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DAEN

12 Jan 2016

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

SUBJECT: Upper Ohio Navigation Study, Pennsylvania -- Final US Army Corps of Engineers 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. The Corps 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 U.S. 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 four members with expertise in civil works planning, economics, environmental, and engineering.
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 Corps 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 further questions or concerns, please do not hesitate to contact me or your staff may contact Yvonne Prettyman-Beck, Deputy Chief, Great Lakes and Ohio River Division Regional Integration Team, at 202-761-4670 or by e-mail at Yvonne.J.Prettyman@usace.army.mil.

Encl

TODD T. SEMONITE
Lieutenant General, USA
Chief of Engineers

**Upper Ohio Navigation Study, Pennsylvania
Draft Feasibility Report and Integrated Environmental Impact Statement**

**U.S. Army Corps of Engineers Response to
Independent External Peer Review
July 2014**

Independent External Peer Review (IEPR) was conducted for the subject study in accordance with Section 2034 of WRDA 2007, EC 1165-2-214, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (2004). The goal of the U.S. Army Corps of Engineers (USACE) Civil Works program is to always provide scientifically sound, sustainable water resources solutions for the nation. The USACE review processes are essential to ensuring project safety and quality of the products USACE provides to the American people.

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 the IEPR for the *Upper Ohio Navigation Study, Pennsylvania, Draft Feasibility Report and Integrated Environmental Impact Statement*, and its supporting documentation. The IEPR consisted of four members with expertise in economics, environmental, engineering and planning.

Battelle issued its Final Independent External Peer Review Report on May 27, 2014. The review resulted in 17 Final Panel Comments. Of these, four were rated as having High Significance, five with Medium/High Significance, six with Medium Significance, and two with Medium/Low Significance.

Initially, the USACE concurred with four comments, and non-concurred with the other 13 comments. The Panel Backcheck resolved with concurrence on 16 comments, leaving only one comment in a non-concur status.

The following discussion presents a summary of the USACE final responses to the comments.

1. High Significance - The estimated project benefits and the benefit-cost ratio (BCR) are based on outdated traffic forecasts that are no longer reliable.

Three specific recommendations were made with this comment. One was adopted and two were not adopted.

1. Conduct a rigorous sensitivity analysis to determine how tonnage forecasts affect the benefits estimates and the BCR.

USACE Response: Not Adopted.

The USACE considers the sensitivity analyses previously conducted for this study are sufficient for determining the impact of traffic projections on the benefit estimates and BCR. Analysis showed that actual waterways traffic through 2013 effectively tracked projected traffic, making a sensitivity test using more current forecasts unnecessary.

2. Use the results of the sensitivity analysis to identify which portions of the traffic forecast to update.

USACE Response: Not Adopted.

The USACE determined that updates to the forecasts were not necessary since the sensitivity analysis showed that actual waterways traffic through 2013 effectively tracked projected traffic.

3. Develop and implement a plan to update those portions of the forecast and benefit estimates, and document the process and results in the relevant portions of Appendix B and the Draft Feasibility Report/Environmental Impact Statement (DFR/EIS).

USACE Response: Adopted.

Action to be Taken: Economic updates are required after every three year interval prior to a decision to construct (ER 1105-2-100, Appendix D, Amendment #1, 30 June 2004; EC 11-2-99; March 2010). The level of detail is required to be commensurate with the changes that have taken place, ranging from price level and interest rate updates in a Level 1 effort to a new project formulation in a Level 4 study. As a result, a Level 3 update will be completed using new feasibility-level forecasts, transportation rates, and project costs in all future budgets for the project. This requirement is cited in Attachment 8, Economics Appendix of the Feasibility Report.

2. High Significance - The transportation rate analysis supporting the estimated project benefits and the BCR is outdated and therefore is no longer reliable.

This comment includes three recommendations and all three recommendations were adopted.

1. Update the transportation rate analysis using the most recent available data.

USACE Response: Adopted.

Action to be Taken: The USACE will complete an economic update during the PED phase of the project (ER 1105-2-100, Appendix D, Amendment #1, 30 June 2004; EC 11-2-99; March 2010). A Level 3 update will be completed using new feasibility-level forecasts, transportation rates, and project costs in all future budgets for the project. This requirement is cited in Attachment 8, Economics Appendix of the Feasibility Report.

2. Verify rate estimates for the truck and rail with actual rate quotes and/or shipper records.

USACE Response: Adopted.

