation debt when multiplied across thousands of acres. The Corps was attempting to be very conservative, and account for any loss in function, no matter how slight it appeared on the FCIs. Once the wetland acreages are finalized, the data would be presented with the appropriate level of significant figures

The abbreviations in the tables (LGRB, RGRO, etc.) represent the subclass names that are found throughout the document and described in detail in the Guidebook. We acknowledge that a table listing the abbreviations with the full subclass names would be convenient for the readers. The panel states that referral to another report to address methods, assumptions and models are not appropriate. Although this information is presented in a single report (the Delta Guidebook) and since all models are used for all but one of the subclasses discussed in that guidebook, a discussion regarding the different subclasses would be made in the main body of the EIS to clarify key aspects of the HGM analysis. The report did list any assumptions that were project-specific, and not inherently part of the models or HGM process.

Response to Recommendations:

1. **Adopt.** The HGM report and main body of the Draft EIS will be revised to condense the material as well as clarify key aspects of the HGM model.
2. **Adopt.** Additional documentation regarding the assignment of FCI indices would be provided in the Draft EIS. Variability with the HGM process would also be discussed. We realize that variability in determining FCI is of a concern. For example, two different people could come up with different FCI scores for the same wetland tract. That is precisely the reason why the model developer(s) conducted the analysis because they are the most knowledgeable regarding the particular HGM models, reference sites, and other wetland functions in the project area that are used in the model. See FPC # 8 regarding how risk and uncertainty would be addressed in the HGM model as well as other models.
3. **Adopt.** "A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Functions of Forested Wetlands in the Delta Region of Arkansas, Lower Mississippi River Alluvial Valley, Version 2.0" (Klimas et al. 2011) can be added as an appendix. In addition further details can be included in the main body of the EIS and revised wetlands appendix. All assumptions regarding FCI would be clearly indicated.

4. **Not Adopt.** Other alternate methods were used to compliment the HGM analysis (fish, waterfowl, shorebirds, and water quality). These methods are intended to compliment the HGM to describe the effects of the alternatives on a suite of environmental services. Although these models were not dependent on the site to be a jurisdictional wetland, they provide other necessary information to describe impacts of the project and formulate appropriate mitigation.

Based on the IEPR teleconferences, necessary revisions would take place prior to the public release of the Draft EIS and would be available to the panel during the Phase 4 IEPR process.

Final Panel BackCheck Response – FPC6

Concur

The FCIs have a great amount of inherent uncertainty, compared to, say, measuring a rate of productivity or a number of plant species. They are an educated professional guess of significance of a wetland's function. Therefore the panel contends that there is a great amount of uncertainty in these assignments of numbers for function. Use of the word "reasonable" above is cited as a cause to go forward, but there is no way to determine analytically or otherwise if it is correct. This is why the Panel suggested a method to determine "ranges or probabilities" to these values. Otherwise, the HGM technique, with all its exquisite details, gives the impression that it is analytically rigorous while it does, in effect, have a great deal of uncertainty associated with it.

We stand by our statement that as written the HGM report is "difficult to read and interpret." It needs to be rewritten and edited, perhaps in a collaboration of the authors with a professional science writer. Every table needs to have proper use of significant figures and all abbreviations described in the table so that reading the text is not required. The panel members also agree that an executive summary would be useful as well.

Comment: 7

The feasibility of the mitigation plan to compensate for impacts on environmental resources is not demonstrated.

Basis for Comment:

The Panel believes that there is a high level of uncertainty regarding the implementation of the wetland mitigation plan. The DEIS contains mitigation plans for all impacted resources that are in the early stages of development. Substantial acreage (>5,000 acres) will be affected by the project, so substantial acreage will be required to mitigate for loss of environmental resources (wetland, waterfowl, shorebird, fish), along with long-term needs for management. The DEIS indicates this property will be purchased from willing sellers, but there is no indication there is an adequate number of willing sellers available for needed purchases or permanent easements. For example, the wetland mitigation proposed at Big Oak Tree State Park cannot be achieved without property acquisition; however, a back-up plan was not presented if the property acquisition does not occur.

In addition, the DEIS does not contain a consensus between USEPA and USACE as to the extent of wetland area within the study area. In addition, the Panel has concerns with the documentation of the HGM indices used to estimate the impact of the alternatives on wetland function. Based on all of these uncertainties, the Panel does not have confidence in the estimates provided in the DEIS on the amount of wetland mitigation needed for the project, nor is the Panel confident that the mitigation will take place as described.

Significance: High

Project success is dependent on the development and implementation of a thorough mitigation plan that accounts for the loss of natural resources in the project area. Without more detail, the Panel is unable to make an accurate assessment of the likely success of the mitigation.

Recommendations for Resolution:

1. Develop the details of the wetland mitigation to include the provision of alternative plans if land cannot be purchased or otherwise acquired.
2. Consider developing a wetland mitigation bank within the project area, perhaps in the vicinity of Big Oak State Park. This should increase the probability of wetland success and provide a secure mitigation future.
3. Develop preliminary agreements between land owners and USACE for land purchase or easements prior to the initiation of the project.

Final Evaluator Response to FPC7

Note – The recommendations for resolution seem to coincide with the first paragraph of the basis for comment only. It appears that paragraph 2 should be moved to another comment that specifically deals with the EPA wetlands assessment and HGM. Perhaps Comment 5 and 6, respectively.

Concur. Site specific mitigation plans are necessary with further detail (specific elevation, flood frequencies, and duration) to ensure project success.

USACE understands the panel's concerns regarding alternative plans if land cannot be purchased or otherwise acquired. However, mitigation land must be acquired from willing sellers. In addition we do not identify potential landowners until a decision regarding the project is formally made and documented in a Record of Decision. Lastly, we are constrained by the Federal budget. Although it is conceivable that the project could be 100% funded up front, it likely will not. Funding would likely be provided over numerous fiscal years.

Compensatory mitigation would occur concurrently with other project construction. Therefore, the following is proposed to ensure that lands are made available and provide a reasonable safeguard:

1. If a Record of Decision is signed to construct the project and following any modifications necessary to the Project Cooperation Agreement (legal contract between the Federal government and non-federal sponsor), landowners would be queried over their willingness to sell and or enroll lands in a conservation-type easement.
2. Each potential tract of land would undergo a preliminary investigation consisting of landscape positions, soil types, source(s) of hydrologic restoration, elevation, etc. Based on this criteria a preliminary determination would be made regarding the type of compensatory mitigation (*i.e*, bottomland hardwood restoration, seasonally inundated farmland, borrow pit) and whether or not the tract should be acquired. The interagency team would be consulted with and available lands would be "ranked" in order of anticipated ecological value. Note that the completion of construction plans and specifications for specific construction items would also be occurring simultaneously but construction would not commence.
3. As funding is made available, specific tracts of lands would be acquired.
4. A site-specific mitigation plan would be developed for each particular tract after it is acquired. The site-specific plan would include the specific gains to ecological/wetland functions from the establishment of mitigation. Although the interagency team will likely participate in the development of site-specific plans (especially MNDR for lands associated with Big Oak Tree State Park), a draft plan would be developed and circulated to the interagency team for official comment. Following the opportunity for the interagency team to comment on the draft and any applicable revisions to the site specific plans, each specific plan would be submitted to MDNR for official approval as part of any state water quality certification requirements.

5. Construction would not commence on any particular construction increment until there is an adequate amount of mitigation credits that are approved in site specific mitigation plans. Therefore, lands would be acquired and an approved plan in place prior to impact. Although this not the same as a formal mitigation bank, USACE is of the opinion that this would satisfy the intent of a bank. Lands surrounding Big Oak Tree State Park will be a priority. **[Recommendation for Resolution 2 – Adopted in part]** Therefore, the impact would not occur until the lands have been acquired. **[Recommendation for Resolution Number 3 – Adopted in part]** In the event that lands are not made available, construction would not commence. Therefore, an alternative plan is not necessary. **[Recommendation for Resolution Number 1 – Adopted in part].**
6. Mitigation implementation and construction of flood risk management features would occur simultaneously.
7. This process would continue for each respective construction increment. Landowners would be periodically queried to determine willingness and mitigation tracts would be re-ranked accordingly.

Although the above methodology would ensure that mitigation lands are acquired prior to direct impacts and that mitigation would occur concurrent with other project features, the following methodology is proposed for the indirect impacts of the project associated with pumping stations and the closure levee:

1. Based on specific fiscal year funding and to comply with budgetary fiscal law, funding would be split proportionally to project engineering and design, construction, mitigation land acquisition, and mitigation implementation. Construction of pumping stations and the levee closure would also likely take place over several construction increments. For example, construction increment 1 could be necessary cofferdams, increment 2 could be foundations, increment 3 could be installation of pumps, and so on. However, construction of any specific increment could not be started (i.e., contract awarded) until a proportional amount of compensatory mitigation lands acquired and a site-specific detailed mitigation plan developed. For example, assume the St. Johns Bayou portion of the project's total cost is $72 million, including $15million necessary for mitigation (approximately 21% of total cost). Next assume that the project is appropriated $6 million for a given fiscal year. With this formula, $1.26 million in mitigation would be necessary (land acquired and site specific detailed mitigation plan approved) prior to awarding a construction contract for the remainder ($4.74 million) of the fiscal year funds.
2. Although adhering to the procedures outlined above should result in concurrent mitigation, to further ensure mitigation is in place, the St. Johns Bayou portion of the project would not be operated (pumps turned on) until all site specific mitigation plans that demonstrate the St. Johns portion of the project has been mitigated are approved by MDNR.
3. The procedures outlined above would also be implemented for the New Madrid Floodway portion of the project. Construction of the New Madrid Floodway would involve re-routing Mud Ditch around the construction site, constructing a cofferdam at

the present location of Mud Ditch for construction features, 1,500-foot closure levee with the exception of the area needed for Mud Ditch, and reestablishment of the Mud Ditch alignment following construction. The last construction item would be to reestablish Mud Ditch alignment and close the last remaining portion of the levee. Although the above methodology should result in concurrent mitigation, this last portion of construction would not take place until all site specific plans that demonstrate the New Madrid portion of the project has been mitigated and approved by MDNR.

Final Panel BackCheck Response – FPC7

Concur

The Panel acknowledges the added detail that has been provided to ensure that mitigation properties will be purchased or obtained and that landowners will be queried to determine their willingness to sell.

Comment: 8

It is unclear if the proposed mitigation plan will compensate for impacts on environmental resources because the models do not incorporate uncertainty.

Basis for Comment:

The environmental models used to estimate resource impacts and required mitigation are deterministic and do not include estimates of variance or confidence intervals. This limitation was also recognized during the certification review of the DUDM. While the models may provide the most likely estimates of impacts on resources, there is an equal likelihood the results may either under or overestimate needed mitigation. The Panel believes that there is an unacceptable amount of uncertainty associated with the estimates of required mitigation predicted by the models due to variance associated with a number of the data-based parameter estimates. In addition to this overall uncertainty, many parameter estimates are based on educated guesses with little or no data available for support. For example, the DUDM estimate of invertebrate biomass in agricultural fields (primarily soybean or corn fields) during February and March is assumed to be the same as for rice fields during fall and winter (5 kg/ha). A recent study (Schultheis et al. in revision) indicates invertebrate biomass during February and March in flooded soybeans and corn is actually 20 kg/ha, 4 times greater than the parameter estimates used in the model based on this assumption. Although the author of the model made an assumption based on the best available data at that time, that assumption led to an underestimate of waterfowl resources being provided by flooded agriculture, thus, an underestimate of needed mitigation. Similarly, mitigation for terrestrial wildlife is based on the habitat needs of a few key species, with no supporting evidence that the habitat needs of those species adequately represent all the species typically found in the terrestrial environments. For example, none of the species used in the model requires adjacent wetlands and terrestrial habitat, while many amphibians and reptiles (none of which are in the model) do.

