



**DEPARTMENT OF THE ARMY**  
CHIEF OF ENGINEERS  
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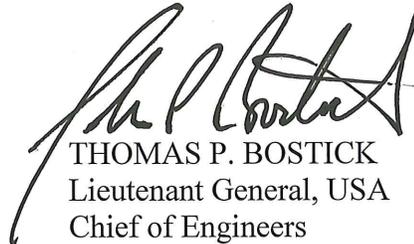
JUN 08 2015

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)  
108 ARMY PENTAGON, WASHINGTON, DC 20310-0108

SUBJECT: Upper Des Plaines River and Tributaries, Illinois and Wisconsin -- Final USACE Response to Independent External Peer Review

1. Independent, objective peer review is regarded a critical element in ensuring the reliability of scientific and engineering analyses. USACE conducted the Independent External Peer Review (IEPR) for the subject project in accordance with Section 2034 of the Water Resources Development Act of 2007, USACE Engineer Circular (EC) 1165-2-214, and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).
2. A US Treasury Code 501(c)(3) non-profit science and technology organization, independent and free of conflicts of interest, established and administered the peer review panel. The IEPR panel consisted of five members with expertise in hydraulic engineering, geotechnical engineering, economics, ecology, and plan formulation.
3. The final written responses to the IEPR are hereby approved. The enclosed document contains the final written responses of the Chief of Engineers to the issues raised and the recommendations contained in the IEPR report. The IEPR report and the USACE responses have been coordinated with the vertical team and will be posted on the internet, as required in EC 1165-2-214.
4. If you have any questions on this matter, please contact me or have a member of your staff contact Ms. Yvonne Prettyman-Beck, at 202-761-4670.

Encl

  
THOMAS P. BOSTICK  
Lieutenant General, USA  
Chief of Engineers

**Upper Des Plaines River and Tributaries, Illinois and Wisconsin  
Integrated Feasibility Report and Environmental Assessment  
USACE Response to Independent External Peer Review  
DRAFT May 2014**

Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resources Development Act (WRDA) of 2007, U.S. Army Corps of Engineers (USACE) policy on Civil Works Review, EC 1165-2-214 (2012), and the Office of Management and Budget's Final Information Quality for Peer Review (2004).

Battelle Memorial Institute (Battelle), a non-profit science and technology organization with experience in establishing and administering peer review panels for the USACE, was engaged to conduct an IEPR of the Upper Des Plaines River and Tributaries Integrated Feasibility Report and Environmental Assessment. The IEPR panel consisted of five members with expertise in Hydraulic Engineering, Geotechnical Engineering, Economics, Ecology, and Plan Formulation. The IEPR was conducted in two parts: the first part was conducted in 2010 on an interim draft of the report displaying the tentatively selected plan; the second part was conducted in 2013 on the Draft Integrated Feasibility Report and Environmental Assessment.

For the interim review (Component A), 22 Final Panel Comments were identified and documented. Of these, six were identified as having high significance, eight had medium significance, and eight had low significance. Subsequent revisions to the USACE report incorporated changes to address the panel comments. In general, the panel determined that the updated report provided for the Component B review appeared to address most of the Component A comments. Component A comments that were not addressed in the documentation provided for the Component B review were updated and carried forward to the final review.

For the final review (Component B), 16 Final Panel Comments were identified and documented. Of these, two were identified as having high significance, seven had medium significance, and seven had low significance. For this review, a complete Draft Integrated Feasibility Report and Environmental Assessment was provided to the panel.

### **Responses to Component A Review Comments**

**1. High Significance: Greater Clarification is needed for the decision to use the urban/rural and county stratified approach for the National Ecosystem Restoration (NER) Plan.**

This comment includes one recommendation for resolution. This recommendation was adopted.

1. Conduct the CE/ICA on all screened NER alternatives without stratification to determine the cost-effective frontier and the best buys for all screened alternatives.

**USACE Response: Adopted**

**Action Taken:** The USACE conducted a multi-step CE/ICA analysis that determined the best restoration alternative on each site, evaluated similar sites in comparison to each other (rural and urban), and finally evaluated combinations of sites to ultimately determine the NER Plan. Rural and urban sites were stratified in the intermediate step to account for disparities in implementation costs for each type of site. Rural and urban sites were stratified to account for different measures, methods, and resulting costs. Restoration in urban areas is constrained by an increased potential for impacts to the human environment and the measures and methods are, overall, more expensive, as shown in the summary measure costs presented in Appendix F. This step ensured that sites in the more impaired urban areas would not be eliminated prematurely due to higher restoration costs, resulting in a restoration plan benefiting only rural portions of the watershed. The final CE/ICA analysis, comparing plans composed of multiple sites, provides an opportunity to evaluate whether the incremental costs of each project are justified by the benefits provided.

**2. High Significance: The future response of the river channels to the various plan features has not been fully investigated.**

This comment includes one recommendation for resolution. This recommendation was adopted.

1. Evaluate potential channel response to NED and NER plan measures to avoid significant adverse impacts on geomorphic processes.

**USACE Response: Adopted**

**Action Taken:** The USACE evaluated potential impacts of the proposed projects, as documented in the Environmental Assessment (Section 9). The potential impacts of each project individually as well as cumulative impacts were assessed. In general, improvements to fluvial geomorphic processes will be integral to the restoration project designs. Structural flood risk management projects are located in urbanized portions of the watershed with existing impairments and the proposed projects would not result in a significant change to the existing impairments. Non-structural projects consist of either modifications at existing

structures or removal of structures that are currently causing impacts and therefore would not have significant impacts.

**3. High Significance: The frequency analysis for the Riverside Gage on the Des Plaines River should be reviewed for accuracy.**

This comment includes three recommendations for resolution. All three recommendations were adopted.

1. Examine the weather conditions for the 1987 and 2008 floods to determine whether rainfall amounts and intensities have similar extreme recurrence intervals and justify the actual occurrence of 200- and 300-year flood discharge events. If these flood events are justified, provide expanded discussion in the flood frequency analysis section of Appendix A, Hydrology and Hydraulics and in Section 2.3 (Inventory of Historic Flooding) of the NED Plan (Volume 2).

**USACE Response: Adopted**

**Action Taken:** The rainfall amounts and intensities for the 1987 and 2008 flood events at the Riverside Gage can reasonably be tied to the precipitation frequency. During the 2008 flood event, an Illinois State Water Survey gage measured 8.04 inches of precipitation. This precipitation depth is between the lower bounds of the 90% confidence interval for the 200 year and 500 year precipitation events (NOAA Atlas 14). During the 1987 event, some areas on the lower Des Plaines River experienced more than 9 inches of precipitation. This precipitation also falls within the 90% confidence interval for the 200 year event. Based on the observed data, the flow events can be reasonably tied to the observed precipitation in the watershed, therefore these flood events can be justified. The discussion on historic events is supplemented by an issue paper included with Appendix A, Hydrology and Hydraulics, Attachment A-1 that specifically addresses gage frequency analyses for this study.

2. If the floods are determined to be caused by much less extreme rainfall conditions, adjust the flood frequency relationships accordingly and revise the benefit cost analysis as needed.

**USACE Response: Adopted**

**Action Taken:** As discussed above, the USACE conducted the requested review. However, the flood events were caused by weather conditions that were not significantly different from the long-term gage record. Therefore the flood frequency relationships were not adjusted.

3. Alternatively, increase the uncertainty related to flood discharge frequency in the HEC-FDA risk analysis and revise the benefit/cost analysis as needed.

**USACE Response: Adopted**

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**Action Taken:** As discussed above, the USACE conducted the requested review. The review determined that no adjustment in the uncertainty of the hydrologic record for these particular events is justified based on the previous explanation.

**4. High Significance: There are discrepancies in damage estimates for the same conditions presented in Figures 1, 2, and 4 of the NED Plan (Volume 2).**

This comment includes two recommendations for resolution. Both recommendations were adopted.

1. Clarify the discussion of Figures 1, 2, and 4 to explain the apparent inconsistencies among the three figures.

**USACE Response: Adopted**

**Action Taken:** The cited figures presented the Upper Des Plaines River, Illinois (Phase I) project residual damages and current study (Phase II) baseline and future without project condition damages. The information presented in the figures was not based on the same conditions: the models, damage categories, inventory, and stage-damage relationships were all revised and updated for the current feasibility study. In addition, the river miles used to present the damages along the river used different scales. Because of these differences, direct comparison across the figures was not appropriate. The USACE recognized that these figures were confusing and replaced them with narrative discussing the residual damages from the Phase I projects and the without project condition damages from the Phase II study.

2. Should significant damages be identified that were not included in the “without project condition,” evaluate and revise the benefit cost analysis as needed.

**USACE Response: Adopted**

**Action Taken:** The USACE reviewed the damage calculations used to develop the figures to ensure that the information presented was accurate and that there were no significant omissions from the without project condition damages. No revisions were required as a result of this review.

**5. High Significance: The rationale and assumptions regarding the remedial/removal approaches for hydrologic restoration methods are not justified, and the restoration costs may be underestimated.**

This comment includes four recommendations for resolution. Three of these recommendations were adopted and one was not adopted.

1. Replace disabling drain tile with removal of drain tile and restoration of soil horizons.

**USACE Response: Not Adopted**

The USACE has implemented several restoration projects in former agricultural fields and has found that installing valves in drain tiles is a more cost effective method than drain tile removal for both the design and construction phases. During the design phase, installation of valves allows for observation of the effects of disablement and adaptation of the disablement to avoid flooding impacts to neighboring properties. During the construction phase, the appropriate valves are then grouted shut. The disabled tiles eventually fill with soil and collapse, achieving the same result that would be accomplished through removal.