Action Taken: Truck rates used in the report were based on field surveys and rail rates on the Surface Transportation Board (STB) Waybill Sample data as documented in Appendix B, Attachment 5, Addendum 2, *Transportation Rate Analysis EDM Regional Economic Development*. The STB Waybill Sample is a stratified sample of carload waybills for all U.S. rail traffic submitted by those rail carriers terminating 4,500 or more revenue carload annual. Actual rate quotes and shipper record can be sensitive and are not readily available from public sources, and very difficult to obtain from private sources. Where possible, rates will be validated. Also, see explanation #3 below.

3. Update the benefits estimates and relevant report sections as needed.

USACE Response: Adopted.

Action to be Taken: As stated in recommendation #1, an economic update will be completed during PED phase, which will be completed using new feasibility-level forecasts, transportation rates, and project costs in all future budgets for the project. This requirement is cited in Attachment 8, Economics Appendix of the Feasibility Report.

3. High Significance - The sources and validity of the truck and rail rates used in the Ohio River Navigation Investment Model (ORNIM) analysis and other parts of the analysis are unclear; therefore, the accuracy of the estimated transportation cost savings and the BCR cannot be determined.

This comment included three recommendations. One was adopted and two were not adopted.

1. Review, reconcile, and document the trucking and rail rate estimates used in different parts of the analysis.

USACE Response: Not Adopted.

The USACE reviewed trucking and rail rates and determined that no reconciliation was necessary. Truck and rail rates were only used to estimate shipper diversion costs as a result of unscheduled closures. Avoidance of these diversion costs was used in the benefit estimation.

2. Verify truck and rail rate estimates with actual rate quotes and/or shipper records.

USACE Response: Not Adopted.

The Tennessee Valley Authority rate analysis for truck and rail were developed through a field survey of shippers accounting for 205 Upper Ohio waterway movements. Their responses were verified or supplanted using STB Waybill data, as the recommendation desires.

3. Update the benefits estimates and relevant report sections as needed.

USACE Response: Adopted.

Action to be Taken: The benefit estimates and relevant report sections shall be updated in required economic updates during Preconstruction Engineering and Design (PED).

4. High Significance - The traffic forecast, rate analysis, and social cost analysis do not appear to account for the predicted utility power plant shift to Powder River Basin (PRB) coal.

This comment included three recommendations. One was adopted and two were not adopted.

1. Analyze the potential impact of the predicted influx of PRB coal on traffic projections, rate analyses, and social cost estimates.

USACE Response: Not Adopted.

The LTI Greenmont Energy Model was chosen to do coal forecasts because of its ability to find the least cost solution for generating expected electricity demands. The transportation rate analysis conducted estimated rates for the existing water route and the least cost alternate route for a large sample of Ohio River System movements. The methodology used to estimate rates for future and unsampled historic movements was based upon a statistical analysis of the sample rates. This included estimating rates for unsampled and future PRB movements based upon rates for PRB movements in the Ohio River sample set.

2. Make appropriate adjustments to estimated project benefits and document the process used in support of these changes.

USACE Response: Not Adopted.

Based upon the response to the comment and the explanation of the response to Recommendation #1, the USACE determined that this recommendations was not required.

3. Update the relevant report sections as needed.

USACE Response: Adopted.

Action Taken: The feasibility report was revised to more clearly explain coal sourcing, routing, and apportionment. The revision is included as an addendum to the Economics Appendix.

5. Medium/High Significance - The sensitivity analysis does not address the vulnerability of the BCR to recent traffic volume declines, estimated truck and rail rates, potential changes in coal sourcing, or combinations of these factors.

Four recommendations were included in this comment. None of the recommendations were adopted.

1. Analyze and document the sensitivity of the estimated project benefits and the BCR to recent traffic levels.

USACE Response: Not Adopted.

Economic updates are required after every three year interval prior to a decision to construct (ER 1105-2-100, Appendix D, Amendment #1, 30 June 2004; EC 11-2-99; March 2010). The level of detail is required to be commensurate with the changes that have taken place, ranging from price level and interest rate updates in a Level 1 effort to a new project formulation in a Level 4 study. A Level 3 economic update will be completed using new feasibility-level forecasts, transportation rates, and project costs in all future budgets for the project. This requirement is cited in Attachment 8, Economics Appendix of the Feasibility Report.

2. Analyze and document the sensitivity of the estimated project benefits and the BCR to truck and rail rate estimates.

USACE Response: Not Adopted.

