APPENDIX F

Federal and State Agency And Public Comments

United States Department of Interior, Office of the Secretary, Office of Environmental Policy and Compliance

DOI Comment 1:

United States Department of the Interior

TAKE PRIDE IN AMERICA

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Denver Federal Center, Building 56, Room 1003
Post Office Box 25007 (D-108)
Denver, Colorado 80225-0007

January 20, 2006

ER 05/1057

Colonel Charles O. Smithers III
Commander, Memphis District
U.S. Army Corps of Engineers
ATTN: CEMVM-PM-E
167 North Main Street, B-202
Memphis, Tennessee 38103-1894

Dear Colonel Smithers:

The U.S. Department of the Interior (Department) has reviewed the December 2005 Draft Revised Supplemental Environmental Impact Statement 2 (DRSEIS 2) for the Mississippi River and Tributaries, St. Johns Bayou and New Madrid Floodway Project; Mississippi, New Madrid, and Scott Counties, Missouri, and offers the following comments.

The Department has provided extensive comments on previous iterations of the EIS for this project, emphasizing the need to explore options for providing flood protection while avoiding or minimizing environmental impacts. This need, as well as the need for the project plans to include adequate compensatory mitigation to offset unavoidable project impacts, remains a concern for the Department. The DSREIS 2 indicates that the primary issue examined in the document is the overall compensatory mitigation strategy that was recommended in the 2002 RSEIS and that the DSREIS 2 will not revisit the entire 2002 RSEIS.

DOI Response 1: The decision to construct the recommended flood damage reduction plan, as outlined in the 2002 RSEIS, was based on economic and environmental principles as outlined by the Principles and Guidelines adopted by the Water Resources Council. The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other planning requirements. The 2002 RSEIS analyzed a series of alternative plans in a systematic manner that ensured all reasonable alternatives were evaluated.

There are alternatives with fewer environmental impacts. However, those alternatives also produce fewer flood damage reduction benefits. The recommended plan produces maximum flood damage reduction benefits while still fully mitigating all unavoidable environmental impacts. This meets the Federal Objective for water and related land resources project planning.

The Corps acknowledges that there are alternatives that alleviate flood damages in the project area with less of an environmental impact. While other alternatives may minimize or lessen impacts, they do not produce maximum benefits. These other alternatives do not yield greater net economic benefits than the recommended plan. The recommended plan is the NED plan. The recommended plan both maximizes benefits and fully compensates, and in many cases over compensates, for all unavoidable impacts to fish and wildlife resources. However, the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies (established pursuant to the Water Resources Planning Act of 1965, PL 89-80, as amended [42 U.S.C 1962a-2 and d-1]) specifically states that the plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment. This RSEIS 2 clarifies the compensatory mitigation and updates the economic analysis accordingly. The recommended flood damage reduction plan, as outlined in the 2002 RSEIS, and the compensatory mitigation, as clarified in this RSEIS 2, is the NED Plan

DOI Comment 2:

Our U.S. Fish and Wildlife Service (USFWS), Missouri Ecological Services Field Office, has been actively involved throughout the planning process. The USFWS has provided a number of planning aid letters and reports to the U.S. Army Corps of Engineers in accordance with the USFWS's responsibilities under the Fish and Wildlife Coordination Act (FWCA) and its agency expertise on fish and wildlife issues as identified in the CEQ NEPA Regulations, as well as in its role as a cooperating agency for the EIS.

The USFWS's most recent planning aid letter, dated August 11, 2005, is included in Appendix B of the DRSEIS 2. The Corps' responses to the USFWS's position on key aspects of the project, as expressed in the planning aid letter, are provided on pages 140 to 146 of the DRSEIS 2.

Colonel Charles O. Smithers III 2

These responses, as well as other information provided in the DRSEIS 2, indicate that the Corps will work with the interagency mitigation team during the development of site-specific detailed mitigation plans. Aspects of these plans include the development of fish-passage best management practices, fish access to specific tracts of land in the project area, and monitoring of fish passage and usage of mitigated areas. The USFWS, as a member of the interagency mitigation team (which also includes the Missouri Department of Natural Resources and the Missouri Department of Conservation) and in its obligations under the FWCA and as a cooperating agency, will continue to coordinate with the team and the Corps to address mitigation needs for this project.