2. Replace ditch plugging with ditch filling including the matching of adjacent soil horizons.

**USACE Response: Adopted**

**Action Taken:** The USACE agrees that ditch filling is preferable to ditch plugging. However, ditch filling could result in adverse flooding impacts at neighboring properties. Therefore, the feasibility level cost estimates were revised to assume a combination of ditch filling and plugging. This hybrid approach accounts for the use of the preferred method (filling), while also acknowledging that plugging will be necessary in some cases.

3. Provide more detail on the approach for estimating the costs of restoration, including the approaches that will be used and mobilization/demobilization, long-term monitoring, and maintenance costs.

**USACE Response: Adopted**

**Action Taken:** The USACE provided additional documentation of the estimated restoration costs in Section 5.4.3 of the Main Report and in summary tables presented in Appendix C.

4. If necessary, recalculate benefit/costs for the restorations.

**USACE Response: Adopted**

**Action Taken:** The USACE updated the estimated restoration costs and expected outputs to incorporate changes resulting from the revisions noted above. The updated costs and benefits are shown in Section 5 of the Main Report and in Appendix C.

**6. High Significance: There are errors and inconsistencies in some of the flood profiles in Appendix A (Hydraulics and Hydrology).**

This comment includes four recommendations for resolution. All four recommendations were adopted.

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1. Examine the hydraulic models and correct any errors in the Bull Creek model.

**USACE Response: Adopted**

**Action Taken:** The USACE reviewed the Bull Creek model prior to completing the final Feasibility Report. In general, water surface profiles were reviewed and crossing profiles were resolved in the hydraulic model. Remaining minor adjustments were performed in the HEC-FDA model.

2. Provide an explanation for the apparent inconsistencies in the Willow Creek model or correct errors as needed.

**USACE Response: Adopted**

**Action Taken:** The Willow-Higgins Creek model was developed as part of a local watershed planning study. Based on an assessment of local flood risk management planning, the study assumed that some structural modifications would be implemented in the future conditions. The future profiles reflect this assumption.

3. Determine whether the results significantly affect damage estimates.

**USACE Response: Adopted**

**Action Taken:** While no revisions were required for the Willow-Higgins Creek model, the USACE had already considered the impacts of water surface profile adjustments in the Bull Creek model to the damage estimates. Minor adjustments lowering calculated damages caused by the 0.2% annual chance of exceedance flood event were made to the profiles prior completing damage computations used in the analyses. The model used to estimate damages, HEC-FDA, requires that damages increase as the flood severity increases. In some instances, where modeled results were very similar between frequencies, these minor revisions were required for model stability.

4. Evaluate and revise the benefit/cost analysis as needed.

**USACE Response: Adopted**

**Action Taken:** The USACE has incorporated the results of revisions discussed above into the benefit/cost analyses in the Feasibility Report.

**7. Medium Significance: The ranking and application procedure for proposed reservoir sites was limited in not considering factors other than soil grain size and organic content.**

This comment includes three recommendations for resolution. All three recommendations were adopted.

1. Develop a proper understanding of how soil will perform under various design loads by determining:
  - a. the geologic origin of the material (glacial vs. residual)
  - b. the past stress history (overconsolidated vs. lightly or normally consolidated)
  - c. the soil strength (loose vs. dense in granular soil; weak or soft vs. hard in cohesive soil)
  - d. compressibility (highly compressible organic soil vs. relatively incompressible low plasticity hard silty clay).

**USACE Response: Adopted**

**Action Taken:** The USACE investigated each site using the U.S. Geological Survey (USGS) online soil classification tool. Additionally, soil borings were completed at sites for which detailed designs were developed, with the exception of FPCI01, DPRS04, and WLRS04. Testing at each site included classification, moisture content, hand penetrometer, Atterberg limits, sieve/hydrometer analysis, dry density, and unconfined compression. Based on information from the online tool, each site not removed from consideration consisted of silty clay loam, silt loam, and/or 'urban land' (see Table 1 of Geotech Appendix G and Attachment 1). Most soils in this area, especially greater than five feet below grade are overconsolidated from the last glaciation. Generally, all borings encountered medium stiff to hard clays with some intermittent coarser grained layers. The only site which encountered soft organic materials was BCRS02, which has since been removed from consideration. Descriptions of the investigations are in Appendix G, with logs included as Attachment 2 and 3.

2. Perform a properly scoped geotechnical exploration and take all of these issues as well as others into consideration to include performance of:
  - a. appropriate field sampling
  - b. laboratory testing of representative materials.

**USACE Response: Adopted**

**Action Taken:** The USACE has conducted initial field sampling, as discussed above. Additional field investigations and field testing will be conducted during the design phase.

3. Use data from all analyses performed to evaluate the soil conditions, and consider all factors for the selection of construction sites and to make appropriate design and construction recommendations.

**USACE Response: Adopted**

**Action Taken:** The results of the analyses, documented as discussed above, were used to inform the site specific designs developed for proposed projects. Geotechnical design analyses for each individual site are included in Appendix G. Slope stability, seepage, and

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settlement analyses, as appropriate, are included as Attachment 4 to the appendix. In addition, the USACE provides recommendations for additional analyses to be conducted during the design phase.

**8. Medium Significance: The geotechnical aspects of the project, which will have civil engineering design and construction implications for the proposed construction, have not been investigated.**

This comment includes eight recommendations for resolution. All of the recommendations were adopted.

1. Conduct a geotechnical investigation at all the subject sites. Refer to the attached spreadsheet for examples and suggestions with regard to potential geotechnically related design issues.

**USACE Response: Adopted**

**Action Taken:** As part of the Feasibility Study, the USACE completed a review of physiographic, bedrock conditions, U.S. Department of Agriculture (USDA) Soil Surveys, existing Illinois State Water Survey well logs, and new and previous soil borings at each proposed site. This analysis is documented in Appendix G (Geotechnical Analysis).

2. Based on the geotechnical characterizations, as well as USACE's geotechnical insights, develop a site-specific geotechnical exploration plan for each of the proposed measures, including appropriate field sampling (borings, in-situ shear strength testing, water elevation monitoring wells, in-situ permeability testing, etc.), laboratory investigation and testing (plasticity, grain size, moisture content, shear strength, etc.), and geotechnical engineering analyses.

**USACE Response: Adopted**

**Action Taken:** The USACE completed borings at all recommended sites other than other than FPCI01, DPRS04, and WLRS04. Previously completed borings from nearby locations were reviewed for these three sites. No potential major construction issues were identified from either the available information or the new investigations completed. The USACE will also complete additional in depth investigations and analyses during the design phase.

3. Define the site geotechnical conditions through appropriate laboratory classification, geotechnical property laboratory testing, and preparation of representative soil boring logs.

**USACE Response: Adopted**

**Action To Be Taken:** The USACE developed, conducted, and analyzed initial soil borings for the proposed projects. During the design phase, the USACE will develop, conduct, and

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analyze additional soil borings prior to construction. The Feasibility Phase has identified key considerations that could impact the study recommendations. Uncertainties in geotechnical conditions and potential impacts to design are reflected in cost contingencies that were developed with input from the Geotechnical Engineer. These contingencies are added to the costs used in the economic analysis of each site and presented in the Final Feasibility Report, reducing the likelihood that the study recommendation would change as a result of unanticipated geotechnical considerations.

4. Analyze the pertinent geotechnical engineering aspects of each project (geologic history and setting, excessive settlement, slope stability considerations, flood water underseepage, subgrade instability, borrow material characteristics, flood wall overturning stability, etc.) through appropriate geotechnical analyses.

**USACE Response: Adopted**

**Action To Be Taken:** Some of the above recommended analyses and investigations have been completed with the information already obtained. These analyses were used to inform the design and remaining uncertainties were considered in the development of cost contingencies. During the design phase, the USACE will complete additional investigations and review the results of all geotechnical analyses to ensure that project design appropriately accounts for geotechnical conditions at the site.

5. Determine what modifications to “standard” measure designs are required to increase the likelihood the proposed measures will be constructible at reasonable cost and will perform acceptably under the design loads, forces, and constraints once construction is completed.

**USACE Response: Adopted**

**Action Taken:** The USACE has developed site specific recommendations based on the investigations conducted to date as documented in Appendix G. Several sites have been analyzed for stability, seepage, and settlement as documented in Attachment 4 to the Appendix.

6. Modify the proposed measures as needed to achieve an acceptable geotechnical performance outcome based on item 4 above.

**USACE Response: Adopted**

**Action Taken:** The USACE used the information from the investigations conducted during the study to inform the design for the proposed projects, as documented in Appendix G.

7. Include all geotechnically relevant information (boring logs, laboratory test results, geotechnical strength and material profiles, geotechnically related analyses, etc.) in the appropriate Appendix of the Feasibility Report/Environmental Assessment.

**USACE Response: Adopted**

**Action Taken:** The USACE has included the results of all geotechnical analyses conducted to date as attachments to Appendix G of the Feasibility Report.