Rate savings do not display significant volatility from year-to-year. Over the last 30 plus years, transportation rate savings (the differential between the existing water route's rate and the alternative route's rate) have changed very little. The USACE follows a process of periodic economic updates prior to a decision to construct that would include current transportation rates reflecting the market conditions at that time. A rate sensitivity shall be performed as part of this economic update.

3. Analyze and document the sensitivity of the estimated project benefits and the BCR to PBR sourcing of steam coal.

USACE Response: Not Adopted.

As demonstrated in sensitivity tests in the study, plan selection was not affected by traffic levels. Though the magnitude of the BCR is sensitive to traffic, the selected plan remains above unity.

4. Analyze and document the sensitivity of the estimated project benefits and the PBR in combination (e.g., more recent truck and rail estimates applied to more recent traffic levels).

USACE Response: Not Adopted.

A Level 3 economic update will be completed using new feasibility-level forecasts, transportation rates, and project costs in all future budgets for the project. This requirement is cited in Attachment 8, Economics Appendix of the Feasibility Report.

6. Medium/High Significance - The computed contingencies used for the Total Project Cost (TPC) estimate do not consider (1) risks due to funding and schedule uncertainties and (2) some risks involved in implementing the recommended plan.

This comment included four recommendations and none of the recommendations were adopted.

1. Develop funding schedules and associated risks considering more realistic assumption of when funds might be made available for this project.

USACE Response: Not Adopted.

The USACE did not adopt this recommendation because an assumption of when funds will become available cannot be developed at this time, based on the uncertainties related to project authorization and appropriations. The cost impacts associated with waiting for funding are mitigated through the WRDA 1986, Section 902 adjustment process, in that the project will be approved based on a Project First Cost (at a constant dollar rate), which will be adjusted for inflation as the project awaits funding.

2. Assign risk associated with the possibility of having lock or dam failure occur before construction starts.

USACE Response: Not Adopted.

The USACE did not adopt this recommendation because risks associated with the possible occurrence of lock or dam failure before construction starts are included in the contingencies. Restoring navigation following a failure of existing locks or dams, whether pre, during, or post-construction of the recommended plan, are addressed through the Corps of Engineers Operations and Maintenance appropriation and are not the focus of this study. Assuming the recommended plan is authorized, a pre-construction failure may prompt the Corps to commence construction of the recommended plan sooner and on a more rigorous schedule, requiring advanced acquisition methods, which is included in the TPC estimate.

3. Assign risk associated with the possibility of having to split each project into multiple contracts due to funding constraints.

USACE Response: Not Adopted.

Implementation schedules are based on assumptions of efficient funding, with risk being addressed through project contingencies.

4. Determine contingencies for the TPC estimate commensurate with the revised schedule and associated risks.

USACE Response: Not Adopted.

The contingencies for the TPC estimate are sufficient and do not require revision at this time. The contingencies included are in accordance with current Corps of Engineers regulations and capture all appropriate funding risks.

7. Medium/High Significance - The Reactive Maintenance Alternative (RMA) costs are incomplete and could impact the selection of the Without-Project Condition (WOPC).

This comment included three recommendations. One of the recommendations was adopted, while two were not adopted.

1. Re-evaluate the cost assessment of the RMA that considers the reasons cited in the bullets in the basis.

USACE Response: Adopted.

Action Taken: The Civil Works Review Board found merit in the IEPR comment and in May of 2015 directed Pittsburgh District and the Upper Ohio Project Delivery Team (PDT) to review their assumptions regarding preconstruction activity durations. Construction durations were not included in this reassessment (for example, the time to reconstruct the middle wall or land wall at any of these projects would remain at 24 or 30 months, respectively). The WOPC is a Fix-as-Fails or RMA policy that replaces major components as they fail. The current evaluation (2015-2016) used longer durations for the downtime following failure. The longer durations result in greater transportation losses from unscheduled closures and higher externality costs associated with higher levels of waterway traffic diverted to overland routes. The changed Without Project condition results in higher net benefits and BCRs. The entire supplemental report is included in the Economics Appendix as Attachment 9.

2. Re-evaluate possible alternative strategies for the WOPC, based on the re-evaluation of RMA costs.

USACE Response: Not Adopted.

Exploring additional strategies for major rehabilitation would not alter the Corps of Engineers presumption of the most likely future condition in the absence of a proposed water resources project at Emsworth, Dashields, and Montgomery Locks and Dams (collectively EDM). Any strategy would need to involve replacement of main chamber walls.

3. Document the approach taken and the results of the evaluation of major rehabilitation for the future WOPC consistent with Appendix E of ER 1105-2-100 in the DFR/EIS.