Significance: High

An accurate estimate of the impact of the project on environmental resources within the project area is required to determine the amount of mitigation needed.

Recommendations for Resolution:

1. There are two potential alternatives to resolving this issue:
   a. Preferred resolution: Incorporate variance estimates with parameters for each of the models, allowing for 95% confidence intervals with the model point estimates. The upper 95% confidence limit could then be used as an estimate of required mitigation. Although this approach would not account for error due to invalid assumptions, it would likely ensure most impacted resources are appropriately mitigated. Important assumptions could be assessed later during the adaptive management phase and an appropriate modification to the mitigation could be made as needed. The Panel acknowledges that there are data limitations that may prevent the use of this approach.
   b. Alternate resolution (suggested in the Phase 1 and Phase 2 IEPR): Identify an increase in the level of mitigation required to ensure the level of mitigation is

adequate for all impacted resources. In the past, Federal agencies have increased mitigation by a ratio of 2:1 to 4:1, estimated level of resource mitigation to estimate level of resource loss, to account for uncertainty in the estimates.

Final Evaluator Response to FPC8

Concur – Pending further USACE review and policy review

We prefer to utilize the language that some model estimates are based upon best professional judgment based upon years of experience for support. Models have been developed by experts within specific fields that underwent further review by independent experts as part of the USACE model certification/approval process. Furthermore, specific estimates were coordinated with the interagency team as well as this independent panel in previous phases of IEPR. Utilizing the term "guess" suggests that we simply made up a number when it is clear we have not.

No herpetological or reptilian species models were used in the HEP analysis. Coordination with USFWS concluded that no readily available HSI models for herpetological resources could capture the hydrologic changes associated with the project. USFWS stated that the models used, coupled with other ecological models (Envirofish, HGM, waterfowl and shorebirds) would adequately quantify impacts to wildlife resources. Based on the IEPR teleconferences, the project could result in a net benefit to amphibians due to fewer acres being available to fish.

1a. Adopt in Part. As stated, the models provide the most likely impacts on resources. Although uncertainty may be an issue if impacts and mitigation were calculated on one particular model, the use of multiple models that account for multiple ecological resources, across multiple habitats, and throughout the entire year, for every day over a 67 year hydrologic period of record addresses this risk. For example, if the mitigation was based solely on the greatest impacted resource (i.e., fish), it would be uncertain if the mitigation plan would compensate for the other resource categories (e.g., wetlands, shorebirds, etc.). This is not the case with the methodology used for this project. The mitigation plan compensates unavoidable significant impacts to multiple resources, not just one resource category.

Although uncertainty with the model conclusions is significantly reduced to levels that would allow for informed decisions regarding the project, one could argue that there will always be additional risks and unknowns. However, this uncertainty is present in both underestimating and overestimating the mitigation requirements. The project team understands the need to incorporate variance estimates with parameters for each of the models. Therefore, 95% confidence intervals will be placed around model results. Based on discussions with the panel, there are numerous methods that could be utilized to establish the confidence intervals. USACE is finalizing methodologies with model developers and statisticians to ensure that confidence intervals are incorporated properly. Many of the models utilize defined HSI scores that would be problematic for the placement of confidence intervals. For example, given that the DUD manual produced estimates of food availability, TME, RMR, etc. from the combination of many studies that used sometimes very different methodologies, locations, techniques, etc., it is not possible to calculate a single CI or Standard Error on the final DUD estimates.

The presence of stochasticity is acknowledged and discussed on p4 of the DUD manual and we note that the SE's of estimates generally are <20%. For the DUD estimates, it might confuse, rather than clarify, the final estimates to suggest something that we really cannot precisely calculate because of heterogeneity of the many studies that have been averaged. In addition, panels comments seem largely based on the false assumption that estimates of invertebrate biomass in agricultural fields (primarily soybean or corn fields) during February and March is assumed to be the same as for rice fields during fall and winter (5 kg/ha), when in fact the panel recommendation of 20 kg/ha was used in the analysis.

As opposed to placing confidence intervals around defined values, confidence intervals could be placed on model input parameters. For example, Habit Units for fish are defined as Average Daily Flooded Acres (ADFA) multiplied by HSI values. There is no variance in the HSI values, they are defined (*e.g.,* bottomland hardwoods = 1.0, agriculture = 0.2). Confidence limits could be set around the ADFA calculations to account for any unknowns. Likewise, a similar "acreage confidence limit" could be established for the other models. Methodologies will be established and results presented in the Draft EIS.

Based on the teleconference, some confidence limits could be higher than total available amount. If this is the case, logic would be used and the value should default to the maximum available instead of the upper confidence interval. For example, vegetated wetlands confidence intervals below the five-year flood frequency are greater than the total amount of vegetated acreage available. In this case, logic would suggest utilizing the total amount of vegetated area available.

In addition to the establishment of confidence intervals, the Draft EIS will be revised to include a discussion on uncertainty.

Your recommendation stating to base mitigation on the upper 95% confidence limit is noted. For the purposes of the mitigation plan, USACE intends to utilize the results of the model because "they provide the most likely estimates of impacts on resources". The costs associated with basing mitigation on the upper 95% confidence limit will be presented and costs calculated, but it will be utilized as a mitigation contingency cost. This contingency cost, in addition to the original mitigation cost, is factored into the project's Benefit:Cost ratio equation. Therefore, the uncertainty associated with the estimates of mitigation would be addressed in the overall project decision..

As stated in the EIS, mitigation would be monitored and the project will be adaptively managed. In the event that a need for further mitigation is identified, the cost of the associated mitigation would already be accounted for and could be readily available for additional mitigation implementation.

1b. **Not Adopt/Not APPLICABLE.** The utilization of arbitrary mitigation ratios would not correct any "uncertainties" from more rigorous methods utilized to determine project impacts and on which mitigation decisions are based. Likewise, the ratios provided by the panel are mostly used in small regulatory requirements that result in a complete destruction of wetlands and not on large Civil Works projects such as the one proposed. The majority of project impacts for the St. Johns Bayou and New Madrid Floodway Project are indirect impacts. For example, the wetlands would physically still occur,

although hydrologically altered. Establishment of mitigation ratios would be highly speculative and are not utilized for water resources development projects due to policy.

Final Panel BackCheck Response – FPC8

Non Concur

Estimates of impacts and needed mitigation are presented in the DEIS as if they were measures or known values, but they are not. Estimates of impacts and needed mitigation are derived from models that use either samples of data that provide parameter estimates (model inputs) or parameter estimates based on educated opinions. Because model outputs are estimates, not measured quantities, they include a certain level of uncertainty due to potential biases and variances associated with the model inputs. The most likely biases are associated with untested assumed functions in the HGM, fish, and shorebird models and the HSIs associated with the fish and shorebird models. Although these potential biases lead to uncertainty, the Panel recognizes alternative information is currently not available, thus, potential biases will have to be addressed in the adaptive management process.

In contrast, variance associated with model inputs can be addressed in the EIS by incorporating variances of inputs and estimating 95% confidence intervals. In the cases where actual data were used to derive inputs for the models (the HGM, and DUD Manual), the variance are means taken from the literature with associated measurement and sampling error (the Panel is not suggesting this isn't the appropriate approach; just that approach is available and used in the DEIS). Because the model inputs are means from actual measurements, the technical aspects of incorporating associated variances with the model input to estimate confidence interval with the model outputs is, although time consuming, relatively simple. In the case of the fish and shorebird models the HSI are educated opinions, thus, they include uncertainties both in the form of unknown variance as well as assumed but relatively untested relationships. Because most parameters in the shorebird and fish models are based on opinion rather than data, variances for the parameter estimates do not currently exist.

Variances can be estimated, however, using Monte Carlo type simulations with some assumed distribution to provide an estimate of the certainty of the model outputs. Although this approach would not account for inappropriate assumptions, it would at a minimum provide an indication of how variation in the HSIs influences the model outputs. In the most recent e-mail exchange prior to the Vertical Meeting on 1/11/2012, it appears the UASCE is proposing to include the variance associated with the hydrologic inputs but not the variance associated with all the other model inputs. The Panel believes this approach could be even more misleading than the current approach of ignoring the variance associated with the model outputs. This approach would include a confidence interval based on only one small component of the variance (uncertainty); thus, produce an over estimate in the level of certainty in the model outputs. The Panel believes that to fulfill the requirements of NEPA, USACE must consider uncertainty associated with the model outputs. The most scientifically appropriate way of doing so is providing 95% confidence intervals for the model outputs. The Panel would like to cite a similar recommendation (Recommendation # 4) was made during the certification review of the WAM DUD manual.

Comment: 9

The feasibility of the mitigation needed to compensate for impacts on the fisheries resources is not demonstrated.

Basis for Comment:

The previously authorized project (Alternative 2) would result in a fish spawning/rearing habitat loss of Average Annual Habitat Units (AAHU) in the New Madrid Floodway of 92.4%, 91.7%, and 88.3% for early, mid, and late seasons, respectively. This improves to 61.6%, 71.2%, and 79.4% of pre-project AAHUs with Alternative 3.1 (tentatively recommended plan). The St. Johns Bayou AAHU habitat loss is the same for both Alternatives 2 and 3.1. Early, mid, and late season loss to fishery resources are 28.5%, 31.1%, and 31.7%, respectively, of pre-project AAHUs. This needs to be clearly stated in terms of both the percentages and changes in AAHUs for each alternative for each season. With this amount of habitat loss and the uncertainty of mitigation due to unknown land acquisition prospects, the project becomes environmentally questionable until a mitigation plan is in place with specific AAHU compensation.

The DEIS uses the Ten Mile Pond Conservation Area modifications as part of the mitigation plan for fish spawning/rearing habitat, but mitigation details are lacking and AAHUs have not been quantified.

Fish access to Big Oak Tree State Park Restoration through the proposed hydrologic connection to the Mississippi River near Big Oak Tree State Park is not addressed. If fish do not have access or use of this area for spawning/rearing, then this area should not be considered a mitigation feature for fish.

As stated in the Phase 1 and Phase 2 IEPRs, gate and pump management was a main feature of the previous NEPA documents. However, examples of potential increases in AAHUs due to holding water during rearing/spawning season have not been provided in the DEIS.

Tables 2.5 and 2.6 show the hypothetical gains the AAHUs for fisheries; however, seasonal comparisons are needed to properly evaluate differences between impacts and mitigation gains. Additionally, the AAHU gains for batture land reforestation and floodplain lakes (located on the batture) are the major (56.3%) mitigation feature outlined for the New Madrid Floodway. This AAHU mitigation is high, considering that fish passage reduction into the floodway is anticipated to be 27%.

The DEIS states that riparian buffer strips are proposed to compensate for the impacts associated with channel modifications, as well as spawning and rearing habitat. However, quantification of channel modification, AAHU loss, and compensation from mitigation needs to be presented in more detail. Plant communities that will naturally revegetate will vary based on slope and elevation. For example, riverfront forest species are not likely to be found at an elevation greater than 20 ft of the surrounding area since this area would never flood. This elevation would more likely revegetate to terrace hardwood forest species.

It is unclear if Table 5.1 takes into account the timing of the flood. For example, if habitat does not meet water duration and depth requirements during the fish spawning/rearing periods, it will not provide mitigation habitat for fish.

Significance: High

With the potential amount of habitat loss and the uncertainty of mitigation due to unknown land acquisition prospects, the project will be considered environmentally questionable unless a feasible mitigation plan is developed with specific AAHU compensation.