8. Include a written exploration report which should consist of at least the following sections:

- a. Explanation of exploration process,
- b. Characterization of the design constraints,
- c. Understanding of the geologic history and conditions at the site,
- d. Summary of the geotechnical conditions at the site,
- e. Implications of the geologic and geotechnical conditions on the design, construction, and operation of the proposed measures,
- f. Analyses that were performed for the study
- g. Results of the analyses performed and the changes to the initially proposed design as a function of those analyses
- h. Soil and groundwater constructability problems associated with or anticipated for the proposed construction.

**USACE Response: Adopted**

**Action To Be Taken:** The USACE has included the reports documenting the geotechnical explorations, including the requested information, as attachments to Appendix G of the Feasibility Report.

**9. Medium Significance: The assumptions and approach used to make the flood damage estimates for the Wisconsin properties needs additional explanation.**

This comment includes one recommendation for resolution. This recommendation was adopted.

1. In Volume 2, Section 2.4.3, the discussion of flood damage estimates for the Wisconsin properties should explain:
  - a. Why the damages were calculated outside HEC-FDA. (Explain which information was not available that was needed in HEC-FDA.)
  - b. How the damages were calculated. (Since HEC-FDA was not used, explain what the methodology was for calculating the damages for the Wisconsin properties.)
  - c. In what way the results may or may not differ between the two methodologies. (Explain whether the damages calculated using this alternative methodology will be less accurate. Explain how this effects the with-project benefits.)

**USACE Response: Adopted**

**Action Taken:** The USACE has documented the available data and procedures used in the economic analyses, including those used to calculate damages in Wisconsin in Appendix E. The USACE did not conduct a detailed comparison between the Wisconsin and Illinois benefit calculations as these damages represent only a small portion of the total damages. Although some economically justified non-structural measures were identified for implementation in Wisconsin, these projects are not compliant with current USACE policy and are recommended for implementation by others.

**10. Medium Significance: The assumptions and approach used to screen potential floodwater storage sites need clarification.**

This comment includes six recommendations for resolution. Four of these recommendations were adopted and two were not adopted.

1. Move the screening language and Table 7 from Section 3.2.1 to Section 3.3.1.

**USACE Response: Not Adopted**

The activities identified as screening by the USACE include hydrologic and hydraulic modeling, development of unit costs and design, and economic analysis. The analysis documented in Section 3.2.1, while reducing the total number of initially identified sites, did not include this level of detail. Therefore, the USACE did not revise this discussion.

2. Add a footnote to Table 7 explaining the elimination of each site.

**USACE Response: Not Adopted**

The Main Report presents a summary of the procedures used to identify sites and the results of that process. Appendix B provides detailed information about each of the identified sites, whether it was determined to be suitable for use as a reservoir, and the rationale behind that determination. An explanation of the reason for elimination of each of the 130 sites removed from consideration could not be reasonably accomplished with a footnote. The USACE believes that the Appendix is the appropriate location for this detailed discussion.

3. Justify the 250-foot length limit of conveyance to a storage site and address whether certain sites could have still been justified with such a limit.

**USACE Response: Adopted**

**Action Taken:** The goal of the initial analysis was to identify sites that warranted further investigation. To accomplish this, general rules of thumb were developed to allow for efficient prioritization among the hundreds of potential sites in the watershed. The maximum distance of 250 feet was established as an upper limit based on the additional costs associated with conveying floodwaters into and out of the site. Even with this cut-off,

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200 potential storage sites were identified across the watershed. This large pool of potential sites provides enough alternatives to identify the reservoir locations and sizes that could be economically justified.

4. Explain the assumption that flood storage volume is 4.41 times the surface area to determine the potential volume of flood storage sites; provide evidence that this conversion is adequate over all sites and did not prematurely eliminate potentially beneficial sites from further consideration.

**USACE Response: Adopted**

**Action Taken:** The analysis used to determine the assumed floodwater storage capacity at each site is documented in Appendix A. The relationship of 4.41 acre-feet of storage per acre of site footprint was based on designs developed for several reservoirs in the Buffalo Creek sub-watershed. The team used this level of detail in the analysis to allow for the evaluation of a large number of sites using limited data. While there is significant uncertainty in this assumption, the analysis also used idealized cost estimates that did not account for all possible construction costs, balancing the level of detail in the benefit and cost computations.

5. Discuss how groundwater levels could affect the calculation for flood storage capacity.

**USACE Response: Adopted**

**Action Taken:** High groundwater levels at a proposed floodwater storage sites would impact the cost of construction. Additional features such as cut-off walls would be required to ensure the capacity and stability of the site. The USACE did not consider these costs when evaluating the 70 sites for which preliminary costs were developed. However, after this screening phase, geotechnical investigations and evaluations were conducted for each retained site. The groundwater level was not established via wells, but due to the predominantly cohesive nature of the subsurface, groundwater seepage is unlikely. Additionally, the boring completed at DPRS04 in 1975 indicated a water level about 50 ft below grade. No borings were available at WLRS04 but it likely has similar groundwater properties. During the design phase, site specific investigations will be completed to ensure groundwater does not negatively affect the project.

6. Clarify the use of average tax assessed market land values as it relates to different areas.

**USACE Response: Adopted**

**Action Taken:** Use of average tax assessed land values provided a method for the evaluation of a large number of sites using limited data. For watershed scale analyses comparing rough cost estimates, an average land value was used as documented in the

report. Site specific estimates were developed during the detailed evaluation process for projects that were retained after this watershed scale screening step.

**11. Medium Significance: The assumptions and screening approach used in determining the benefit cost ratios (BCR) to select road raises, bridge modifications, floodwater storage sites, floodwater protection sites, modifications to existing structures, and non-structural sites need more explanation and justification.**

This comment includes six recommendations for resolution. Five recommendations were adopted, and one was not adopted.

1. Provide more detail to support the statement “within most clusters not all structures were retained for further evaluation” (Volume 2, Section 3.3.5).

**USACE Response: Adopted**

**Action Taken:** Subsequent to this review, the referenced non-structural screening was revised significantly. The USACE ultimately evaluated groups of homes and businesses identified as potential candidates for non-structural measures as a group. The determination of whether the non-structural measures are economically justified was based on the overall cost-to-benefit ratio, thereby avoiding implementation of non-structural measures unevenly across a community.

2. Clarify how a BCR of  $>30$  ends with a BCR of  $<1.0$  and address whether the analysis for the earlier screening was adequate to eliminate sites.

**USACE Response: Adopted**

**Action Taken:** The high benefit-to-cost ratio shown for reservoir site WHRS06 at the screening stage was the result of a modeling error. The USACE has updated the screening level modeling for this site. The updated screening results resulted in much lower flood damage reduction benefits. These results are in line with the results of other modeled reservoirs in the watershed. The updated results and resulting benefit-to-cost ratio are documented in Section 2.1 of Appendix B.

3. Consider using a lower BCR for initial screening, such as 0.8 or 0.9, to allow for alternatives that could be justified under further analysis, or provide the rationale for the BCR of 1.0 on the first screening.

**USACE Response: Adopted**

**Action Taken:** The USACE reviewed the 1.0 benefit-to-cost ratio (BCR) criteria used in the initial screening and believes that this is an appropriate cut-off point. The minimum BCR of 1.0 reasonably captures all sites likely to be economically justified upon further analysis.

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While the hydrologic, hydraulic, and damage assessment models had been developed in great detail, the level of detail used to develop the screening level design was likely to result in cost estimates that are lower than site specific estimates. Therefore, retaining additional sites is not likely to have resulted in the identification of additional economically justified sites.

4. In Table 15 of Volume 2, explain how the BCRs shown in this table relate to the BCRs for the same components in the NED (p. E-78 of the economic appendix).

**USACE Response: Adopted**

**Action Taken:** The summary of the screening level analysis of potential road raise sites presented in the referenced table was based on an idealized and abstracted analysis. The benefits, costs, and benefit-to-cost ratios reported in Appendix E (Economic Analyses) are based on additional analysis conducted after the initial screening was conducted. Detailed site designs and assessments of flood damages reduced were used to determine the final benefits and costs for each proposed project as reported in Appendix E.

5. Clarify how future construction would not increase risk when only a 10-year level of protection would be provided by SCLV03 and DPLV15. Explain what controls would be in place to prevent increased risk due to future construction.

**USACE Response: Adopted**

**Action Taken:** The analysis of all identified levee/floodwall sites included an evaluation of the benefits and costs of the project at a range of heights. USACE guidance requires that the project that maximizes net benefits (benefits minus costs) be selected as the National Economic Development plan. The proposed levees noted above, would provide protection for areas that are fully developed and would provide benefits to those existing structures by preventing damages at more frequent flood events. Due to the low crest elevation, any future construction on lands protected by the levees would continue to be governed by the rules of the National Flood Insurance Program. Note that, based on subsequent analyses, sites SCLV03 and DPLV15 were eliminated from consideration after the draft report was provided to the panel for review.

6. Consider increasing the level of protection to reduce the risk of frequent flood damage despite the addition of improvements.

**USACE Response: Not Adopted**

As discussed above, the levee and floodwall crest elevations selected in the Feasibility Study are the heights at which net benefits are maximized, as required by USACE guidance. The report does clearly document the risk and likelihood of overtopping at each proposed levee project.

**12. Medium Significance: More detail is needed to explain how vegetation restoration will be accomplished.**

This comment includes three recommendations for resolution. All three recommendations were adopted.

1. Include planting and long-term operation and maintenance (O&M) as a part of measures for both P1 and P2.

**USACE Response: Adopted**

**Action Taken:** The alternative plans address the role of invasive species control and native plant restoration, including operation and maintenance requirements. Additional discussion of the estimated requirements for operations and maintenance and, additionally, monitoring and adaptive management, is provided for all restoration measures, including P1 and P2, in Section 5.4.3.