USACE Response: Not Adopted.

Major rehabilitation was deemed too costly to be included in the WOPC (without a Congressional Authorization). Major Rehabilitation was eliminated in With-Project evaluation due to multiple years of main chamber and river closures necessary to reconstruct in the same footprint.

8. Medium/High Significance - It is unclear why the Reactive Maintenance Alternative (RMA) was selected as the future Without-Project Condition (WOPC), even though it was more costly than the Advanced Maintenance Alternative (AMA).

This comment included two recommendations. Neither of the recommendations were adopted.

1. Evaluate the other two Major Rehabilitation options (Scheduled Maintenance and Scheduled Rehabilitation), compare them with the AMA and RMA consistent with Appendix E of ER 1105-2-100, and evaluate whether a new future WOPC is warranted.

USACE Response: Not Adopted.

Major rehabilitation was deemed too costly to be included in the WOPC (without a Congressional Authorization). Major Rehabilitation was eliminated in the With-Project evaluation due to multiple years of main chamber and river closures necessary to reconstruct in the same footprint.

2. Reassess project socioeconomic and environmental impacts of the alternative plans relative to the new future WOPC.

USACE Response: Not Adopted.

Re-assessing socioeconomic and environmental impacts for the WOPC would not change the agency position that RMA is the most likely future condition without an authorized water resource project for EDM Locks and Dams.

9. Medium/High Significance – The Value Engineering (VE) study for this project developed several revised design technique proposals and comments that are not considered but could potentially have significant impacts on project cost and selection of the recommended plan.

This comment included four recommendations. One recommendation was adopted, while three were not adopted.

1. Evaluate the applicability of the VE team's revised design techniques as a part of the feasibility phase of the study.

USACE Response: Not Adopted.

The USACE did not adopt this recommendation. USACE agrees there could be a significant effect on the total project cost by realizing opportunities associated with the VE study, but does not concur that it would have an impact on the selection of the recommended plan. The USACE evaluated the VE team recommendations and agrees that there is a potential for cost savings. Deferral of the significant additional analysis required to evaluate potential cost savings measures to a future phase of the project was approved by the Great Lakes and Ohio River Division and USACE Headquarters.

2. Re-evaluate the appropriate length of upstream guardwalls for each of the EDM Locks and Dams sites during the feasibility phase.

USACE Response: Not Adopted.

The appropriate length of the upstream guard walls will be determined in the next project phase. Re-examination of the cost and schedule risk analysis revealed that potential for a longer guardwall length contains a nominal project cost risk.

3. Conduct Phase I Hazardous, Toxic, and Radioactive Waste testing of the river sediments likely to be disturbed during the construction of the new locks and guard walls.

USACE Response: Adopted.

Action Taken: The costs for special handling of excavated materials (both on land and in river excavations/disposals) at a licensed commercial landfill are included in the total estimated project cost. Based on Corps of Engineer Pittsburgh District's experience and judgment, it is more efficient and effective to sample and analyze sediments for the presence of regulated chemicals as one of the last steps in finalizing construction plans and specifications.

4. If warranted, revise the recommended plan design details and associated estimate of cost.

USACE Response: Not Adopted.

It is not appropriate during the feasibility study to incorporate VE proposals that require significant additional analysis to determine merit. The report currently captures the 80% confidence cost associated with the recommended plan. The incorporation of any appropriate VE study measures would serve to reduce the overall project cost but would not have an impact on the recommended plan selection.

10. Medium Significance - The Planning, Engineering, and Design (PED) estimated cost of 15 percent of construction costs may be overstated since much of the plans, specifications, and modeling can be used at multiple sites.

This comment included two recommendations. One recommendation was adopted, while the other was not adopted.

1. Review other navigation projects for actual PED costs to determine PED costs for the first EDM Locks and Dams lock.

USACE Response: Adopted.

Action Taken: Review of other navigation projects for PED costs was completed during the feasibility study during the selection of the percentage.

2. Estimate the PED cost for the second and third EDM locks considering the repetition in design with the first lock site.

USACE Response: Not Adopted.

The percentage chosen is a conservative figure for this phase of the project and considering that design is not the only item captured by the PED cost account. There are several items that have to be accomplished that are site specific. The estimated percentage for the PED costs were developed after investigating other recently authorized navigation projects. One navigation project in particular, also located in the Pittsburgh District has a recent cost certification having PED costs as 15.2% of the total costs. The percentages on similar navigation projects varied widely. There is a potential for cost reduction associated with repetitive and concurrent designs, however, there are many additional activities required during the next project phases that are typically charged against the PED account that are not repetitive.