Recommendations for Resolution:

1. Finalize development of land acquisition and mitigation plans prior to construction. This is due to the large amount of fish spawning/rearing habitat loss expected.
2. Explain the AAHU mitigation gains for fish spawning/rearing habitat at Ten Mile Pond.
3. Clarify the required fish access to Big Oak State Park and recommend monitoring of this mitigation feature.
4. Develop mitigation scenarios that show potential gains in AAHUs by holding water on fish spawning/rearing habitat for the entire spawning periods. Revise Tables 2.5 and 2.6 so that they are based on fish spawning/rearing seasons.
5. Limit the percentage of mitigation in the batture to no more than fish passage reduction (27%) of all mitigation in the New Madrid Floodway.
6. Quantify and clearly present the channel modification impacts and riparian buffer mitigation to compensate for loss.
7. Provide details of water depth and duration criteria for Table 5.1.

Final Evaluator Response to FPC9

Concur

Response to Recommendations

1. **Adopt in Future.** Land acquisition and mitigation plans would be finalized prior to construction and necessary safeguards have been incorporated into compensatory mitigation to ensure lands are acquired prior to construction. Additional information is found in FPC # 7.
2. **Adopt in Future.** Anticipated gains in AAHU from restoring hydrology to the Ten Mile Pond Conservation Area will be finalized prior to the release of the Draft EIS. Restoring hydrology to Ten Mile Pond remains an option, but it is not known if the Missouri Department of Conservation would be willing to restore the flood pulse on their managed property. Therefore, this would remain an option that could be used in the future during the development of site-specific mitigation plans but is not necessary to demonstrate that mitigation would be successful.
3. **Adopt in Future.** Fish access is required to Big Oak Tree State Park for it to provide the stated compensatory mitigation amount. Although fish access is expected to occur, methods that maximize fish access to the park will be explored during the completion of site specific mitigation plans and other necessary plans and specifications required for the gated structure. Considerations will be made on the timing of water introduction to maximize benefits to fish reproduction. The depth and velocity of flow and minimization of any head differential that may impede fish access will also be considered.

4. **Adopt in Future.** Mitigation scenarios that show potential gains in AAHUs by holding water for the entire spawning and rearing periods to create a spawning and rearing pool will be included in the EIS. Mitigation estimates will be documented seasonally (i.e., early, mid, and late seasons) consistent with the way impacts were calculated. Based on previous IEPR phases, HSI would be based on underlying land use and not the formation of a permanent waterbody.

5. **Not Adopt.** Based on the IEPR teleconferences, fish habitat provided in the batture should not be limited to 27%. However, the Draft EIS must demonstrate that other ecological resources are compensated. Based on the teleconference, providing mitigation in the batture is a prime area for some resources (wetlands and fish). USACE acknowledges that batture mitigation is not prime for all resources and specific wetland sub-classes. Therefore, in a similar method that was utilized in previous NEPA documents, USACE will develop a basic mitigation plan that demonstrates that impacts associated with the Clean Water Act (*i.e.*, jurisdictional wetlands and Waters of the United States) are compensated. This will be accomplished by utilizing the HGM model and the Missouri Stream Mitigation Method. Benefits to remaining ecological resources (fish, shorebirds, and waterfowl) would be quantified for this basic mitigation plan utilizing the applicable model. Additional mitigation would be "added" to the basic mitigation plan to demonstrate that all significant impacts as a result of the project are compensated to the extent justified and mandated by law.

6. **Adopt.** The Missouri Stream Mitigation Method is being utilized to compensate for channel modifications. This section would be clarified.

7. **Not Adopt.** The mitigation zones presented in Table 5.1 are used to base mitigation priority. Specific details of water depth and duration as it relates to fish can be found in Section 4.8.5.9. Therefore, it was omitted from Table 5.1 because it was previously discussed.

Final Panel BackCheck Response – FPC9

Concur with Comment

The final Evaluator Responses to FPC9 and FPC7 seem inconsistent. The project construction impacts a relatively small land area compared to the project impacts from the operation of gates and pumps. The Panel concurs that incremental land acquisition and mitigation plans will take place during construction and would be finalized prior to operation. This approach would provide insight regarding land purchases before construction is completed assuming that the construction time period is long enough to make changes to mitigation opportunities if land is unavailable for purchase.

Comment: 10

The shorebird mitigation plan contains inconsistencies that make its goal unclear.

Basis for Comment:

The DEIS provides a detailed plan to compensate for impacts on shorebird habitat area (pp. 147-152), but then later states (p. 152) that "Additional mitigation for shorebird habitat will not be required, as any needed mitigation will be provided through compensatory actions for impacts to waterfowl, fish, wetlands, and terrestrial wildlife." The references to "additional mitigation" or "any needed mitigation" in this statement are unclear. If this is intended to convey that no mitigation will be performed to replace shorebird habitat lost to other mitigation projects, this issue is no longer relevant with respect to shorebird mitigation. The Panel raised the issue in the earlier versions of the mitigation plan in the Phase 2 IEPR relative to several different resources because that plan did not compensate for all of the impacts on each resource, including shorebird habitats. Since the goal of the current mitigation plan is to compensate for all impacts on shorebird habitats, the discussion about additional mitigation is no longer relevant with respect to shorebird habitat mitigation. As discussed in the Mid-Review Teleconference on 10/31/2011 with USACE, Battelle, and the Panel, this section could be simplified by removing the text starting on p. 151 with "USACE's position…" up to Section 4.8.5. This would help reduce the uncertainty and inconsistency of the presentation of the plan.

Significance: High

The mitigation plan should be described clearly and consistently so that its adequacy can be determined.

Recommendation for Resolution:

1. Remove the text on p. 151 starting with "USACE's position…" through Section 4.8.5.

Final Evaluator Response to FPC10

Non-Concur

Response to Recommendation

Although restoration activities such as bottomland hardwood restoration provide historic habitat, according to the shorebird model, restoration of bottomland hardwoods would result in an impact to shorebirds. USACE is of the opinion that restoration of bottomland hardwoods and other historic habitat does not result in a need for compensatory mitigation. USACE is proposing shorebird mitigation only to impacts of the flood risk management project and not on compensatory mitigation measures needed to compensate for other ecological/wetland resources. As stated in the EIS, there are conflicting resources with different habitat requirements.

Final Panel BackCheck Response – FPC10

Non Concur

WRDA states that the goal of mitigation is that "any remaining unavoidable damages have been compensated to the extent possible" (WRDA 2007). The DEIS, on page 227, describes the goal of mitigation as to "ensure that other habitat types are mitigated to not less than in-kind condition, to the extent possible." The Panel's opinion is that full mitigation for project impacts to habitat functions is both possible and desirable, and that it is also supported by WRDA. USACE provided a memo dated 22 December 2010 and a reply dated 11 January 2011 on this issue. The Panel's opinion is that the policy expressed in the 6 January 2011 memo does not agree with either the policy quoted in the DEIS or with WRDA, and includes several incorrect statements that understate the impact of the proposed project in terms of shorebird habitat, and possibly other functions as well. As discussed in Final Panel Comment 26, which was adopted by USACE, there was likely historical habitat in the project area for shorebirds before agricultural conversion. Second, simply saying that shorebirds can relocate to other areas does not address the net loss of habitat function that would result from the project if the impact is not fully mitigated. It is impossible for the Panel to determine the extent of potential mitigation plan impacts to other resources, because the mitigation plan has not yet been specified in detail. However, the Panel maintains that the goal of the mitigation plan should be to follow WRDA guidance, and to fully mitigate for all project impacts, with a final goal of not less than in kind replacement of significant ecosystem functions.

Citation

WRDA 2007. Implementation Guidance, Section 2036(a) of the Water Resources Development Act of 2007—Mitigation for Fish and Wildlife and Wetlands Losses requires that the project "… demonstrate that damages to all significant ecological resources, both terrestrial and aquatic, have been avoided and minimized to the extent practicable, and that any remaining unavoidable damages have been compensated to the extent possible… ."

Comment: 11

The adaptive management plan lacks the details necessary to ensure that environmental resources affected by the project are appropriately mitigated.

Basis for Comment:

Additional detail is needed on the type of parameters to be monitored and what objective criteria will be used to determine if mitigation wetlands for waterfowl have reached their desired objectives. Further, the adaptive management approach requires both a monitoring and response phase. There is no indication as to what type of modification would occur in the mitigation plan (e.g., increase in mitigation acreage) if the mitigation actions do not meet objectives.

Significance: High

Without more detail, it is impossible to determine whether the DEIS meets resource mitigation requirements.

Recommendation for Resolution:

1. Provide a detailed monitoring plan that accounts for more frequent monitoring of herbaceous wetlands (moist soil habitat, e.g.,, every 3 years throughout the life of the project), identification of specific parameters that will be monitored (preferably food availability in each of the habitat types), objective criteria or thresholds for assessment of success (e.g., kilogram of food per hectare), and potential responses if mitigation does not reach objectives (e.g., additional mitigation).

Final Evaluator Response to FPC11

Concur

Response to Recommendations:

The DEIS would be revised to provide greater details regarding short term and long term compensatory mitigation monitoring.

Every mitigation tract of land would undergo short term monitoring (expected to occur for 5 years following mitigation implementation). The goal of short term monitoring is to ensure that implementation of mitigation features are functioning as designed. Specific monitoring would be based on the objective of the tract and what type of resource(s) is being compensated. The Draft EIS will be expanded to include more details regarding short term monitoring. In summary, short term monitoring would include parameters such as hydraulics and hydrology and % survivorship of newly planted vegetation.

Once specific mitigation tracts are determined to be successful, a portion of mitigation tracts will be utilized for long term monitoring and adaptive management. Section 6 of the Draft EIS will be expanded to include more details. In addition, based upon the teleconferences the following will also be incorporated:

1. Fish access at Big Oak Tree State Park.

2. Waterfowl – Section 6.4.3 will be expanded to include methods that would be utilized to assess available waterfowl food.
3. Details regarding costs would also be provided.

Final Panel BackCheck Response – FPC11

Concur

Comment: 12

The adaptive management plan does not provide specific details on the source(s) of funding needed to implement the plan.

Basis for Comment:

Adaptive management is a widely accepted practice, allowing for mid-course corrections when the original mitigation goals are not achieved. Use of adaptive management can significantly increase the effectiveness of mitigation efforts. However, it requires considerable data input on project conditions, because the data are used as the basis for future mitigation decisions. Effectively implementing adaptive management requires a commitment to collect data on which to base ongoing management decisions.

The Panel supports the use of adaptive management as described in the DEIS. However, the cost to implement adaptive management can be high, given the need for repeated iterations of management action, collection of field data on site conditions, and reanalysis of approaches required to provide the necessary mitigation. In an era of increasingly tight agency budgets, the costs for implementation need to be determined and appropriate sources of funding identified.

The DEIS suggests that the management responsibility for some of the proposed mitigation sites should be transferred to other agencies. However, the source of the funding is not clear. Without a source of funding, crucial adaptive management activities would likely be halted, jeopardizing the success of the project.

Significance: High

The source of funding is a critical aspect of the adaptive management plan that needs to be identified to ensure that the project goals are achieved.

Recommendation for Resolution:

1. Specify the funding source(s) to support ongoing adaptive management of the mitigation projects, and include these costs in the overall cost of the project.

Final Evaluator Response to FPC12

Concur

Response to Recommendations

1. **Adopted.** Adaptive management costs are included in the project's cost estimate. Funding for adaptive management associated with the New Madrid Floodway closure would be a Mississippi River and Tributary Project item (Mississippi River Levees Feature). Remaining project features would be funded pursuant to the project's cost sharing authorization (75% federal funds St. Johns Bayou and New Madrid Floodway Project and 25% non-federal funds). All federal funds would be subject to Congressional authorization and applicable fiscal laws. Based on cost sharing policies and regulations, non-federal funds cannot be obligated until the cost share control record is in balance with non-federal cost sharing requirements. This usually entails the non-federal sponsor placing the non-federal amount in escrow that can be withdrawn by the

government at the time of need. These requirements will be established in the Project Cooperation Agreement.