2. Include appropriate descriptions and costs.

**USACE Response: Adopted**

**Action Taken:** Detailed restoration actions per measure are included in the discussion of measures P1 and P2 in Section 5.4.1.3 of the Main Report. Discussion of operation and maintenance activities and estimated costs is provided in Section 5.4.3.

3. Provide additional information on the assumptions and methods for calculating the average annual cost per habitat unit.

**USACE Response: Adopted**

**Action Taken:** Section 5.4.3 of the Main Report discusses the measure costs and assumptions. In addition, detailed information is provided in Appendix C.

**13. Medium Significance: The effects of construction on residents, such as driveway and property accessibility, does not appear to have been considered at all proposed construction locations.**

This comment includes four recommendations for resolution. None of the recommendations were adopted.

1. Review the grades at sites DPBM10, DPBM08, DPRR05, DPRR03, DPRR09, and DPRR08 and confirm that all existing commercial and residential driveways and building access walks can be accessed by normal means.

**USACE Response: Not Adopted**

The USACE conducted additional analyses after the draft report was provided for review, and the referenced projects are no longer proposed for construction. The sites were eliminated based upon extensive coordination with local transportation agencies responsible for these roadways and an assessment of the remaining design life of each road segment or bridge. These road raise and bridge modification projects were being planned in conjunction with major rehabilitations that occur once the design life of the infrastructure is reached, many of which exceeded the 50-year planning horizon for this study.

2. For all driveways and walks noted to be inaccessible by normal means, modify the proposed flood risk reduction measure to permit normal access.

**USACE Response: Not Adopted**

As discussed above, the USACE conducted additional analyses after the draft report was provided for review, and the referenced projects are no longer proposed for construction.

3. Review the projects at sites DPBM10, DPBM08, DPRR05, DPRR03, DPRR09, and DPRR08 and confirm that all the proposed measures do not render inaccessible a structure or location previously accessible to the handicapped.

**USACE Response: Not Adopted**

As discussed above, the USACE conducted additional analyses after the draft report was provided for review, and the referenced projects are no longer proposed for construction.

4. For all locations found to be inaccessible to the handicapped, modify the proposed flood risk reduction measures to permit access to the handicapped.

**USACE Response: Not Adopted**

As discussed above, the USACE conducted additional analyses after the draft report was provided for review, and the referenced projects are no longer proposed for construction.

**14. Medium Significance: There is no discussion of the possibility that removal of the dams might facilitate Asian carp invasion.**

This comment includes two recommendations for resolution. Both of these recommendations were adopted.

1. Briefly describe the problems with invasive Asian Carp downstream on the Illinois River

**USACE Response: Adopted**

**Action Taken:** Asian carp (Silver and Bighead) pose a threat to native fishes, humans, and the economy in the Illinois River basin. These filter feeding fish move through the water and filter out microscopic organisms important as food for many native species. Competition with Asian Carp could result in lower abundances and diversity of native fishes, including several recreationally important species such as panfish and Walleye. Impacts to these species may severely impact the region's economy through loss of recreation. In addition to the potential of decreased fishing opportunities, Silver carp are known to leap out of the water when frightened, creating a human safety risk and further disrupting the local economy. Currently, the leading edge of the Asian carp population is over 30 miles downstream of the study area. While populations of these fish persist at this leading edge, no confirmed spawning has been observed. The closest confirmed successful spawning location for Asian carp is located approximately 48 miles downstream.

2. Analyze and describe whether dam removal would have any effect on potential invasion into the Des Plaines River system.

**USACE Response: Adopted**

**Action Taken:** The USACE conducted an analysis of the watershed conditions and has determined that removal of the low-head, run-of-the-river dams along the Des Plaines River would not facilitate establishment of Asian carp in the watershed. The dams themselves do not serve as a barrier to the carp: during high flow conditions the carp would easily be able to jump over the dams. Invasive organisms thrive best in disturbed environments and improving the stability of native populations is their best defense against non-indigenous organisms. Removal of the dams will restore conditions favorable to native species, enhancing the health and stability of those populations. The dams actually create suitable habitat for the Asian carp which prefer lower velocity, backwaters conditions such as those provided by the dams. The effect of dam removals, therefore, would be a reduction in the likelihood of establishment of Asian carp, should the species reach the watershed.

**15. Low Significance: The description of the current ecological resource conditions in the watershed is incomplete and inconsistent.**

This comment includes three recommendations for resolution. These recommendations were adopted.

1. When describing communities, include a description of the characteristic plant species that dominate the community within the given categories, e.g. prairie, savannah, woodland, wetland, etc.

**USACE Response: Adopted**

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**Action Taken:** The USACE expanded the description of the ecological resources, now located in Section 3.1.2, to include the dominant plant species within each plant community.

2. List animals characteristic of the habitats described in a consistent manner for all communities.

**USACE Response: Adopted**

**Action Taken:** The USACE has updated the discussion of plant community types to include discussion of animal species, particularly threatened and endangered species, associated with those communities.

3. For highly mobile animals, like birds, list the reason they are considered threatened or endangered in the project area.

**USACE Response: Adopted**

**Action Taken:** Within the study area, there are 89 species, including mobile animals, listed per the Illinois Endangered Species Protection Act (IESA) as amended and 11 of these species, including mobile animals, are also listed by the Federal Endangered Species Act (FESA) of 1973 as amended. The USACE is required to comply with the IESA (520 ILCS 10/2) and the FESA (7 U.S.C. sec 136) by protecting threatened and endangered species. All species listed by the state must be based upon scientific evidence including population size, changes in ranges in the state, any known threats to its existence, and features of its life history which might have a bearing on its survival. To be Federally listed, the species must meet one of the following criteria: 1. There is the present or threatened destruction, modification, or curtailment of its habitat or range; 2. An over utilization for commercial, recreational, scientific, or educational purposes; 3. The species is declining due to disease or predation; 4. There is an inadequacy of existing regulatory mechanisms; 5. There are other natural or manmade factors affecting its continued existence. Mobile animals can become threatened or endangered for a variety of reasons including the result of a taking, exposure to pesticides and poisons, exposure to anthropogenic structures (e.g. cell phone towers, tall buildings, and power lines), lack of nesting habitat, lack of habitat along migratory routes (the portion of the migratory flyway in the metro Chicago area is globally significant per the Chicago Region Audubon Society), lack of niche specific food sources and habitats, and fragmentation of habitat. The Main Report has been updated to include discussion of significance of the proposed ecosystem restoration plan to threatened and endangered species, including mobile species.

**16. Low Significance: Assumptions regarding future development are not clearly stated.**

This comment includes three recommendations for resolution. These recommendations were adopted.

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1. Volume 1, Sections 4.1.2.5 and 4.2.1; Tables 10 and 11 illustrate population and land use trends. Clarify the assumptions and relationships used to project the land use changes from the population projections, particularly for understanding projected changes in agricultural land use.

**USACE Response: Adopted**

**Action Taken:** The projected future land use changes discussed in the main report, now located in Section 3.2.1, were developed by the regional planning organizations Southeastern Wisconsin Regional Planning Commission (SEWRPC) and Chicago Metropolitan Planning Agency (CMAP).

2. In Volume 1, Section 4.2.2, clarify how future development impacts future condition projections, including flood stages up and downstream, and explain what development controls are in place at the present time.

**USACE Response: Adopted**

**Action Taken:** The USACE has added discussion to the section (now 3.2.1) to clarify the anticipated effects of land use changes. For the flood risk management portion of the project, modeled future conditions incorporate projected land use changes. Areas that would be protected by proposed flood risk management measures are already developed and are not projected to change in the future. For the ecosystem restoration analysis, habitat benefits in the without project condition are only provided by existing natural areas. These remaining areas are typically in public ownership as conservation lands and this status is not likely to change. Conversion of agricultural lands to residential or commercial uses would not impact habitat quality as none of these land uses currently provide habitat benefits.

3. In Volume 3, clarify how the continued development of the watershed could affect the benefits of the restoration (positively or negatively) and whether the ecological models have taken this into account.

**USACE Response: Adopted**

**Action Taken:** As discussed above, the USACE considered the impacts of future land use changes on the ecological conditions in the watershed. Habitat benefits cited in the without project condition are only provided by existing natural areas. These remaining areas are typically in public ownership as conservation lands and this status is not likely to change. Conversion of agricultural lands to residential or commercial uses would not impact habitat quality as none of these land uses currently provide habitat benefits.

**17. Low Significance: The alternative screening summary tables are inconsistent in providing benefit, cost, and benefit cost ratio data.**

This comment includes one recommendation for resolution. This recommendation was adopted.

1. Provide consistent information for each of the summary tables in Volume 2. Tables 13, 17, and 25 should include the BCRs. Table 15 should show the benefits and costs. Table 11 should show the net benefits.

**USACE Response: Adopted**

**Action Taken:** The USACE provided benefit and cost information in all summary tables and reviewed subsequent drafts to ensure consistency in reporting. In general, the summary tables include benefits, costs, and net benefits, and in some cases benefit-to-cost ratios. Some variation in the summary information can be attributed to additional analyses conducted to ensure that the optimized measures were identified.

**18. Low Significance: The Equivalent Annual Damages (EAD) presented in Figure 3 (Section 2.3.4 of NED Volume 2) needs clarification.**

This comment includes two recommendations for resolution. Both recommendations were adopted.