11. Medium Significance - The assumption that all authorized projects will be implemented in the future may not be realistic, which could affect the impacts of the Without-Project Condition (WOPC) and With-Project Condition (WPC) alternatives.

This comment included two recommendations. One recommendation was adopted, while the other was not adopted.

1. Expand the discussion of the future WOPC and WPC to include a description for each project in the Ohio River Basin that is currently authorized but not constructed.

USACE Response: Adopted.

Action Taken: Projects assumed to change over the period of analysis and assumptions made for modeling purposes was added to the Main Report in Section 2.6, under Constraint #3, "All authorized improvements in the Ohio River Basin are included in all analyses."

2. Assess the probability that the project will be constructed, and analyze potential impacts under the WOPC and WPC alternatives.

USACE Response: Not Adopted.

USACE did not adopt this recommendation because development of a probability of construction would be subjective and would necessitate estimation of the completion year. Construction completion is less about risk (can be defined probabilistically) and

more about uncertainty (unknown funding streams). Given that the Ohio River System projects under construction do not alter waterway shipping patterns or characteristics (origin-destinations, tow-sizes, etc.), there would be little value added to this additional sensitivity analysis.

12. Medium Significance - The Economic Appendix of the Draft Feasibility Report and Environmental Impact Statement does not explain the derivation of the “Equilibrium System Traffic” and “Equilibrium System Savings” shown for the National Economic Development (NED) plan.

This comment included a single recommendation, which was adopted.

1. Revise Appendix B to explain the relationship between the Equilibrium System Traffic and the Projected Traffic Demands.

USACE Response: Adopted.

Action Taken: Table 5-9 of Appendix B to the Economics Appendix was revised to show five-year interval forecasts.

13. Medium Significance - The Draft Feasibility Report and Environmental Impact Statement does not contain sufficiently detailed project benefits tables to allow for assessment of the relative importance of commodity flows and benefit sources.

This comment included a single recommendation, which was adopted.

1. Augment the Appendix B benefits tables and charts with more detailed breakdowns by commodity, direction, and type (i.e. transportation costs avoided from closures, water transportation surplus, and social costs).

USACE Response: Adopted.

Action Taken: Economics Appendix B tables were revised to include more detailed breakdowns by commodity, direction, and type.

14. Medium Significance - The metrics used to formulate and screen ecosystem restoration alternatives are not described, and it is unclear how these alternatives relate to the project’s planning objectives for ecosystem restoration.

This comment included three recommendations. All three recommendations were adopted.

1. Revise Section 4.7.3 to describe how the initial set of 17 alternatives was formulated based on the planning objectives.

USACE Response: Adopted.

Action Taken: Section 4.7.3 of the Draft Feasibility Study was revised to discuss elimination of restoration opportunities having no current authority or applicability to the

project area. Further, a discussion was added to explain how the set of 17 alternatives relate to the remaining opportunities and planning objectives.

2. Clarify the set of metrics applied to the alternatives and how they were uniformly applied to all alternatives.

USACE Response: Adopted.

Action Taken: The five metrics and their application described in the text that screened the 17 alternatives to a list of 9 high priority alternatives were clarified.

3. Revise Section 4.7.3 to clarify how the screening process was based on the ecosystem restoration planning objectives.

USACE Response: Adopted.

Action Taken: The text of Section 4.7.3 was revised to clarify the screening process with respect to **Objective 2. Identify and evaluate reasonable opportunities for ecosystem restoration projects in the study area, consistent with navigation planning and interests of non-federal cost-sharing partners.**

15. Medium Significance - Appropriate mitigation measures to reduce the potential impacts on environmental resources are identified, but the commitment to their implementation and over what timeframe has not been discussed.

This comment included two recommendations and all recommendations were adopted.

- 1.a. Add a section at the end of Section 5 of the Draft Feasibility Report and Environmental Impact Statement that tabulates: a) environmental commitments and deferred actions (including determining appropriate mitigation).

USACE Response: Adopted.

Action Taken: The District added introductory text to Section 5.1.4 *Environmental Features and Commitments* that describes the future environmental commitments and conditions under which deferred compliance will be anticipated. The section states that the District will review detailed design plan and specification packages and real estate acquisitions to determine whether compliance with the National Environmental Policy Act and other environmental laws and regulations is adequate or needs to be supplemented. If supplemental compliance is required to address project changes or changes in environmental conditions, the District, in accordance with current Corps policy, will implement reasonable measures to avoid impacts and will justify appropriate mitigation of non-negligible impacts through cost effectiveness/incremental cost analysis.