Based on the IEPR teleconferences, specific costs and details associated with adaptive management would be presented in the Draft EIS.

Final Panel BackCheck Response – FPC12

Concur with Comment

The Panel is still unclear what the total cost of adaptive management of the project mitigation features will be, and how adaptive management costs are included in the project's cost estimate as indicated by USACE under Recommendation 1 above. The Evaluator Response indicates that these costs will be detailed in the revised EIS. The Panel encourages USACE to clearly specify these figures. Without a specific cost estimate for adaptive management, the Panel remains concerned that the funds required will not be available when needed.

Comment: 13

The fisheries adaptive management plan requires additional fish passage studies and lacks the detail needed to establish monitoring frequency.

Basis for Comment:

The index of biotic integrity (IBI) may not be an appropriate method to monitor the resident fish community in the St. Johns Bayou Basin and the New Madrid Floodway due to the difficulty in finding reference streams and/or a diversity of stream conditions. As stated throughout the DEIS, the ditches, streams, and bayous are highly modified habitats, and this may limit the use of an IBI approach. In addition, IBI is a general indicator of stream condition and may not be precise enough to assess changes in individual fish populations.

The proposed fish passage studies do not combine fish access with spawning/rearing habitats used by fish that pass through culverts in the St. Johns Bayou Basin and New Madrid Floodway. Additionally, no fish passage studies are planned for Big Oak Tree State Park.

The DEIS (Section 6.4.5) indicates that monitoring of the resident fish community will be conducted prior to each assessment report. Specific details relating to the length of monitoring prior to each report and triggering points for adaptive management changes are not included in the DEIS. In addition, specific monitoring details for connectivity, access, hydrograph, and Habitat Suitability Index (HSI) values were not provided in the DEIS and are needed to evaluate mitigation as part of the adaptive management process.

Significance: High

Without scientifically based monitoring, the fisheries adaptive management plan cannot be assured of success.

Recommendations for Resolution:

1. Identify the agency responsible for conducting the monitoring program and writing the adaptive management reports. Include alternatives to IBI development for resident fish monitoring. For example, monitoring commonly used IBI fish matrices through time may be an appropriate alternative if a full IBI is deemed inappropriate.
2. Conduct fish passage studies that identify spawning/rearing habitats used by fish that pass though the culverts in the St. Johns Bayou Basin and New Madrid Floodway.
3. Conduct fish passage/access through culverts at Big Oak Tree State Park if it is used for mitigation of spawning/rearing habitat.
4. Develop a long-term fish monitoring/adaptive management plan prior to project construction that provides specific details relating to the length of monitoring prior to each report, triggering points, and specific monitoring details for connectivity, fish access, hydrograph, and HSI values.

Final Evaluator Response – FPC13

Concur

Response to Recommendations

1. **Adopt.** USACE is the agency responsible for conducting the monitoring program and writing the adaptive management reports. However, it is anticipated that the actual monitoring would be conducted by a lab or university.
2. The IBI was suggested as one approach to monitoring environmental benefits. However, given the issues of defining a reference condition, it is not necessary to use a classic IBI approach but rather a multimetric assessment of the fish community without relying on reference stream concepts. Metrics, or attributes of the fish community (e.g., tolerance to habitat changes, species richness, abundance), will be derived using acceptable statistical procedures and monitored before and after mitigation. By tracking metrics, the relative changes in important attributes can be determined and applied to an adaptive management approach. In addition, population modeling can be conducted on key species of interest to determine benefits to recreational, commercial, or sensitive fishes that may benefit from the mitigation.
3. **Adopt in Future.** Spawning and rearing usage on a portion of mitigation sites would be monitored. Adult fish usage will be monitored using conventional collecting techniques and the reproductive condition determined (e.g., condition of gonads). Telemetry can also be employed to assess movement and habitat use of spawning adults. Larval fish will be collected to determine actual spawning events in the mitigated lands.
4. **Adopt.** Section 6.3.6.3.3 will be revised to include monitoring at Big Oak Tree State Park.
5. **Adopt.** Fish monitoring will be conducted as part of the overall project monitoring and adaptive management that is outlined in Section 6 of the pre-Draft EIS. Monitoring of residential fish population would take place prior to channel modification and two years after each construction increment. An additional survey effort would take place in all reaches following a period of five years after the project becomes operational.
6. Fish passage will be assessed for two seasons prior to Floodway closure, and for two seasons prior to each adaptive management report (5, 15, 25, and 50 year intervals). The hydrograph and connectivity would be plotted/calculated for each basin utilizing newly established interior gages (Section 6.6.2). To maintain consistency in the method that impacts were calculated, adaptive management reports would utilize the same HSI value, unless there is compelling reason to change.

Adaptive management triggering points are discussed in Section 6.5 and will be expanded in the EIS (See FPC # 11 and 12).

Final Panel BackCheck Response – FPC13

Concur

Comment: 14

The shorebird adaptive management plan lacks the detail needed to establish monitoring frequency and to determine the habitat value of rice agriculture.

Basis for Comment:

The DEIS (Table 5.4) lists the parameters necessary to monitor the proposed mitigation, including vegetation present, which is applied to moist soil units but not to seasonally inundated farmland. Monitoring at shorebird mitigation sites should include tracking vegetation on seasonally inundated farmland. The farming activity to be allowed following spring shorebird migration could include plowing or other activities that would maintain low vegetation cover over time. However, if not managed or actively farmed between years, lack of soil disturbance might significantly reduce habitat quality over time.

The adaptive management section of the DEIS related to shorebirds (Section 6.4.4, p. 242) states that shorebird compensatory mitigation will be assessed at 5, 15, 25, and 50 years. Because successful establishment of mitigation areas is often most uncertain when first constructed, the Panel believes that the mitigation sites should be evaluated in the years immediately after establishment, particularly in years 1-5 when sites are first being established, as well as during the later years proposed.

The DEIS (p. 242), also raises the possibility that increased rice agriculture may be used to provide mitigation for loss of shorebird habitat resulting from the project, including the potential sale of the compensatory mitigation lands. Determining the value of increased rice agriculture to shorebirds would require development of appropriate HSI values for areas newly converted to rice agriculture. In addition, there may be considerable uncertainty in choosing the appropriate HSI values, given the variations in habitat quality that will result from different agricultural management practices, which would make measurement of the habitat value provided challenging.

Significance: High

Monitoring early results for mitigation of shorebird resources is critical to establishing successful mitigation projects, and the selection of appropriate HSI values is critical to determining the value of any additional rice agriculture.

Recommendations for Resolution:

1. Include monitoring of seasonally inundated farmland early in the project to ensure that appropriate habitat is being provided as planned.
2. Include an approach to measuring HSI values for rice agriculture that would be sensitive to variations in agricultural management practices likely to be employed in the project area, and that would determine the value of increases in rice agriculture, if they occur, to migrating shorebirds.

Final Evaluator Response to FPC14

Concur

Response to Recommendations

1. Adopt. Each compensatory mitigation tract would be monitored. Monitoring criteria would include depth of water over the shorebird migration window (time of year) as well as appropriate documentation of shorebird usage. Table 5.4 would be revised to include these criteria. Although overall manipulation of water levels would be relatively simple in the project area due to current farming practices and spring precipitation, monitoring would occur in each of the respective zones over each specified time periods (15 March – 2 April, 3 April – 23 April, 24 April – 23 May, and 24 May – 8 June). Short term monitoring would occur for five years. In a similar fashion to other kinds of mitigation, a site specific monitoring report would be prepared following the five years of monitoring. Costs associated with monitoring are included in the cost estimate wand will be presented in the Draft EIS.
2. Adopt in the future during Adaptive Management. Based on discussions with the project sponsors, land owners, and the amount of rice grown in the region, additional rice acreage is likely. However, it is difficult to estimate future rice acreages as a result of the project. In addition, rice is usually rotated with a soybean crop in the region. Therefore, attempting to quantify future rice acreage is difficult and the DEIS did not attempt to do it. USACE is committed to compensating for unavoidable impacts to shorebirds and have not reduced any compensatory mitigation requirements based on future increases to rice acreage. If there is a significant increase in rice acreage as a result of the project, a study would be commissioned to determine an appropriate HSI value for rice acreage. The study would look at planting dates, inundation periods, depths, and vegetation growth to determine the appropriate HSI value. The results of the study as well as any project modifications would be coordinated in adaptive management reports that would be coordinated with the interagency team and any other interested stakeholder prior to an adaptive management decision.

Final Panel BackCheck Response – FPC14

Concur

The Panel concurs that if the additional monitoring proposed in Recommendation1 above, and the additional study of appropriate HSI values for rice agriculture proposed in Recommendation 2 above are conducted, the issues raised in this comment will be addressed.

Comment: 15

The new shorebird habitat model, Assessment of Shorebird Habitat within the St. Johns-New Madrid Basins, Missouri, should be validated to ensure that the HSI values are correct.

Basis for Comment:

The Panel believes that the new method for assessing shorebird impacts and planning shorebird mitigation, Assessment of Shorebird Habitat Within the St. Johns-New Madrid Basins, Missouri, appears sound. The new model is a significant improvement over the initial approach presented in the Phase 2 IEPR, and the Panel commends USACE for supporting development of the new model. Because this model is new, validation work will be required, in particular to ensure that the proposed HSI values are accurate.

The validation of the model suggested in the IEPR model certification review has not yet been conducted, and is an important step in ensuring that the model is accurate and precise. The validation process, including collection of field data showing how the various HSI values compare to actual shorebird use of the various habitat types, should be completed prior to using the model to calculate needed mitigation.

The Draft Planning Model Quality Assurance Review Report for the Model Review of the Assessment of Shorebird Habitat within the St. Johns-New Madrid Basins, Missouri, (Volume 3, Part 6.4) includes the recommendation by the expert review panel that "the performance of the model needs to be tested and verified before it is applied for decision-making." Field-based evaluations will be necessary to address the recommendation of the review, and to validate the relative HSI values assigned to the various water depths in the model (DEIS, p. 144). The proposed HSI values are likely good first approximations, but require field data for validation.

The Assessment of Digital Elevation Model (DEM) Accuracy on the St. Johns - New Madrid Shorebird Habitat Model (Appendix M, Part 4) concludes that the aggregation of low resolution estimates from the DEM is adequate for estimating the overall inundated area, but further recommends adjusting the mitigation area upward to the 95% confidence interval value to account for uncertainties resulting from the lower resolution of the DEM. Implementation of this recommendation should be applied for the calculations related to the St. Johns Basin portion of the project.

Significance: High

Validation of the Assessment of Shorebird Habitat Within the St. Johns-New Madrid Basins, Missouri must be completed before the model is applied so that any adjustments to model parameters can be applied when calculating necessary mitigation.

Recommendations for Resolution:

1. Include specific plans for field validation of the shorebird habitat model in the DEIS.
2. Apply the model review recommendation to adjust the St. Johns Basin mitigation upward by the 95% confidence interval to account for any uncertainties related to the DEM.

Final Evaluator Response to FPC15

Concur

Response to Recommendations

1. **Adopt.** HSI values were developed based on best available data. However, the model has not been validated. The model would be validated post Record of Decision during the completion of plans and specifications for the project but prior to construction of features that result in shorebird impacts. Specific aspects regarding validation have not been finalized to date but specifics would be included in the Draft EIS.
2. **Adopt.** See FPC#8 Response 1a.

Final Panel BackCheck Response – FPC15

Concur with Comment

The Panel commends USACE for agreeing to conduct validation exercises prior to construction of features that result in shorebird impacts. Because the model is new and has never been applied in practice, it should be validated before it is used to calculate impacts and plan mitigation, especially since the best available data is sparse. The Panel also commends USACE for exploring approaches to estimating uncertainty related to model parameters and calculated mitigation required to offset project impacts, and encourages USACE to apply estimates of uncertainty to calculations of needed mitigation.