1. Explain why, in Figure 3, EAD increases between 2010 and 2020 and why EAD remain flat after that time.

**USACE Response: Adopted**

**Action Taken:** The figure (now Figure 4.1) is intended to illustrate how use of the two without project condition scenarios, baseline and future, are used to calculate average annual damages over the period of analysis. The model uses the baseline condition (2010) to calculate damages in the initial year of the analysis and the future condition (2020) to calculate damages in 2020. The damages in the intervening years are interpolated between the values, resulting in increasing damages over that period. Because conditions were not projected beyond 2020, the damage estimates assume that the conditions remain constant over the remaining 40 years of the analysis. The report has been revised to more clearly describe the significance of the figure.

2. Explain how EAD in Figure 3 relates to Table 6.

**USACE Response: Adopted**

**Action Taken:** The Equivalent Annual Damages Presented in Table 6 (now Table 4.7) are the Expected Annual Damages shown in the figure, discounted over the period of analysis and annualized using the current Federal discount rate.

**19. Low Significance: Some sections of the report rely too heavily on the appendices to explain the steps in data acquisition, analysis, and conclusions.**

This comment includes five recommendations for resolution. One recommendation was adopted, four were not adopted.

1. Summarize and integrate into the report the supporting information detailed in the appendices. For example, in Volume 3, Section 1.2, include a map or a plate to show the reader the plant types or plant community change; this could also possibly serve as an orientation map for the reader.

**USACE Response: Adopted**

**Action Taken:** The USACE revised the report to include additional summary information throughout the report to more clearly present the methodology and analyses conducted. However, the level of detail presented in the main report is intended to provide decision makers and the public with a landscape level overview of the study, and detailed information is presented in the appendices.

2. Include Table 3 from Appendix C (p. 330) in Volume 3, Section 2.1.1, Fishes, Index of Biological Integrity.

**USACE Response: Not Adopted**

The USACE believes that the level of detail presented in the tables in Appendix C is not appropriate for the main report. The main report presents an overview of the methodology and analyses, while the appendix is provided to supply this additional information for those interested.

3. Add Table 23 from Appendix B (p. B-33) to Volume 2 to more clearly describe the criteria used to identify the construction sites, or refer to where this is covered in another part of the report.

**USACE Response: Not Adopted**

The USACE provides a narrative discussion of the criteria used to identify potential levee/floodwall sites in the Main Report in Section 4.5.2.2 rather than extensive detail for each possible site. The appendix is the appropriate location for the detail provided in the table.

4. Include Table 29 from Appendix B (p. B-38) in Volume 2, and clarify if there were any individual properties that were identified as candidates for non-structural flood reduction measures but not geographically located in one of the clusters. If there were such properties, explain how these were evaluated or included.

**USACE Response: Not Adopted**

The USACE revised the non-structural analysis to ensure that isolated structures would be considered. The updated information and summary table is presented in Section 4.5.2.5.

5. Explain the rationale for averaging the cost calculations derived from two different methods.

**USACE Response: Not Adopted**

The USACE revised the methodology for estimating the cost of implementing non-structural measures and is no longer using this procedure of averaging costs estimated from two methods. Rather than relying on estimating methods developed by others, costs specific to the study were developed as documented in Appendix F.

**20. Low Significance: In several places in the report, statements or calculations have not been supported by adequate explanations.**

This comment includes three recommendations for resolution. Two recommendations were adopted, one was not adopted.

1. Provide additional discussion to clarify whether any structures were identified outside of the cluster areas selected for non-structural measures and how these were eliminated or included.

**USACE Response: Adopted**

**Action Taken:** The USACE revised the non-structural analysis to ensure that isolated structures would be considered. The revised analysis is discussed in Sections 4.5.2.5 and 4.5.3.5 of the Main Report.

2. Provide justification for averaging the results of the two methods used for calculating the costs of elevating structures instead of relying on one or the other.

**USACE Response: Not Adopted**

The USACE revised the methodology for estimating the cost of implementing non-structural measures and is no longer using this procedure of averaging costs estimated from two methods. Rather than relying on estimating methods developed by others, costs specific to the study were developed as documented in Appendix F.

3. Explain whether differences in market land values between urban and developed areas were considered for cost estimates used for the screening of flood risk reduction sites.

**USACE Response: Adopted**

**Action Taken:** For watershed scale analyses comparing rough cost estimates, an average land value was used as documented in the report. Site specific estimates were developed during the detailed evaluation process for projects that were retained after this watershed scale screening step.

**21. Low Significance: The habitat assessment method for quantifying the quality of habitat cover types is highly subjective and needs to be explained more thoroughly.**

This comment includes two recommendations for resolution. These recommendations were adopted.

1. Acknowledge which portions of the ecological analyses depend on subjective assertions or "best professional judgment" and explain what was done to maximize measurability and objectivity to make the results more repeatable in the future.

**USACE Response: Adopted**

**Action Taken:** The USACE agrees that some of the ecosystem analysis is subjective and it is unlikely that identical conclusions would be reached by a different team of experts. However, the subjective analyses were limited to smaller scale factors such as the identification of ecosystem response variables. For comparing alternatives at an ecosystem scale, the results are less sensitive to these subjective factors and the USACE is confident that the recommendations would not change.

The group of experts brought their own experience to bear when identifying ecosystem response variables. This region contains some of the oldest ecosystem restoration projects in North America (University of Wisconsin Arboretum) and data collection on ecosystem response to the restoration activities has been extensive. The backgrounds and areas of expertise of ecosystem restoration specialists cover a wide range from avian ecologists to soil ecologists. If another group of experts from the region were to complete the same process, there is no guarantee that the new group would agree upon the same variables or develop the same exact response curves. Different experts have different professional experiences dictating which variables they are most comfortable with in terms of exploring expected responses of ecosystems to restoration activities (e.g. a dragonfly expert vs. a wetland hydrologist). However, the identified ecosystem level variables were based not only on professional experience, but also extensive research and empirical evidence. These variables have known responses to restoration activities as shown in the evidence presented in the model documentation included as an attachment to Appendix C (Ecosystem Restoration Plan Formulation).

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Although there is a small chance that the use of experts to identify ecosystem response variables would have resulted in variation in the rankings of some of the more closely related alternatives, it is more likely that the alternatives would have been ranked in the same manner. The variables and restoration targets were identified at an ecosystem scale. Even if some of the variables chosen would be different between groups of experts, the target ecosystem of the restoration would not change and the ecosystem level model would still have been sensitive to changes at the ecosystem scale, consistently capturing differences between restoration alternatives.

2. Provide a rationale for why certain habitats were not evaluated.

**USACE Response: Adopted**

**Action Taken:** The discussion in the report was incorrect. The USACE did assess all habitats in the watershed. The report has been updated to clarify this information.

**22. Low Significance: Information on stakeholder and public involvement is very limited to one reference.**

This comment includes one recommendation for resolution. This recommendation was adopted.

1. Provide a summary of public and stakeholder involvement throughout the study.

**USACE Response: Adopted**

**Action Taken:** The USACE conducted this study collaboratively throughout all stages. The study team included members from the non-Federal sponsor agencies as well as stakeholders and partners representing local, state, and Federal agencies. An Upper Des Plaines Advisory Committee was also formed and has met four times a year throughout the study process. At the start of the study, scoping letters were provided to the public and public meetings were held. Once the tentatively selected plan was identified, a public review of the draft report was conducted which included a public comment period and public meetings. Additional detail is provided in Section 9.1 of the Main Report.

**Responses to Component B Review Comments**

**1. High Significance: Assumptions used for the with- and without-project conditions for the six Phase I projects and the basis for estimating flood damage reduction may no longer be valid.**

This comment includes three recommendations for resolution. All three have been adopted.

1. Describe the current status of the six Phase I projects.

**USACE Response: Adopted**

**Action Taken:** The Phase I projects were authorized by Section 101 of WRDA 1999 as a result of the Upper Des Plaines River, Illinois Feasibility Study (Phase I) which recommended the construction of two levees and four floodwater storage projects. The current study (Phase II) investigated plans within the Phase I study area as well as along tributaries to the mainstem and in the Des Plaines River headwaters in Wisconsin. Implementation of the Phase I projects would provide significant flood risk management benefits in the watershed. This is recognized in the authorization of the projects by Congress and in the continued support by the non-Federal sponsor for implementation of the projects. A summary of the Phase I projects and their current status is provided below.

Authorized Features	Location (City, State)	Storage (ac-ft)	Current Status
North Fork Mill Creek Dam Modification	Old Mill Creek, IL	500	On hold
Van Patton Woods Lateral Storage	Wadsworth/ Russell, IL	412	In design
Buffalo Creek Reservoir Expansion	Buffalo Grove, IL	476	On hold
Prospect Heights/Mt. Prospect Levee	Prospect Heights/ Mt. Prospect, IL	N/A	Construction
Rand Park Levee	Des Plaines, IL	N/A	Complete
Big Bend Lake Reservoir Expansion	Des Plaines, IL	587	On hold

Coordination between the non-Federal sponsor, USACE, and the landowners in the implementation of these projects has been ongoing during the development of the Phase II Study. One project, the North Fork Mill Creek Dam Modification, can no longer be constructed due to a dam notching project at the site completed for ecosystem restoration purposes. Although this project can no longer be constructed using the original designs, as noted in the Feasibility Report and reflected in the updated without project condition models, implementation of the remaining features is still possible and is the subject of ongoing negotiations with the landowners.