1.b. Add a section at the end of Section 5 of the Draft Feasibility Report and Environmental Impact Statement that tabulates: b) a timeframe for when they will be addressed.

USACE Response: Adopted.

Action Taken: The Section 5.1.4 introductory text was supplemented to include the timeframe of anticipated future compliance requirements in reference to their supporting design, contract advertisement, or real estate acquisition, as applicable. The District will need to anticipate construction contract advertisement and award schedules to provide adequate lead time to conduct compliance surveys and consultation in order to assure timely compliance in advance of advertisement. In advance of construction, the District will update Endangered Species Act (ESA) consultation and undertake any surveys (e.g., native mussel surveys) necessary to address relevant environmental compliance requirements. While the cultural resource survey required at the Montgomery primary work area should be conducted as soon as possible following real estate acquisition to allow adequate time for any necessary follow-on survey and/or data recovery work prior to construction.

1.c. Add a section at the end of Section 5 of the Draft Feasibility Report and Environmental Impact Statement that tabulates: c) conditions or limitations such as USACE policies, costs, authorities, or other constraints that could affect implementation.

USACE Response: Adopted.

Action Taken: The Section 5.1.4 introductory text was supplemented to address conditions or limitations that could affect implementation of future compliance activities.

2. Section 5 of the DFR/EIS should clearly state that studies will continue and that future decisions on environmental issues such as appropriate mitigation are pending.

USACE Response: Adopted.

Action Taken: The Section 5.1.4 introductory text was amended to state that future project changes or changes in environmental conditions will be reviewed to assure that compliance is either adequate or needs to be supplemented. If supplementation is necessary, the text states that supporting studies, impact analyses, consultation, and decisions on appropriate justified mitigation are pending.

16. Medium/Low Significance - The potential impacts of climate change on the recommended plan are not described.

This comment included three recommendations and all three recommendations were adopted.

1. Discuss the potential effects of climate change, either in the final Environmental Impact Statement or in a brief attachment to the DFR/EIS. Include the implications climate change could have on power demands, system operations, engineering, economic analyses, and ecosystems.

USACE Response: Adopted.

Action Taken: Report text was supplemented under the future Without-Project Conditions (Section 3.3.1.4) to include a summary of the federal and state guidance reports on climate change.

2. Document potential risk and vulnerabilities of the operation of the proposed navigation improvements to determine how the USACE 2013 Climate Change Adaptation Policy applies.

USACE Response: Adopted.

Action Taken: The report was modified to document guidance from USACE 2013 Climate Change Adaptation Policy Appendix B and Engineering and Construction Bulletin No. 2014-10, *Guidance for Incorporating Climate Change Impacts into Inland Hydrology in Civil Works Studies, Designs, and Projects*.

3. Include a discussion of the USACE pilot study with the Ohio River Basin Alliance to demonstrate consideration of climate change in the Ohio River Basin.

USACE Response: Adopted.

Action Taken: The report was amended to mention that the USACE is participating in a pilot study with the Ohio River Basin Alliance. However, as this study is incomplete, discussion was limited to its outcome being considered as applicable in post-authorization design activities.

17. Medium/Low Significance - The hydraulic analyses performed to support decision-making are not described in sufficient detail to determine the reasonableness of the findings.

This comment included two recommendations and both recommendations were adopted.

1. Describe in detail all aspects of the hydraulic analyses, including data sources and characteristics, assumptions, and methodologies/models used.

USACE Response: Adopted.

Action Taken: There is sufficient detail in the Engineer Technical Appendices to describe the proposed lock designs at the feasibility level. The detailed design of the recommended plan will be further refined in the next phase to include physical modeling. The hydraulic analyses were performed during the Feasibility Study are documented in the Engineering Technical Appendices specific for each site (Emsworth, Dashields and Montgomery) in the narrative within Section 7 titled *Hydraulic Design*.

2. Explain how these aspects of the analyses were applied, provide the results, and discuss the findings and conclusions in the relevant report sections.

USACE Response: Adopted.

Action Taken: The derivation of the lock designs are described in the narrative. The recommended plan will be further developed in the next phase. The hydraulic analyses were performed during the Feasibility Study are documented in the Engineering Technical Appendices specific for each site (Emsworth, Dashields and Montgomery) in the narrative within Section 7 titled *Hydraulic Design*.