Comment: 16

The calculation of economic and ecological benefits does not consider the impact of global climate change and the economic opportunities for carbon sequestration and bottomland hardwood forest management.

Basis for Comment:

Emerging markets for carbon to offset the impacts of global climate change have created opportunities to finance afforestation worldwide. The DEIS states that the Lower Mississippi River Valley has seen afforestation of more than 77,000 acres of agricultural land due to carbon finance. This region also receives high attention from carbon market entrepreneurs, attracted by the scientific evidence that bottomland hardwood forests have high capacity to sequester carbon. For example, the Ohio River, located just upstream of this site, is estimated to have 35,000 MW of electrical generation capacity and a high-level need for offsetting carbon credit. Connecting the carbon need between the two locations (i.e., the project site and the power generation facilities upstream) would make economic and ecological sense. However, the assessment of the affected environment in terms of the carbon footprint in the DEIS was limited to the anticipated carbon dioxide emissions produced by the two electrical pumping stations, and did not consider the broader context of global climate change.

If the Village of Pinhook relocates to the St. Johns Basin, and other residents have already been displaced by operation of the Floodway in 2011, the Panel believes that conversion from agriculture to silviculture is a more viable option for the New Madrid Floodway. This alternative would also have ancillary economic and ecological benefits. Conversion from agriculture to silviculture in the New Madrid Floodway would have a nutrient trading benefit because taking cropland out of production reduces nutrient loads to the system by eliminating annual fertilizer applications. Afforestation would also have the added benefit of maintaining ecological connectivity with the Mississippi River. The forests, if made up of bottomland hardwood species, would tolerate seasonal flooding, would not require fertilizers, and would be able to assimilate seasonal loadings of water, sediments, and nutrients from upstream rivers. Downstream benefits would include increased flood protection and water quality improvements.

Significance: High

Further analysis is needed in order to justify the decision to eliminate any alternative from further consideration.

Recommendations for Resolution:

1. Conduct an economic analysis of the benefits of carbon sequestration and bottomland hardwood forest management from conversion of the New Madrid Floodway from agriculture to silviculture and/or forest conservation. This analysis should include capturing and storing carbon not only as timber wood, deadwood, litter, and understory, but especially permanently in the soil.
2. Conduct an economic analysis of the nutrient trading benefit of eliminating annual fertilizer applications from conversion of the New Madrid Floodway from agriculture to silviculture and/or bottomland hardwood forest conservation.

Final Evaluator Response to FPC16

Concur

Response to Recommendations

Recommendations 1 and 2. **Adopt.** Based on the teleconference, the alternative will include the following in the New Madrid Floodway:

1. Construction of the closure levee
2. Construction of the gravity outlet.
3. Associated setback/frontline levee grade raises.
4. Close gates at an elevation of 287.5 feet.
5. Start Pump at 289.5 feet (note this is approximately 0.5-feet below road elevations)
6. Stop Pump at 288 feet.

Unlike the two avoid and minimize alternatives that have set management elevations based on the time of the year (floods are gradually lowered as the growing season commences), the management elevations for this alternative is constant regardless of the time of year. Therefore, the alternative satisfies the project's objective for social well being by keeping roads open year round and preventing community isolation. In addition, the project would provide flood risk management benefits for agricultural lands that are greater than en elevation of 289.5 feet. Likewise, there would be an environmental impact for lands greater than 289.5 feet. With the exception of the fish access coefficient, there would be no environmental impact for lands below an elevation 289.5 feet.

Although there would be no agricultural benefit for farmland below an elevation 289.5 feet, there would be a flood risk management benefit by taking farmland out of production and converting it to a land use that is conducive to the current flood regime. In addition to the benefits that this provides, the additional benefits from nutrient trading and carbon sequestration would be considered. Although it is not known whether or not such an alternative is economically justified, it makes ecological sense due to the poor habitat found within the project area (mostly agriculture) and its location in the vicinity of the Ohio River.

There are many aspects of the alternative that are not known at this time and USACE will have to makes several assumptions regarding the economic benefit of carbon and nutrients. However, the two sources (protocols for Yazoo Backwater and Guidance for Electrical Companies) provided will be utilized. In addition and if this alternative is economically justified, USACE may need additional Congressional authorization to implement.

Lastly, to maintain consistency with other project alternatives, USACE will not propose any mitigation to shorebirds by taking agriculture out of production and reforesting it. USACE is of the opinion that this is a benefit to the ecosystem as a whole and no mitigation is required (See FPC #10). However, USACE will quantify the impact to shorebirds above an elevation 289.5 and propose similar compensatory mitigation as a result of this flood protection.

Final Panel BackCheck Response – FPC16
Concur

Comment: 17

The assumptions for the No-Action Alternative are not justified.

Basis for Comment:

The No-Action Alternative (Alternative 1) requires an estimate of future conditions that would prevail in the absence of the project, over the full anticipated life of the project, approximately 50 years. This necessitates a variety of assumptions regarding uncertainties in weather patterns and economic conditions throughout this period. Both may be affected by changes in climate conditions.

The observed progression from hydric vegetation to drier species in Big Oak Tree State Park would continue if no action is taken to restore hydrology to the park. However, the assumption that no effort would be made to restore hydrology to the park is problematic since past efforts have been made by the Missouri Department of Natural Resources (MDNR).

Table 4.34 indicates changes in acreage between existing conditions and Alternative 1 without providing an explanation. Additionally, based on this table, it is unclear what changes would occur in AAHU between existing conditions and Alternative 1.

Significance: Medium

The No-Action Alternative current and future conditions are used as a basis for comparison of each of the project alternatives, but these conditions are not justified.

Recommendations for Resolution:

1. Provide assumptions and justification for future weather patterns in the region and the associated impact on the No-Action Alternative.
2. State assumptions regarding future economic conditions that pertain to agricultural production (costs, profits, prices, etc.), and provide justification for these.
3. Provide assumptions related to anticipated changes in the region's population profile and justify these for the No Action Alternative.
4. Modify the assumptions regarding the restoration assumption of Big Oak State Park to indicate that it is likely that hydrology will be restored over the next 50 years.
5. Provide narrative to the changes identified in Table 4.34 and also present AAHU changes in this table.

Final Evaluator Response to FPC17

Concur

Recommendations for Resolution

1. Adopt

   The Phase 2 IEPR report stated the following:

   The capabilities of global circulation models to predict future climate are generally recognized as approximate, strongest in predicting temperature changes, and weak in predicting precipitation changes. Climate change modeling capabilities are strongest in

predicting changes over large regions of the world and weak in downscaling to watersheds. Thus, the panel agrees that accurate quantitative predictions of future changes in stream flow characteristics at the project site would be extremely difficult, if not impossible.

The EIS utilized period of record analysis to determine likely future conditions in both watersheds. The following is stated in Section 4.4.1:

> Since the project area has experienced variable floods/droughts and wet/dry precipitation years during this period, on can reasonably conclude that similar conditions will continue in the future.

The uncertainty of the future values of variables, such as temperature and the amount of precipitation applies to means and variability, both seasonally and over decades. The project design has been optimized for the climatic conditions experienced over the past seven decades. That analysis period in itself comprehends considerable variability in temperature and precipitation.

Since it is difficult to make accurate predictions regarding precipitation in the project area even in the near future, no attempt was made to make predictions over a 50-year period. The hydrologic period of record will continue to be used to determine project benefits and impacts because this is the best information to base project decisions. However, the no action alternative will be expanded to include a discussion on likely future weather conditions as a result of global climate change. Based on Easterling (1993) the project area may experience drier conditions. However, this would make the overall need for the project more because of its close proximity to an available water supply (Mississippi River). This discussion will be included in the No Action Alternative but we must emphasize that the observed period of record (that has measured any changes in climatic conditions over the last 67 years) data will be used to make project decisions.

2. Adopt.

   Economic impacts would continue under future without project conditions. Although there have been some recent changes to land use within the project area as a result of WRP and the project has accounted for likely future trends, current conditions show that farming is very profitable and would likely remain so under future without project conditions. Area producers would continue to attempt to minimize flood risks to predictable floods by delayed planting. Delayed planting limits the types of crops that could be grown as well as yields. However, there would always be a risk due to late season unpredictable floods. In addition to agricultural damages, streets and roads would continue to be damaged as a result of flooding. Assumptions and justification regarding future economic conditions would be included in the Draft EIS.

3. Adopted. Population changes are not expected under future without project conditions. There may be temporary displacement of residents within the New Madrid Floodway during periods of Floodway operation. However, it is anticipated that some residents would return to the Floodway after operation. Additional justification will be provided in the Draft EIS.

4. Not Adopt. As previously stated by USACE, Big Oak Tree State Park staff, and the Missouri Department of Natural Resources, we are not aware of any such restoration

proposal. Although there was a previous plan that relied on groundwater pumps, it has been abandoned.

Even if such a plan did exist that restored the Mississippi River connection, it would be appropriate to reduce the impacts of the project to account for it, instead of increasing mitigation. Thus, the project would have a lesser impact and no longer the same mitigation need.

The previous plan that was abandoned relied on groundwater pumps to maintain hydrology. This was problematic for a variety of reasons. For example, although groundwater may kill the drier species (*i.e.*, red maple), the clear (non-turbid) groundwater may result in invasive coontail. This would be detrimental to the park. Likewise, the park would remain isolated and would not experience the numerous benefits of connectivity with the Mississippi River. Therefore, it may not be a reasonable assumption to state that the park would re-instate the previous plan absent this project.

Regardless, Big Oak Tree State Park is a priority of this project and we are committed to restoring hydrology to the park. This would be used as a portion of the project's mitigation needs. The State of Missouri will be consulted again to ensure that the assumption regarding the future of the park is still valid.

5. **Adopted in the future.** A narrative to the table would be provided. The difference in functional floodplain acres is the addition of future anticipated WRP enrollment. There are no changes in AAHU. However, there are HU changes at year 0 and year 50.

Final Panel BackCheck Response – FPC17

Concur with Comment

Recommendation 1. Recent evidence suggests that reliance solely on the past period of record in hydrologic modeling may be inappropriate because of changes in stationarity (see Milly, P.C.D., J. Betancourt, M. Falkenmark, R.M. Hirsch, Z.W. Kudzewicz, D. P. Lettenmaier, and R.J. Stouffer. (2008) "Climate Change: Stationarity is Dead: Whither Water Management?" *Science* 319:573-574.).

Recommendation 2. To the Panel's knowledge there is no irrigation infrastructure in the region. Therefore, if reliance on groundwater and imported surface water supplies from the Mississippi or elsewhere is part of future conditions, then economic analysis needs to incorporate the cost of building that infrastructure and supporting it (i.e., through operation and maintenance costs). Thus, it is speculative as to whether profits will increase, decrease, or stay the same.

Comment: 18

A detailed justification for eliminating project alternatives from further consideration is not provided.

Basis for Comment:

NEPA requires that all "reasonable" alternatives be considered. A project of this magnitude, i.e., one that affects a wide range of resources, should consider land and water management scenarios that would provide major economic, social, and ecological benefits. This is especially relevant given that the economic benefits of the proposed alternatives are uncertain. Specifically, the benefit-cost ratios of the proposed alternatives do not incorporate economic uncertainties that could result in ratios less than 1. Additionally, alternatives with varying locations for setback levies were included in the Consolidated NEPA Document reviewed under the Phase 1 IEPR, but are not included in the Working Draft DEIS. These different locations should be included as subsets of reasonable alternatives or justified as not meeting the purpose and need of the project.

The DEIS does not evaluate conservation or silvicultural alternatives that have high ecological benefits and potentially significant economic benefits. Specifically, major land management scenarios that would involve bottomland hardwood forests rather than corn and soybeans were not considered as a viable alternative.