2. Describe what steps were taken to ensure that the proposed plans accurately represent the most likely reduction in flood damages if some of the six proposed Phase I projects are not funded and constructed as proposed.

**USACE Response: Adopted**

**Action Taken:** The USACE revised the hydrologic and hydraulic (H&H) models and the economic model throughout the study where appropriate to reflect current and expected future conditions. When Phase I project site designs were revised or, as in the case of the North Fork Mill Creek Dam modification, a project was eliminated, the H&H modeling was updated to include these changes. In addition, other changes in the watershed, such as the notching of Hoffman Dam at the downstream end of the study area, have been incorporated when it was determined that the alterations would impact the Phase II analysis. These H&H models were used as input to the HEC-FDA economic model, which was also updated throughout the study process. The final report includes discussion of these revisions.

3. Re-run the without-project conditions in both HEC-FDA and VISTA with the most likely combination of Phase I projects and then rerun the with-project damages.

**USACE Response: Adopted**

**Action Taken:** As discussed above, the USACE updated H&H and economic models over the course of the study. The USACE believes that these updates to the without project conditions used to model flood damages in the watershed provide an appropriate representation of watershed conditions used as a basis for computing benefits and plan justification.

2. **High Significance: There is a general lack of geotechnical data to support reliable exploration at the project sites.**

This comment includes five recommendations for resolution. All five have been adopted.

1. Review the geologic conditions anticipated at each of the proposed flood damage mitigation elements.

**USACE Response: Adopted**

**Action Taken:** As part of the Feasibility Study, the USACE has completed a review of physiographic, bedrock conditions, U.S. Department of Agriculture (USDA) Soil Surveys, existing Illinois State Water Survey well logs, and new and previous soil borings at each proposed site. This analysis, completed as part of the study process, is documented in Appendix G (Geotechnical Analysis).

2. Assess the likely impact of variable soils (type, strength, workability and compressibility) on the proposed construction site by site.

**USACE Response: Adopted**

**Action Taken/Action To Be Taken:** The USACE considered available data for each site and likely conditions, anticipated design considerations, areas of uncertainty, and recommends areas for additional investigation during the preconstruction engineering and design phase. Areas recommended for additional investigation include borings for each site. These analyses are presented in Appendix G (Geotechnical Analysis) under the following headings: Design Analysis, Construction, and Additional Information.

3. Develop a soil boring plan that addresses the potential risks presented by each site and structure.

**USACE Response: Adopted**

**Action To Be Taken:** The USACE will develop soil boring plans during the Design Phase, prior to construction. The Feasibility Phase has identified key considerations that could impact the study's recommendations. Uncertainties in geotechnical conditions and potential impacts to design are reflected in cost contingencies that were developed with input from the Geotechnical Engineer. These contingencies are added to the costs used in the economic analysis of each site and presented in the Final Feasibility Report, reducing the likelihood that the study recommendation would change as a result of unanticipated geotechnical considerations.

4. Revise the plan based upon the data obtained in the field while the investigation is ongoing.

**USACE Response: Adopted**

**Action To Be Taken:** The USACE will revise the boring plan developed and executed during the Design Phase if warranted by data obtained in the field.

5. Obtain supplemental geotechnical information before completion of the design phase should the results of any geotechnical analyses indicate structure performance is likely to be less than required.

**USACE Response: Adopted**

**Action To Be Taken:** The USACE will perform additional borings during the design phase. The results and associated geotechnical analyses will inform the designs. Boring plans will be developed based on anticipated data needs. If the analyses show that there are data gaps, additional investigations would be completed.

3. **Medium Significance: There is insufficient detail about the prescribed burning regimen to ensure understanding and support from affected property owners.**

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This comment includes three recommendations for resolution. All recommendations have been adopted.

1. In Section 5.4.1.3 in the Main Report, under P2, provide the public with a specific statement of anticipated frequency, time of year, and extent of fire management on prairies associated with this project.

**USACE Response: Adopted**

**Action Taken:** The USACE has included additional information in the report about planned coordination and burn considerations under the description of measure P2. All burning activities require permitting at various levels depending on the community, and outreach will be conducted through letters and meetings with adjacent landowners to coordinate and discuss both controlled burning and tree removal activities. Considerations include, but are not limited to, weather and wind patterns, notification of local fire and police departments, and strategic implementation plans.

2. In Section 5.4.1.3 in the Main Report under P2, provide an example of the safety ground rules for deciding under what circumstances on a given day a prescribed burn will or will not be undertaken.

**USACE Response: Adopted**

**Action Taken:** The USACE has included discussion of the safety and coordination activities that will be conducted under the description of measure P2. These activities will vary based on the local permitting requirements, but include, at a minimum, the activities discussed in response to recommendation 1.

3. In section 5.4.1.3. in the Main Report under P2, provide an example of the typical safety rules and precautions that will be taken to ensure that a prescribed burn will remain controlled and will not become a hazard.

**USACE Response: Adopted**

**Action Taken:** The USACE has included discussion of the safety and coordination activities that will be conducted under the description of measure P2. These activities will vary based on the local permitting requirements, but include, at a minimum, the activities discussed in response to recommendation 1.

- 4. Medium Significance: The calibration of the hydrologic and hydraulic models has not been documented in the Phase II report, and the relevant information in the Phase I report shows significant discrepancies between model and observed values.**

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This comment includes three recommendations for resolution. One has been adopted and two were not adopted.

1. Include details of the calibration of the hydrologic and hydraulic models (plots or tables of model versus observed values) in Appendix A of the Phase II report.

**USACE Response: Adopted**

**Action Taken:** The USACE has incorporated additional discussion and documentation of the calibration of the hydrologic and hydraulic models in Appendix A (Hydrology and Hydraulics). The USACE devoted significant time and effort to calibration of the Des Plaines River during the Phase I study. The calibration was accomplished through coordination between the USACE Chicago District, the USACE Hydrologic Engineering Center (HEC), and the State of Illinois Department of Natural Resources. This additional documentation in Appendix A provides context for understanding the model, its appropriateness and level of complexity, and uncertainty in the results.

2. Validate the accuracy of the hydrologic and hydraulic models against more recent historical floods for which input information can be readily available (e.g., the 2008 flood).

**USACE Response: Not Adopted**

The USACE does not consider additional verification necessary. Discrepancies between modeled and observed peak flows in recent events such as the 2008 flood can be attributed to the complexity of the watershed, extensive existing development and modifications, and limitations associated with developing models for such a complex watershed. Examples of complexities to which these discrepancies are attributed include:

- a) There are 64 bridges in the approximate 65 river miles of mainstem channel alone. Inclusion of the tributary channels adds hundreds of additional channel crossings. The location and degree of accumulation and movement of debris through bridges and culverts throughout the system during the 1986 and 1987 events and subsequent floods such as the 2008 event, along with the effects of this accumulated debris on conveyance and attenuation, is not known.
- b) The calibration events simulated in the model accounted for the spatial variability of rainfall, but only to the extent possible. The large basin experienced rainfall variability greater than could be accounted for due to gaps in the rain gage network.
- c) In addition to providing the estimated flood stages for the Phase I and Phase II feasibility studies, the hydrologic and hydraulic models are also used for regulatory modeling by the State of Illinois and are the basis of the Upper Des Plaines River floodplain mapping for the National Flood Insurance Program and therefore need to be readily usable for this purpose. To make the model more accessible, loss parameters were

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applied consistently for each frequency. While adjusted loss rates may have resulted in a better calibration for the 1986 or 1987 storms, it would have limited the usability of the models.

In summary, observed discrepancies are not an indication of model inaccuracy, but rather model uncertainty and the inability of the model to account for complex site conditions present during specific calibration events. A less developed watershed with fewer modifications would not present the same level of complexity with calibration. To evaluate the representativeness of the models, the USACE conducted a review of confidence limits, considering the full period of record at each gage location. Based on this review, the model as calibrated to the 1986 and 1987 events provides reasonable estimated flood stages.

3. If recommendation 2 above shows significant discrepancies between model and observed values, both for peak flows and for flood hydrograph volumes, discuss and quantify impacts on flood damages and benefits estimates.

**USACE Response: Not Adopted**

Based on the explanation provided above, the USACE does not believe there is any need to quantify potential impacts to flood damages or benefits estimates from discrepancies between modeled and observed peak flows during recent flood events.

**5. Medium Significance: The impacts from raising roads and constructing flood walls on existing infrastructure, residences, and commercial facilities have not been adequately addressed.**

This comment includes three recommendations for resolution. All have been adopted.

1. Review the grades along Ashley Street for DPLV09 – Segment 1 flood wall and confirm that all existing commercial and residential driveways and building access walks can be accessed by normal means.

**USACE Response: Adopted**

**Action Taken:** The USACE considered impacts to existing facilities in the design of DPLV09. An earlier iteration of the design included an alignment that impacted residential and commercial properties along Ashley Street. To address these impacts, the design included ramps and other structural modifications allowing property access across the levee, which had a height of approximately two feet in this location. However, the USACE has since revised the design to tie in to high ground by extending along the river side of Des Plaines River Road, avoiding impacts to the properties.

2. Modify the proposed flood damage risk reduction measure at all driveways, sidewalk, and private access walks noted to be inaccessible by normal means to permit normal access.

**USACE Response: Adopted**

**Action Taken:** The USACE has revised and the updated the design, eliminating impediments to access at commercial and industrial properties, as discussed above.

3. Modify the proposed flood damage risk reduction measures to permit handicapped access at all locations found to be inaccessible to the handicapped

**USACE Response: Adopted**

**Action Taken:** The USACE has revised and the updated the design, eliminating impediments to access at commercial and industrial properties, as discussed above.

**6. Medium Significance: The current alignment of DPLV09 - Segment 3 is not the most efficient and effective way to mitigate the risk of flood damage in the unprotected area.**

This comment includes one recommendation for resolution which has been adopted.

1. Review the existing topography along the suggested alternative alignment. If the elevation of the Tristate Tollway proximate to the site is at or above El. 636, then realign the termination of Segment 3 as nominally indicated on the included imagery.

**USACE Response: Adopted**

**Action Taken:** The USACE has revised the design of DPLV09 to extend south along Des Plaines River Road and tie in to high ground at the Interstate 294 embankment as recommended. This design change, identified through a review of existing topography and verified through a review of the extents of severe flooding experienced in April 2013, eliminates impacts to the properties along Fargo Avenue and also extends the line of protection to incorporate additional area.

**7. Medium Significance: The assumptions associated with models and analyses lack thorough documentation and explanation, making it difficult to assess their influence on conclusions.**

This comment includes four recommendations for resolution. One has been adopted and three were not adopted.

1. Inventory the assumptions in the Main Report and the supporting appendices.

**USACE Response: Adopted**

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**Action Taken:** The USACE has reviewed the assumptions used in the feasibility study to ensure that they are appropriately documented and accounted for in the analyses used to develop the study recommendations. Uncertainty is thoroughly integrated in the modeling and analysis approach used by the USACE. Each technical area incorporated assumptions and documented these assumptions in the associated technical appendix. In general, the appendices provide detail on how inputs to the cost and economic models were developed, the associated assumptions, and the level of uncertainty. Appendix E (Economics) details the uncertainties in the Flood Damage Assessment model and how they were addressed, including assignment of Manning's  $n$  values to characterize channel roughness, hydraulic stage-discharge calculations, structure elevations, and assignment of depth-damage relationships. Appendix F (Cost) includes Risk, Assumptions and Concerns, and Contingency and Escalation sections discussing how these impacted the analysis.

2. Evaluate the available and potential support or documentation for each assumption, adding that discussion to the Main Report.

**USACE Response: Not Adopted**

The USACE did conduct a review and evaluate the supporting documentation for the assumptions. However, a catalog of the numerous assumptions and how they were supported would not add clarity to the Main Report. This documentation is currently provided in the technical appendices, which the USACE believes is appropriate. A brief discussion of risk and uncertainty and how assumptions were addressed has been added to the Main Report and additional documentation of assumptions identified through the review of assumptions discussed above has been added to the technical appendices, as appropriate.

3. Conduct sensitivity analyses of the assumptions surrounding the variables in the models or analyses, thus identifying the critical variables and processes to be closely monitored as the chosen plan is developed.

**USACE Response: Not Adopted**

The USACE has integrated uncertainty in the economic and cost models to capture the critical areas of risk and uncertainty associated with the benefit-cost analysis. Rather than conducting a sensitivity analysis, the USACE incorporated uncertainty in the modeling by defining parameters for the uncertain variables in the economic and cost models. This analysis is the key factor in decision making for the flood risk management portion of the project. While a sensitivity analysis would demonstrate which variables have the most impact on the analysis, the USACE believes that the incorporation of uncertainty parameters to bound the benefit and cost calculations accomplishes the same intent. The information presented in the technical appendices, as discussed above, documents the uncertainty and how it was incorporated in the models.

4. Add the sensitivity results to the plan being evaluated in the relevant areas of discussion in the Main Report.

**USACE Response: Not Adopted**

The USACE incorporated uncertainty in the analyses using the methods discussed above rather than through a sensitivity analysis. The discussion in the report, therefore, documents the parameters defining the level of uncertainty and its impacts on the results instead of the proposed sensitivity analysis.

**8. Medium Significance: The objective of achieving restored habitats with less than 1% cover of invasive plant species seems highly unrealistic given the current state of the art.**

This comment includes three recommendations for resolution. One has been adopted and two were not adopted.

1. Clarify whether the objective of “keeping invasive plant species cover to less than 1% of the site” with plans to keep invasive plant species cover, at a minimum, to less than 5% is a suggested target or a required success criterion.

**USACE Response: Adopted**

**Action Taken:** Keeping invasive plant species cover to less than 5% of the total site area is a required success criterion established in the planning objectives. The removal of invasive plant species allows for increased biodiversity by reestablishing the critical structural and functional components provided by native plants including soil structure, microbial and fungal interactions, hydrologic regulation, food production, reproductive structure, and controlled allelopathy. The USACE has required invasive plant species spatial coverage under 1% at several projects in the region and this target has been consistently met by contractors implementing the projects and by the project sponsors during the operation and maintenance phase.

2. Address the intensity, frequency, and kind of effort required to achieve and maintain invasive plant species cover to such levels.

**USACE Response: Adopted**

**Action Taken:** The USACE and other experienced restoration ecologists within the region do not support allowing invasive plant species to be abundant within a site after construction is complete. The requirement and criteria are set forth in the contract plans and specifications. Contractors bid knowing that invasive species eradication is part of the project. This has been successfully accomplished by either removing existing cover, with herbicide or by clearing and scraping the site, or intensive planting of native species at sites such as agricultural fields where there is no existing cover. To maintain the site, sponsors

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will periodically survey the site according to the Monitoring Plan and Operation and Maintenance Manual provided by USACE. When invasive plants are indentified, they will be removed or treated by a herbicide. The costs for controlling invasive species at the desired target levels are included in the alternatives analysis.

3. Discuss how frequently levels such as less than 5% or less than 1% invasive plant species have been attained and maintained over time in real-world projects.

**USACE Response: Adopted**

**Action Taken:** The USACE currently has several restoration projects in various phases of implementation in the region which require eradication of invasive plant species and have been successful in achieving the 1% invasive species spatial coverage target. These projects include Red Mill Pond, Eugene Field Park, Little Calumet Riparian Restoration, Calumet Prairie, 63rd Street Dune and Beach, Chicago Botanic Gardens, Orland Tract Perimeter, and Jane’s Ravine Estuary. This eradication of invasive species is not only a project goal, but is also a requirement of the non-Federal project partners. These efforts have been successful because the project reestablishes hydrogeomorphic conditions and cultivates native plant communities by sowing native seed and planting plugs. Both of these actions help to prevent the reestablishment of invasive plant species. The proposed projects are very different from restoration projects that simply let fields “go wild” and result in domination of the site by invasive species. Similar restoration projects implemented by other agencies in the area have also successfully achieved and maintained this target over time, such as Bluff Spring Fen (Illinois Department of Natural Resources), Bartel Grassland (Forest Preserve District of Cook County) , and Wolf Road Prairie (Illinois Department of Natural Resources and Forest Preserve District of Cook County). These projects are complete and have maintained the invasive species spatial coverage target for several years, some as long as 15 years.

**9. Medium Significance: The proposed riverine restoration projects do not include site specific information on existing conditions and feasibility designs, which is considered necessary to support estimated gains in habitat units that can be attributable to these projects.**

This comment includes three recommendations for resolution. Two have been adopted and one was not adopted.

1. Include the results of the QHEI in the Main Report.

**USACE Response: Not Adopted**

The USACE included the results of the Quantitative Habitat Evaluation Index (QHEI) in Appendix C of the draft provided for review and the final report. The appendices are the appropriate location for this documentation as they are intended to supplement the Main Report, providing additional information for those interested in the details of the analysis.

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The two publications included in Appendix C providing the QHEI results are “A Survey of Riverine Fish Assemblages and Habitat of the Upper Des Plaines River System” and “Effects of Tributary Spatial Position, Urbanization, and Multiple Low-Head Dams on Warmwater Fish Community Structure in a Midwestern Stream”

2. Include the results of the Net Average Annual Habitat Unit spreadsheet used to evaluate riverine restoration projects in Appendix C.

**USACE Response: Adopted**

**Action Taken:** The USACE has provided this information in Appendix C. The Appendix details the calculations of riverine AAHUs.

3. If no additional analysis and design can be completed in the Upper Des Plaines River and Tributaries, Illinois and Wisconsin Feasibility Study (Phase II Study), provide examples of similar riverine restoration projects in the study area that can serve as a reference for the estimated gains in habitat units that can be attributable to the riverine restoration projects proposed in Phase II.

**USACE Response: Adopted**

**Action Taken:** The USACE did conduct the recommended analysis as discussed above. Examples in the watershed of dam removal projects on the mainstem Des Plaines River include removal of Armitage and Fairbanks Dams along with notching of Hoffman Dam on the Des Plaines River. Other reference projects completed by USACE include removal of the Wright and MacArthur Woods dams (completed in partnership with the Illinois Department of Natural Resources and the Lake County Forest Preserve District) and removal of a dam at Red Mill Pond in Indiana. The Red Mill Pond project restored a cobble stream resulting in the repopulation of stoneflies and native fish, including rare species such as the Chestnut Lamprey and Northern Starhead Topminnow.

**10. Low Significance: Future development is not discussed sufficiently to determine how risk and uncertainty associated with that development will affect the with-project conditions.**

This comment includes five recommendations for resolution. All have been adopted.