Overall, the evaluation process for alternatives lacks the detail and consistency needed for the reader to understand how alternatives were identified and compared. For example, the number of criteria used to identify alternatives (three) is different than the number of criteria (four) used to compare proposed alternatives.

Significance: Medium

The process for evaluating and selecting among alternatives is unclear and incompletely presented, limiting the Panel's understanding of the screening process that led to the selection of the recommended plan.

Recommendations for Resolution:

1. Include a clear and consistent comparison of alternatives.
2. Include an analysis of the economic efficiency of the alternatives that maximizes the present value of net benefits, not just whether the alternative has a benefit-cost ratio greater than 1.
3. Consider the alternative of converting agriculture to silviculture in the St. Johns and New Madrid, i.e., converting the local economy from fertilizer and/or nitrogen fixation-based agriculture to silviculture and/or cover crops and allowing the site to flood more frequently by backwater and overbank flooding.
4. Include the alternatives that contain the various locations for setback levies or justify their exclusion in this draft of the DEIS.

Final Evaluator Response – FPC18

Concur

Response to Recommendations

1. **Adopt in Future –** The Draft EIS will be revised that presents a better comparison of alternatives. The specific recommendations regarding additional rows to Table 2.7 and a separate parallel table with a brief narrative will be provided in the Draft EIS.
2. **Adopt in Future.** The authorized project maximizes economic efficiency, whereas the avoid and minimize measures reduce the environmental impact.
3. **Adopt in the Future –**Additional clarification required for this alternative can be found in comment/response 16.
4. **Adopt in the Future**. Additional justification for not analyzing levee setbacks in detail would be made in the Draft EIS. Previous NEPA analysis that dismissed this alternative would be re-presented.

Final Panel BackCheck Response – FPC18

Concur

Comment: 19

The methods and model used to assess the impacts on fish and to estimate the compensatory mitigation are not clearly described.

Basis for Comment:

It is critical that model results are presented clearly to allow a full comparison among project and mitigation alternatives. As currently written, impacts are not fully disclosed and project alternatives are difficult to compare. The Panel suggests that the following specific clarifications be addressed.

- The first paragraph of Section 4.8.5.2 states that floodplain water bodies provide spawning and rearing habitat regardless of river conditions. Therefore, Average Daily Flooded Area (ADFA) was not calculated and only based on surface acres. The next paragraph states that river connectivity is needed to benefit the remainder of the fishery. However, timing of this connectivity is not defined or referenced to the section that contains these data.
- Connectivity of borrow pits used for mitigation is an important consideration, but connectivity use in mitigation is not evident unless reviewing multiple tables and text.
- The Panel agrees that all fish do not need to have access to the floodplain for reproductive success for a particular species. However, the ones that do have access would not likely have "high reproductive success" as stated. Individual reproductive success is typically low for fish due to a variety of factors that can cause high mortality of eggs and larvae. This is particularly true in floodplain habitats.
- The fish access coefficient is a reasonable measure in the quantification of available pre- and post-project habitat in the St. Johns Bayou Basin and post-project habitat in the New Madrid Floodway. However, access coefficients may vary by season and were not calculated.
- The summary of impacts in Table 4.33 does not include existing AAHUs, which reduces the ability for comparisons among project alternatives.
- It is unclear why the 2- and 5-year flood frequencies change with alternatives and if these changes are incorporated into AAHU loss estimates.
- AAHU reductions for each method are not clearly presented in Tables 4.34 to 4.39 or stated in Sections 4.8.5.5 through 4.8.5.8.
- Although the batture land is suitable to mitigate impacts based on the fish access studies, the amount of AAHU compensation in the batture land is too high and should be based on fish access restrictions.

Significance: Medium

The methods and model used to assess the impacts on fish and compensatory mitigation should be clearly described to achieve completeness and to have the reader correctly interpret the DEIS.

Recommendations for Resolution:

1. Reference and define the timing of the connectivity in Section 4.8.5.2. Tables 4.47, 4.48, 4.49, and 4.50 should include percentage of connectivity loss for alternatives.
2. Provide discussion on the impact of borrow pit connectivity reductions and how connectivity is incorporated in alternatives.
3. Provide clarification of reproductive success that focuses on population level maintenance that can be achieved and not individual reproductive success.
4. Provide clarification of why access coefficients were not calculated for each spawning/rearing season.
5. Expand Table 4.33 to include existing AAHUs for a more complete comparison of alternatives.
6. Provide clarification of why the 2- and 5-year flood frequencies change with alternatives and if/how these changes are used in AAHU estimates.
7. For comparative purposes, clarity would be improved by presenting reduced AAHUs as both lost AAHUs and as a percentage for each habitat type and total pooled habitats in Tables 4.34 to 4.39. For example, late spawning period alternative 3.1 AAHUs are 1810.8 pre- project and are estimated to be 372.3 post- project. This is a loss of 1438.5 AAHUs or 79.4% of late season spawning habitat in the New Madrid Floodway. The narrative for these tables should briefly explain the reasons for the losses. In addition, functional floodplain acres should be presented in separate tables.
8. Mitigation in batture land and floodplain lakes should be limited to no more than 27% of AAHUs based on the fish access coefficient (0.73) since this estimated access restriction cannot be compensated within the New Madrid Floodway.

Final Evaluator Response to FPC19

Concur

Response to Recommendations

1. **Adopted.** For clarity, ADFA = surface acres as long as the waterbody is within the five year floodplain so fish can access it. The analysis assumed that access at any time of the year would satisfy this criterion (see Table 4.34 and 4.35 where consistent average annual habitat units were taken for open water habitat for each of the respective spawning and rearing seasons). This would be clarified in the Draft EIS.

   One can calculate the impact of connection to existing waterbodies by comparing Tables 4.45 – 4.50. However, the tables will be revised in the Draft EIS to show the impact more clearly

2. **Adopted**. The EIS will clearly state that waterbodies have to be connected (within the post project 5-year flood frequency) to be of benefit. For example, those waterbodies that are no longer connected due to the project, no longer provide spawning and rearing habitat for fish. Therefore, a complete loss (ADFA=surface acres) was taken. Likewise newly established waterbodies as a result of ecologically designed borrow pits have to

be constructed within the post project 5-year flood frequency to compensate for impacts associated to inundated floodplain habitat.

It was also discussed during the teleconference to explore options that would provide connectivity to existing waterbodies that are impacted by the project. For example a fish access channel (*i.e.,* ditch) could be constructed from an existing isolated waterbody to the interior sump elevation to provide connectivity/fish access. Outlet structures may also have to be constructed. It would be problematic to address this in the EIS due to the need for site specific locations. However, options such as these would be considered during the development of site specific mitigation plans as opportunities arise because they make ecological sense and would be of tremendous value to spawning and rearing habitat (*i.e,* ADAF=surface acres and HSI=1.0). This conceptual option would be discussed in the Draft EIS.

3. **Adopted.** A discussion in the Draft EIS will be provided on population-level success. We can provide concepts and potential benefits in terms of recruitment. Recruitment is directly related to survival of young-of-year, which we believe would be enhanced in mitigated lands by providing optimum spawning and rearing habitat. This can be inferred by monitoring species and abundance of larval fishes. However, it should be noted that population modeling of Mississippi River fishes is a difficult task given the size of the system and the many intervening variables (e.g., both density independent and dependent) that influence recruitment and standing crop.

4. **Adopted.** Clarification will be provided in the EIS. In summary, fish would be able to access the floodplain through the culverts during any time of the year. For example, fish may enter the basin prior to gate closure during the early season but will not necessarily spawn until the mid season period. The elevation of constructed borrow pits will be determined so that connectivity will be known. For any given water year, the percent time a borrow pit is connected will be calculated. Other measures to enhance connectivity (location of borrow pits at lower elevations, providing inlet/outlet channels) can be considered by the mitigation team.

5. **Adopted –** Table 4.33 would be revised to include a column on existing ADFA and AAHU, alternative ADFA and AAHU, and impacted ADFA and AAHU.

6. **Adopted -** The 2 and 5 year flood frequencies are different with each alternative due to the fact that each alternative provides a different level of connectivity. These changes are incorporated into the AAHU loss estimates (along with ADFA and HSI value).

   Since frequency is a key variable in multiple model outputs, the changes in flood frequencies as a result of different alternatives is contained in Section 4.4 of the EIS. Additional clarification would be included that describes the changes in flood frequencies in this section. Appropriate figures would also be added.

   It is important to note that although flood frequency elevations are lowered due to project alternatives, there would still be variable flooding.

7. **Adopted.** The recommendations regarding clarity will be adopted and the Draft EIS will be revised.

8. **Not Adopt.** See FPC #9. Based on the teleconference, there should not be a maximum allowable mitigation standard placed in the batture land because the batture provides excellent habitat for fish as well as wetlands. However, the EIS will demonstrate that impacts to remaining resources would be compensated. Batture land may not be appropriate or only offer limited value to other ecological resources.

Final Panel BackCheck Response – FPC19

Concur

Comment: 20

The description of fisheries resources is inconsistent and is not adequately explained.

Basis for Comment:

Inconsistent and incomplete descriptions of the fisheries resources are found in several locations throughout the DEIS and Appendix G. Ultimately, conflicting descriptions and conclusions of the resource and project impacts raise questions regarding mitigation necessity and implementation.

Section 3.8.5 of the DEIS states that environmental advocacy group claims are used to support the argument that the ecosystem is "destroyed or in a disastrous state" and has "no remaining value." The two references cited are a fact sheet and a memo. While the Panel agrees that the fish communities have made adjustments to anthropogenic changes, we are unaware of any scientific publications that state the Mississippi River ecosystem is destroyed and has no remaining value either economically or biologically. This section should describe the current fisheries resources in the Mississippi River near the project area and in the St. Johns Bayou Basin and New Madrid Floodway.

Section 3.8.5 and Appendix G provide a description and comparison of fisheries resources (species richness and relative abundance) in the St. Johns Bayou Basin and New Madrid Floodway. However, this section does not describe the fisheries resources of the Mississippi River fishes and those species that use floodplain habitat.

Quantitative approaches are used throughout the DEIS to estimate existing fish spawning/rearing habitat and project impacts. For example, Alternative 3.1 projects fisheries spawning/rearing habitat loss in the St. Johns Bayou Basin to be 28.5%, 31.1%, and 31.7% for early, mid, and late seasons, respectively. It projects losses in the New Madrid Floodway to be 61.6%, 71.2%, and 79.4% for early, mid, and late seasons, respectively. However, Section 4.17, Cumulative Impacts (p. 216) contains an argument that, due to differences in the fish communities between historic conditions and current conditions, "the project would not have any significant additional impacts because it no longer provides any significant habitat."

Section 4.17, Cumulative Impacts (Loss of Connectivity, p. 222-223), has nothing to do with cumulative impacts and qualitatively dismisses the fish resources that were quantified in the DEIS. This section also fails to recognize that batture lands have been affected by the same or similar anthropogenic changes to the Mississippi River as in the St. Johns Bayou Basin and the New Madrid Floodway.

Significance: Medium

The fisheries resources and habitat value (AAHU) has been described and quantified throughout the DEIS. However, inconsistencies with the fisheries resource and habitat values affect the completeness of the report.

Recommendations for Resolution:

1. Revise the DEIS to include a description of the current fisheries resources in the Mississippi River near the project area and in the St. Johns Bayou Basin and New Madrid Floodway and eliminate environmental advocacy group claims.
2. Correct the inconsistency between the quantitative evaluation and qualitative suggestions of no fish resource value and remove the language in the DEIS suggesting that the project area has no value or significant habitat for fish resources
3. Remove Section 4.17, Loss of Connectivity, from the DEIS.