1. Revise the risk and uncertainty discussions in the Main Report specifically related to future development.

**USACE Response: Adopted**

**Action Taken:** The USACE considered projected future development in technical analyses used to project future conditions in the watershed. The Main Report presents the projections

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of future development used in the analyses documented in the technical appendices. The USACE has included additional discussion in Main Report to highlight the risk and uncertainty associated with future development projections.

2. Relate the risk and uncertainty parameters to the range of future development expected as one of the proposed plan(s) is implemented.

**USACE Response: Adopted**

**Action Taken:** The USACE has incorporated the risk and uncertainty associated with a number of factors, including future development and availability of land, in a cost and schedule risk analysis conducted for the feasibility study recommendations. These uncertainties are incorporated as contingencies added to the cost estimates.

3. Discuss and consider impacts of varying levels of development on the relevant variables that could affect the NED/NER plan.

**USACE Response: Adopted**

**Action Taken:** The USACE has reviewed the potential impacts of future development on the Feasibility Study recommendations. The potential impact of uncertainties in future development on project benefits is minimal. For the flood risk management portion of the project, modeled future conditions incorporate projected land use changes. Areas that would be protected by proposed flood risk management measures are already developed and are not projected to change in the future. For the ecosystem restoration analysis, habitat benefits in the without project condition are only provided by existing natural areas. These remaining areas are typically in public ownership as conservation lands and this status is not likely to change, as discussed in Section 3.2.1. Conversion of agricultural lands to residential or commercial uses would not impact habitat quality as none of these land uses provide habitat benefits.

4. Evaluate the impact of denser development and increased run-off on the agricultural lands.

**USACE Response: Adopted**

**Action Taken:** The USACE conducted this analysis during the development of future without project condition hydrologic models of the watershed. Documentation of this modeling is included in Appendix A (Hydrology and Hydraulics).

5. Expand on the conclusion that new development will be minimal and how that conclusion was reached and supported.

**USACE Response: Adopted**

**Action Taken:** The USACE has incorporated additional discussion of future development in the report, clarifying that new development will be minimal in the highly urbanized southern portion of the watershed, but land use is expected to change in northern portion of the watershed. The source of the projections, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and Chicago Metropolitan Agency for Planning (CMAP), is also documented in the report.

**11. Low Significance: It is not clear when ditch filling will be applied instead of ditch plugging in wetland restoration.**

This comment includes one recommendation for resolution which was not adopted.

1. State when and why ditch plugging would supersede ditch filling in the wetland restorations.

**USACE Response: Adopted**

**Action Taken:** The USACE has incorporated uncertainty in the decision whether to implement ditch filling or plugging in wetland restoration areas. The decision depends on a number of site specific factors that will be uncertain until detailed design is developed and construction is underway. The critical factors in feasibility level decisions are whether restoring the hydrology will provide benefits, the anticipated costs are covered, and adverse effects can be avoided. Project implementation must avoid impacts to neighboring properties and filling all ditches on a site could result in flooding at adjacent sites. Although ditch filling is the preferred restoration method, the feasibility level cost estimate assumes a combination of ditch filling and plugging to account for adaptation to site conditions and design requirements. A cost contingency is added to account for uncertainty in these assumptions. During construction, contracts allow for adaptive management to ensure that the appropriate measures are implemented. Discussion was added to the descriptions of restoration measures in Section 5.4 to clarify this assumption.

**12. Low Significance: Public concerns and the outreach process have not been identified nor adequately described.**

This comment includes three recommendations for resolution. All have been adopted.

1. Add a paragraph in the Main Report describing the steps taken to involve the public.

**USACE Response: Adopted**

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**Action Taken:** The USACE added discussion of public involvement as steps in the public review and outreach process were completed. At the time of the IEPR, public review of the draft report had not been conducted. Since that time, the report has been released for public review and the USACE held public meetings in the three counties in which projects are recommended. Concerns raised by the public as a result of this outreach process have been considered and are addressed in the report.

2. Conduct a public release of the plan, accompanied by public meetings, as the first step in the outreach process. Such a release could include the results of running the H&H models for the recent large floods (2008 and 2013) to give the public a base for comparison. Comments and concerns raised by the public as a result of this outreach process have been considered and are addressed in the report.

**USACE Response: Adopted**

**Action Taken:** The USACE released the report for public review in September of 2013 and held public meetings to present the project to the public and receive comments. Comments and concerns raised by the public as a result of this outreach process have been considered and are addressed in the report.

3. Responses to public concerns/comments should be openly published.

**USACE Response: Adopted**

**Action Taken:** The USACE has included a summary of the public concerns and comments submitted as a result of the public review in Appendix L (Coordination) as well as responses to those comments. A summary is also presented in the integrated Environmental Assessment.

**13. Low Significance: Potential relocations as a result of the six Phase I projects have not been adequately addressed.**

This comment includes three recommendations for resolution. All have been adopted.

1. Evaluate plan components and measures for all three plans, determining which measures may entail relocations.

**USACE Response: Adopted**

**Action Taken:** The lands for the unconstructed Phase I projects are Forest Preserve lands that are in the public ownership. No relocations would be required to implement the projects. The USACE has added a statement clarifying this to the discussion of the Phase I projects in the report.

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2. Develop a list of properties that would require relocations and a planning level cost for relocations.

**USACE Response: Adopted**

**Action Taken:** There are no properties that would require relocations.

3. Conduct sensitivity analyses to determine impact on costs, benefits, and benefit/cost ratios if relocations are delayed or not achieved.

**USACE Response: Adopted**

**Action Taken:** Since relocations are not required, there would be no impacts to costs, benefits, or benefit/cost ratios.

**14. Low Significance: There is no discussion of how benefits for non-structural alternatives are calculated, or if they are excluded in the Hydrologic Engineering Center- Flood Damage Reduction Analysis calculations.**

This comment includes one recommendation for resolution which was adopted.

1. Add a discussion in Appendix E, Economic Analysis, to detail the methodology used to calculate damage reduction for the non-structural alternatives.

**USACE Response: Adopted**

**Action Taken:** The USACE calculated benefits for non-structural alternatives using Hydrologic Engineering Center – Flood Damage Analysis (HEC-FDA) outputs modeled for the watershed. Additional detail of the methodology used to calculate these benefits has been incorporated in Appendix E (Economic Analysis).

**15. Low Significance: Uncertainty surrounding benefits from the Full, National Economic Development (NED)/National Ecosystem Restoration (NER), and Continuing Authorities Program (CAP) plans is not clearly analyzed or presented.**

This comment includes one recommendation for resolution which was adopted.

1. Include a discussion of uncertainty and the probability that the tentatively recommended plan will achieve the expected benefits at the end of Appendix E. Since each plan has uncertainty associated with variables, state what the likelihood/probability that the proposed plan(s) will achieve the indicated damage reduction. A table similar to Figure 15.3 of the HEC-FDA User's Manual, V1.2.4 (p. 15-3) (USACE 2008) may serve as a useful model.

**USACE Response: Adopted**

**Action Taken:** The USACE has included the recommended outputs from HEC-FDA in Appendix E (Economic Analysis) along with a discussion of potential impacts to the study recommendations. A summary of the analysis is also included in the Main Report.

**16. Low Significance: It is not clear whether models based on subjective expert analyses could be replicated by a different team of experts and whether they would vary significantly.**

This comment includes two recommendations for resolution. Both have been adopted.

1. Explain how the conclusions drawn from the methods used were based on measureable, repeatable, objective facts rather than subjective opinions (even if expert).

**USACE Response: Adopted**

**Action Taken:** The USACE agrees that some of the ecosystem analysis is subjective and it is unlikely that identical conclusions would be reached by a different team of experts. However, the subjective analyses were limited to smaller scale factors such as the identification of ecosystem response variables. For comparing alternatives at an ecosystem scale, the results are less sensitive to these subjective factors and the USACE is confident that the recommendations would not change.

The group of experts brought their own experience to bear when identifying ecosystem response variables. This region contains some of the oldest ecosystem restoration projects in North America (University of Wisconsin Arboretum) and data collection on ecosystem response to the restoration activities has been extensive. The backgrounds and areas of expertise of ecosystem restoration specialists cover a wide range from avian ecologists to soil ecologists. If another group of experts from the region were to complete the same process, there is no guarantee that the new group would agree upon the same variables or develop the same exact response curves. Different experts have different professional experiences dictating which variables they are most comfortable with in terms of exploring expected responses of ecosystems to restoration activities (e.g. a dragonfly expert vs. a wetland hydrologist). However, the identified ecosystem level variables were based not only on professional experience, but also extensive research and empirical evidence. These variables have known responses to restoration activities as shown in the evidence presented in the model documentation included as an attachment to Appendix C (Ecosystem Restoration Plan Formulation).

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Although there is a small chance that the use of experts to identify ecosystem response various would have resulted in variation in the rankings of some of the more closely related alternatives, it is more likely that the alternatives would have been ranked in the same manner. The variables and restoration targets were identified at an ecosystem scale. Even if some of the variables chosen would be different between groups of experts, the target ecosystem of the restoration would not change and the ecosystem level model would still have been sensitive to changes at the ecosystem scale, consistently capturing differences between restoration alternatives.

2. Provide some reassurance that the results garnered from the methods “under review” will not differ significantly once the methods pass final review.

**USACE Response: Adopted**

**Action Taken:** The USACE does not believe that this model development approach would produce a different ranking of alternatives if a different group of experts were convened to produce another model(s) using the same process as the first group, as discussed above.