Final Evaluator Response to FPC20

Concur

Response to Recommendations

1. **Adopt.** The EIS will be revised stating environmental advocacy groups claim that the Mississippi River is a lost cause but the scientific community does not agree with their statements.
2. **Adopt.** The inconsistency would be corrected. The project area still provides habitat.
3. **Not Adopt.** This entire section was placed into the EIS in response to the Phase 2 IEPR discussion FPC #14. The panel stated the following:

   The panel believes that the New Madrid Floodway is unique because, in context, it is the last remaining connection between the Mississippi River and its floodplain in the State of Missouri. Therefore, it plays a much larger role in providing natural floodplain services than the other areas. If the other originally connected areas had not been disconnected, the Floodway would be playing a proportionally smaller, and less important, role in maintaining the natural ecosystem. The loss of this last remaining connection and its ecosystem functioning would be the "straw that broke the camel's back" in terms of the total cumulative impact. That is, not all incremental impacts are equal and it is the impact that exceeds a threshold that is significant. In this case, the adverse impact of removing the last floodplain connection, once the other connections have already been removed, is disproportionally high.

Although backwater flooding persists in the New Madrid Floodway due to constructed levees and other highly modified engineered structures, it is not unique and is not the last remaining connection in the State of Missouri. In addition, the tentatively recommended plan specifically outlines a plan that would retain connectivity to the remaining natural habitat found within the Floodway and contains a plan that would restore connectivity to the last remaining uncut bottomland hardwood tract (Big Oak Tree State Park) in the region.

Based on the discussion during the teleconferences, the paragraph will be revised to demonstrate that the existing connectivity, although it is highly modified, provides functions to ecological resources (*i.e.*, the language in the paragraph will be softened).

Final Panel BackCheck Response – FPC20
Concur

Comment: 21

The species used to construct the Habitat Evaluation Procedure (HEP) model analysis for assessing terrestrial wildlife are not representative of the affected species.

Basis for Comment:

The Panel recognizes that the representative terrestrial animals (fox squirrel, mink, barred owl, muskrat, pileated woodpecker, black-capped chickadee, red-winged black bird, and great blue heron) were selected based on the availability of habitat suitability index models for the HEP analysis. However, the Panel believes that the life history characteristics of the animals used to represent terrestrial animals only represent birds and mammals and are not adequate to represent reptiles and amphibians.

Significance: Medium

A broader range of animals should be used to ensure adequate mitigation for terrestrial wildlife.

Recommendation for Resolution:

1. Include representatives of amphibians and reptiles in the HEP model.

Final Evaluator Response to FPC21

Non-Concur

1. **Not Adopt.** The Memphis District had coordinated with USFWS and MDC and concluded that the indicator species used in the analysis would adequately describe likely project induced direct impacts to terrestrial wildlife habitat. Discussion included the hydrologic impacts of the project and the need to model herpetological resources. It was determined that no readily available HSI models for herpetological resources could capture the hydrologic changes associated with the project and concluded that the models used, coupled with other ecological models (Envirofish, HGM, waterfowl and shorebirds) would adequately quantify impacts to wildlife resources.

   Based on the teleconference, a sub-heading titled Herpetological Resources would be added to Section 3 and Section 4 that describes existing conditions and environmental consequences, respectively. Although impacts to herpetological resources would not be quantified, other models account for impacts. In addition, based on the discussions during the teleconferences, amphibians may benefit from the project because there would be more "isolated" forested areas than under existing conditions. This isolation would be a benefit to amphibians because fish would likely not have access to areas above the interior sump elevation (post project 5-year flood frequency elevation).

Final Panel BackCheck Response – FPC21

Concur

Comment: 22

The positive ecological effects of the flood pulse on the landscape are not considered and the flood pulse is applied inaccurately in a social impact context.

Basis for Comment:

The historical accounts of human suffering due to flood pulses are interesting and relevant, but they should not be tied to Junk's concept of flood pulsing. The Panel believes that this is an artificial connection between an ecological concept and social effects of flooding; the link should be removed from the document.

More importantly, the economic benefits of flood pulsing are not described in the DEIS or in the benefit-cost section. Flood pulses are natural subsidies to ecosystems such as bottomland hardwood forests and backwater swamps. Floods cause an increase in nutrient availability to wetlands in these settings, as well as increased nutrient cycling due to water level fluctuations. Historically, flood pulses supported entire civilizations (i.e., Mesopotamia, Nile Delta) where nutrient-rich waters and sediments subsidized agriculture. Artificial fertilizers and drainage control are now employed to achieve similar effects, and the flood pulses are considered nuisances and destructive.

Significance: Medium

Scientific concepts such as "flood pulse," as described well in the scientific literature, should be used properly in impact statements.

Recommendations for Resolution:

1. Include a balanced discussion of both the negative impacts of flooding on human culture and the positive impact of flooding on ecological systems.

Final Evaluator Response to FPC22

Concur

The EIS set out to describe the ecological benefits as well as socio-economic damages related to flooding within the project area. Consistent terminology (i.e., the flood pulse) was used to describe both and was used to develop project specific objectives. However, terminology will be modified in the EIS because the term flood pulse is widely accepted to describe ecological benefits and not used to describe economic losses or human suffering.

Response to Recommendations

1. The EIS provides the balanced discussion. In fact the tentatively recommended plan provides a balance between the remaining natural ecosystem and providing socio-economic benefits. The positive impact flooding provides to bottomland forests and backwater swamps have been quantified with the various ecological models. These two types of habitat are lacking in the over 80% agricultural project area. Compensatory mitigation would provide this much needed habitat in the project area. Likewise, nutrient cycling was also quantified in the water quality section. Although, the project

area serves as a nutrient sink during floods, its role in the overall nutrient cycle is that of a nutrient source due to the thousands of tons of fertilizer that are applied on an annual basis. The project area would still serve as a nitrogen sink during periods of floods due to the connectivity provided by the avoid and minimize measures. In fact it will likely take more nutrients out of the system due to the mitigation. Although the project area would still serve as a nutrient source due to the agricultural landscape, compensatory mitigation would reduce the overall nutrient load to the river.

The avoid and minimize measures are a new concept that seeks to retain connectivity to a large portion of the project area for environmental reasons while providing socio-economic benefits. Therefore, many of the beneficial ecological functions the project area provides would still occur with the project. In fact one could argue that there would be a greater amount of natural habitat occurring in the project area with compensatory mitigation measures than what currently exists. Therefore, the project could be considered a positive for the environment as well as socio-economic resources.

Based on the teleconferences, ecosystem services will be analyzed to carbon sequestration and nutrients (See FPC #23).

Final Panel BackCheck Response – FPC22

Concur

Comment: 23

The cumulative impacts analysis does not consider the value of ecosystem services that have diminished over time.

Basis for Comment:

The DEIS assigns little value to the ecosystem services (e.g., carbon sequestration) provided by floodplain connection to the Mississippi River, based on the argument that the system has been significantly changed over time. However, the Panel believes that the ecological value of the remaining connection to the Mississippi River is high. As described in CEQ (1997), the loss of this last remaining connection is an example where additional impacts, no matter how small, will have a disproportionate cumulative effect by exceeding the threshold where floodplain connection ecosystem functioning is eliminated. The Panel believes that closing the last connection would have a significant cumulative impact on the flood-dependent system. While it is not required that a project compensate for historical impacts, it is incumbent on the project not to contribute the incremental impact that may cause the project to exceed this overall threshold.

The value of the flood-dependent system can be characterized in terms of ecosystem services such as carbon and nitrogen sequestration (Costanza et al. 1997). Throughout the DEIS, ecosystem services are not considered or are undervalued, while economic benefits may be inflated and based on previous socioeconomic data, particularly given the major changes in the Floodway after the 2011 floods.

Significance: Medium

The analysis of cumulative impacts is incomplete without a proper consideration of the effect of closing this river connection on the diminution over time of regional ecosystem services (such as carbon and nitrogen sequestration) provided by this flood-dependent ecosystem.

Recommendations for Resolution:

1. Prepare an analysis of cumulative effects that includes evaluation of the last remaining connection to the Mississippi River in terms of ecosystem services that have diminished over time.
2. Evaluate each of the alternatives (including any new alternatives) in terms of cumulative impacts on ecosystem services.

Final Evaluator Response to FPC23

Concur

Response to Recommendations

1. **Adopt**

   Numerous ecological values were quantified in the EIS utilizing the methods established during the Project Work Plan that underwent Phase 2 IEPR review. These models quantified the ecological value on multiple habitats over different periods of the year to ensure that ecological value was adequately described. These same models were utilized in the cumulative impacts section of the EIS. In general terms, the project area

was once a vast bottomland hardwood swamp that had a vast array of ecological value that is difficult to imagine in the present context. However, the project area is now extremely valuable farmland that deserves special recognition as prime farmland from the USDA. Obviously this transformation to highly productive farmland has come at the expense of the environment. However, this is true of all human development.

Although the Floodway is not the last remaining connection to the Mississippi River in the State of Missouri or the region, avoid and minimize measures were specifically formulated to reduce the impact associated with a reduced connection. Moreover, compensatory mitigation measures for Big Oak Tree State Park would restore this connection that presently does not exist at frequencies necessary to maintain the park's natural vegetation. As indicated in the cumulative impact write-up, avoid and minimize measures for this project represents a new change in the overall thinking regarding flood risk management in the Lower Mississippi Valley. Gates and pumping stations are a common management technique. Lessons learned from the project monitoring and management of the St. Johns Bayou and New Madrid Floodway project could be adopted to other areas. Therefore, it is a reasonable argument that although this project would reduce the connection to the New Madrid Floodway, lessons learned could lead to a cumulative increase of connection if other areas incorporate similar management scenarios.

Based on the teleconferences, two additional ecological services would be analyzed (1) Carbon Sequestration and (2) Nutrients. It was advised not to make an attempt to economically quantify the value of ecosystem services. Both of these ecological services would have a heading in Sections 3 and 4 to describe the impact/benefit of the project in the project area as well as a section devoted in the Cumulative impacts section to describe impacts/benefits to adjacent/downstream areas.

2. **Adopt**

We respectfully disagree with your statement regarding major changes in the Floodway after the 2011 floods. Prior to operation of the Floodway the project area was mostly agriculture. Following operation and the resulting flood pulse, the project area is still mostly agriculture. Crevassed levees are being restored that provide the same level of flood protection that existed prior to operation. Local government and drainage districts have removed sediment from the vast network of drainage ditches. Area farmers have replanted. Although the Village of Pinhook will likely relocate to the St. Johns Bayou basin, other residents have moved back. The EIS will be clarified in regards to how the 2011 flood has not significantly changed the New Madrid Floodway.

The panels' recommendation regarding ecological services and the reference to Costanza et al. (1997) indicated that this recommendation may be beyond the current state of science. The referenced research could identify no valuation studies at all for some major biomes, including cropland. In an area where agricultural accounts for ≈80% of the landscape, using methods described by Constanza et al. (1997) may lead to inaccurate results. However, the Draft EIS will be revised to analyze project impacts/cumulative impacts to ecological services (specifically to nutrients and carbon sequestration

Costanza, R., R. d'Arge, R. de Groot, S. Farberk, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton, and M. van den Belt (1997). The value of the world's ecosystem services and natural capital. Nature 387:253-260.

Final Panel BackCheck Response – FPC23

Concur with Comment

The Panel notes that there are a host of studies that consider the value of agricultural land beyond the dimension of its value in agricultural production. The database known as "Econlit", available at all university libraries, showed well over 100 studies. Costanza et al. (1997) may indeed be inappropriate for many reasons, but this does not mean that the issues should be ignored completely. The Panel agrees that it would be too difficult to quantify the ecological values in monetary terms, but these should be discussed qualitatively.

Comment: 24

The project's direct and indirect impacts on ecosystem services are not fully addressed.

Basis for Comment:

The DEIS does not contain an evaluation of the ecosystem services that will be directly or indirectly affected by the project. In addition, an economic value has not been apportioned to compensate for the loss of these services. For instance, the DEIS estimates the economic benefit to cropland when water levels are decreased (i.e., implementation of the recommended alternative); however, the report does not contain an estimate of the loss in ecosystem services to bottomland forests and other wetlands associated with that corresponding drop in water level. Furthermore, the indirect impact of the proposed project on downstream ecosystem services, such as flood mitigation or water quality improvement, is also not included in the DEIS.

Significance: Medium

Ecosystem services such as flood prevention, water quality improvement, and carbon sequestration are an important part of the true value of natural ecosystems whether they occur at the project site or downstream.

Recommendations for Resolution:

1. Implement the use of the ecosystem services paradigm in the HGM analysis and other analyses that determine impacts on ecological function.
2. Estimate the ecosystem services that wetlands caused indirectly by the project on downstream and adjacent landscapes.
3. Include the cost of protecting the existing wetlands from potential impacts from proposed project alternatives in the benefit-cost calculations.
4. Include the benefits in the project alternatives that could enhance downstream services such as silviculture or bottomland hardwood forest conservation/management.

Final Evaluator Response to FPC24

Concur

Response to Recommendations

1. **Adopt.** Current analysis in the DEIS accounts for impacts to identified significant resources. A discussion of ecosystem services would be included in the EIS.
2. **Adopt.** Significant impacts to wetlands were quantified utilizing the HGM model. This method was specifically chosen as "the best available tool" to quantify the partial impacts to wetlands as a result of changes to hydrology (*i.e.*, drop in water level). The HGM includes variables such as detain floodwaters and detain precipitation. The Draft EISD will be revised to include a discussion on downstream and adjacent landscapes.
3. **Adopted.** The avoid and minimize measures were specifically formulated to protect existing wetlands from the proposed project. These avoid and minimize measures are captured in the benefit to cost calculations as a reduction in benefits associated to

agriculture. We did not quantify ecological values to protecting wetlands in the economic analysis. These were all captured as non-monetary units and converted to project costs if mitigation was required. The Draft EIS will be revised to clarify this point.

4. **Adopted.** As authorized by Congress, the purpose of the project is Flood Risk Management. Although there are numerous projects that could be implemented by USACE, other federal agencies, and the private sector to enhance downstream services, this project is not authorized to do so. Your recommendation specifically mentions bottomland hardwoods and potential for silviculture. Since this project will result in a greater area of forested areas compared to future without project conditions, it is likely that this project will provide the stated benefits. An additional alternative will also be considered in the Draft EIS (See FPC# 16).

Final Panel BackCheck Response – FPC24

Concur

Comment: 25

It is unlikely that the warm season grass buffers proposed for use on the project channel will be successfully established.

Basis for Comment:

Native warm season grasses and forbs require substantial disturbance such as burning every 3 to 5 years to be successfully maintained. Difficulties in maintaining the desired vegetative communities are exacerbated when the ratio of edge to total patch size is great, such as when the patch is a long narrow strip rather than a square. Because even under ideal conditions (large, >20 ha square plots) it is difficult to maintain warm season grasses, the Panel believes that it is unlikely the establishment of warm season grasses in long narrow buffers would be successful or successfully maintained. Furthermore, because grass buffers do not currently exist in the region, they would not be appropriate for mitigating lost habitat, thus the Panel recommends forested riparian buffers if these areas are to be used for mitigation.

Significance: Medium

Many habitat types can be used as buffers for restoration along riparian corridors, but native warm season grass would be difficult to maintain successfully in such an application.

Recommendation for Resolution:

1. Remove the native warm season grass buffers from use as stream bank mitigation.

Final Evaluator Response to FPC25

Concur

Response to Recommendations

1. **Not Adopt.** Due to maintenance activities associated with agricultural ditch systems, forested riparian buffers would impede access; however, warm season grass buffers would likely quickly recover from equipment use. In a landscape where agriculture accounts for ≈80% of the landcover, field burning after harvest is a common occurrence and could easily be expanded to burn grass buffers. Wolf (2009) stated that switchgrass provides excellent erosion control when used as filter strips, grass hedges, or cover such as river levee banks. Rinehart (2006) also noted that *switchgrass is an excellent plant to use in riparian buffer strips or on other sensitive lands, as its root system prevents erosion while slowing the travel of surface water, decreasing run-off from agricultural fields, and allowing for greater water infiltration.* It is also important to note that many of the areas proposed for grass buffer establishment are currently being farmed to top bank and the addition of the proposed buffer would improve water quality in the immediate area. Castel et al. (1994) reported that grass buffers 30 feet wide had NH_4-N, NO_3-N and PO_4-P trapping efficiencies between 96 and 99.9%.

   Based on the teleconference, the comment was based on concerns with overall management, we can incorporate these concerns into the Project Cooperation

Agreement, monitoring, and adaptive management to ensure that grass buffers are maintained.

An alternative conceptual plan was also discussed that USACE will adopt in the Draft EIS. The plan calls for the following:

1. Installation of previously recommended instream structures that provide low flow habitat.
2. Provide a tree buffer on one side of the channels.
3. Provide a grass buffer on the opposite side of the channel.
4. Place necessary disposal areas for future maintenance outside of the grass buffer.

The grass buffer will be maintained by prescribed burning and or mowing. The grass buffer will serve as a construction right of way for future maintenance but will be reestablished following any maintenance activities. Although grass buffer strips provide outstanding water quality improvements, they do not provide all of the habitat improvements as a tree buffer. Therefore, the Missouri Mitigation Method will be modified to take a less valuable credit for grass buffers.

Castle, A.J., A.W. Johnson and C. Conolly. 1994. Wetland and stream buffer size requirements – a review. J. Environ. Qual. 23: 878-882.

Rinehart, L. 2006. Switchgrass as a bioenergy crop. ATTRA – National Sustainable Agriculture Information Service. https://attra.ncat.org/attra-pub/summaries/summary.php?pub=311

Wolf, D.D. 2009. Planting and managing switchgrass for forage, wildlife, and conservation. Virginia Cooperative Extension, Virginia Tech and Virginia State University. http://pubs.ext.vt.edu/418/418-013/418-013.html

Final Panel BackCheck Response – FPC25

Concur

Comment: 26

The description of shorebird resources includes inconsistencies and inaccuracies..

Basis for Comment:

The DEIS contains assumptions about shorebird use of the project area that are not accurate. For example, it is stated that "Historically, the project area did not provide any suitable shorebird habitat (DEIS, p. 212)." The Panel believes it is likely, based on general geomorphologic principles, that river scour areas and other similar river features, as well as margins of open wetland areas, provided sparsely vegetated areas suitable for shorebirds before landscape conversion, even though these areas were probably not extensive in the project area.

Several places in the DEIS describe historic habitat conditions as having no value for shorebirds. While the historical conditions analysis (Heitmeyer et al 2010, Appendix D) includes an estimation of the former extent of various forested habitat types, other habitats not accounted for in the analysis were likely also present in smaller amounts. For example, river scour areas, depositional alluvial fan areas, recently formed wetlands around river channels, and other features likely to result from the actively meandering main channel could be expected to provide some sparsely vegetated habitat for shorebirds. The statement (DEIS, p. 98) that the area "previously did not attract large flocks of shorebirds" may be accurate, but the places within the DEIS which specifically mention that there was no value for shorebirds should be revised.

The DEIS is also inconsistent in its description of shorebird use of the area, and some editing would improve the document in this respect. In Section 3.8.4 (p. 98), it is correctly stated that "Away from coastal areas, most shorebird species forage in areas of sparse vegetation…" In contrast, in Section 4.8.4 (p. 152), it is stated that "By definition, shorebirds frequent coastal areas…" This is a common and understandable misconception of the term "shorebirds." However, as correctly pointed out on p. 98 of the document, many shorebirds migrate through interior areas and use seasonally inundated and sparsely vegetated habitats as foraging areas. Consistent descriptions of the use of the project area by shorebirds would strengthen the document.

Significance: Low

The historical value of the project area for shorebirds should be accurately described so that the resource is accurately represented throughout the DEIS.

Recommendations for Resolution:

1. Remove the statements suggesting that the area did not historically provide any habitat for shorebirds.
2. Remove the statement suggesting that by definition shorebirds frequent coastal areas.

Final Evaluator Response to FPC26
Concur **Response to Recommendations:** 1. **Adopt.** DEIS will be updated to state that small patches may have historically supported shorebirds. 2. **Adopt.** Removed "that by definition, shorebirds frequent coastal areas" from DEIS.
Final Panel BackCheck Response – FPC26
Concur with Comment USACE has indicated that it will address the recommendations of the Panel on this comment. Under Recommendation 1, the Panel suggests that, rather than saying "small patches of habitat may have historically occurred", which likely understates historical conditions, USACE describe the historic conditions in the project area as including the dynamic feature of river meandering that would be expected to establish appropriate habitat conditions for shorebirds persistently through time.

Comment: 27

The impacts/benefits to water quality are not thoroughly discussed in the DEIS, nor are they consistently treated in Section 4.11 of the DEIS and Appendix I.

Basis for Comment:

In Ashby et al. (2000), sensitivity analyses were conducted for wetland function factors, export coefficients, constituent concentrations in floodwaters, and the assumed 50 percent reduction in the available load associated with inundation. No sensitivity analyses are presented for the revised export model. The discussion of constituent export in Section 4.11 of the DEIS is confined to decreased export due to capture of winter runoff with the project in place. However, the revised export model in Appendix I calculates net total export for the entire annual cycle, thus including non-winter periods of reduced flooding and periods coinciding with fertilizer applications. These annual constituent export results provide a more complete context for the discussion of water quality impacts.

The following appear to be inconsistencies or errors:

- DEIS, p. 103 -- It is stated that the project area serves more as a nutrient source rather than a nutrient sink. Appendix I (p. ii) -- It is stated that overall the basin is expected to retain or remove materials from headwaters and floodwaters.
- DEIS, Table 4.51 -- The caption refers to Season 1 and Season 2. These seasons are defined in Appendix I, but not in Section 4.11 of the DEIS.
- Appendix (p. 5) -- It is stated that the revised export model calculates a net total export for each year. The captions for Table 1 and Figures 3-10 refer to export model results for seasons, not the entire annual cycle.
- Appendix I, Equations 1-7 —They contain plus signs instead of multiplication signs and do not show any units for volumes, concentrations, or mass loads.
- Appendix I, Equation 3 -- The first term on the right hand side appears to be mass and the second term appears to be mass per unit time.

Significance: Low

Providing results from a sensitivity analysis of the revised export model, and correcting inconsistencies and errors, will strengthen the conclusions of the water quality analysis and improve the organization and readability of the DEIS.

Recommendations for Resolution:

1. Conduct sensitivity analyses for wetland function factors, export coefficients, constituent concentrations in floodwaters, and the assumed 50 percent reduction in the available load associated with inundation.
2. Improve the discussion in Section 4.11 of the DEIS by ensuring that summarized results from each of Sections 3.2, 3.3, 3.4, and 3.5 in Appendix I are incorporated.
3. Improve the discussion in Section 3.3 of Appendix I by integrating the results from Robertson et al. (2009) (cited on p. 103 in the DEIS) on watershed yields of nitrogen and phosphorus.

4. Include a conceptual diagram of the revised export model.
5. Include a box-and-arrow diagram showing individual constituent mass flux components for each land cover (wetlands, upland, agricultural lands, and "dry land"). It should also include inundation export and trapping fluxes.

Final Evaluator Response to FPC27

Concur

Response to Recommendations: Adopt, Not Adopt, or Adopt in Future

1. **Adopt.** Per discussion with the panel the sensitivity analysis conducted by Ashby et al. (2000) will be re-run for the current analysis.
2. **Adopt.**
3. **Adopt.**
4. **Adopt.**
5. **Adopt.**

Final Panel BackCheck Response – FPC27

Concur