DOI Response 2: Comment noted. Of particular interest, the Corps would like to coordinate the planning, design, and construction of the proposed culverts that would be required through the Mississippi Mainline Levee to restore hydrology to Big Oak Tree State Park with personnel from the USFWS' National Fish Passage Program. The National Fish Passage Program routinely modifies existing culverts to benefit fish passage. There is a unique partnering opportunity to restore the hydrology to Big Oak Tree State Park, provide significant benefits to fish habitat, and maintain the integrity of the Mississippi Mainline Levee System that protects thousands of acres from flooding.

DOI Comment 3:

Please continue to coordinate with the USFWS with respect to mitigation needs and other aspects of the project related to fish and wildlife resources. The primary contact for coordination continues to be Mr. Charles Scott, Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services Field Office, 101 Park DeVille Drive, Suite A, Columbia, Missouri 65203-0057, phone: (573) 234-2132.

Sincerely,

Robert F. Stewart
Regional Environmental Officer

DOI Response 3: Comment noted. Continued coordination with the USFWS will be maintained throughout all aspects of compensatory mitigation and ecological monitoring.

United States Environmental Protection Agency, Region VII
EPA Comment 1:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

2 8 JAN 2008

Commander
U.S. Army Engineer District, Memphis
ATTN: CEMVM-PM-E
167 North Main Street, B-202
Memphis, TN 38103-1894

Dear Colonel Smithers:

The Environmental Protection Agency (EPA) has reviewed the St. Johns Bayou and New Madrid Floodway Project Draft Revised Supplemental Environmental Impact Statement 2 (RSEIS 2). Our review is provided under the National Environmental Policy Act (NEPA), Council on Environmental Quality regulations (40 CFR Parts 1500-1508), Section 309 of the Clean Air Act, and Section 404 of the Clean Water Act (CWA). As noted in the draft RSEIS 2, this document supplements the June 2002 Final Revised Supplemental Environmental Impact Statement, and is focused on clarifying how the Corps intends to compensate for impacts to fish and wildlife resources from the construction of the St. Johns Bayou-New Madrid Floodway Project.

Given this proposed project's large geographic scale, EPA understands the importance of careful assessment of potential mitigation efforts for their suitability in offsetting project impacts. We agree that mitigation measures will need to be evaluated on the extent to which habitat functions are replaced, and not solely on the number of acres enhanced or restored. To assist in clarifying how mitigation provisions under the U.S. Army Corps of Engineers' regulations are to be met, EPA recommends that the Final RSEIS 2 should:

1. Provide additional information to address uncertainties regarding proposed mitigation measures (e.g., location and acreage to be acquired), and expected benefits of mitigation measures in Table 2-2, and;

2. Provide additional information regarding contingencies for fisheries impacts should the proposed fish passage measures not perform as anticipated.

EPA Response 1: The Corps concurs with the statement that mitigation measures will need to be evaluated on the extent to which habitat functions are replaced, and not solely on the number of acres enhanced or restored.

1. Precise mitigation locations are not known at this time for the majority of mitigation measures.

   The overall acreage of compensatory mitigation is also not known at this time because mitigation is based on replaced habitat functions. Conservative estimates regarding gains in habitat functions have been

made throughout this RSEIS 2. Table 2.8 of the RSEIS 2 provides real estate requirements for four conceptual mitigation scenarios. RSEIS 2 Figure 3 illustrates the potential locations for some of the additional mitigation measures.

Additional information has been added to Table 2.2 in the RSEIS 2 to clarify the uncertainties over the proposed mitigation measures. The term "to be determined" (TBD) has been replaced with a range of values. The ranges of values represent potential gains from implementing compensatory mitigation measures. These ranges reflect the uncertainties of various mitigation measures. It is important to note that the minimum value has been used to calculate overall mitigation benefits for the purpose of this RSEIS 2. This is an extremely conservative approach. Habitat gains would be calculated during the development of site-specific mitigation plans. Additionally, sites will be modified to ensure that mitigation is successful and that gains in habitat were accurately calculated. Modifications will be made to overall mitigation accordingly. It is highly likely that site-specific tracts will yield greater gains in habitat than the conservative values that have been used in this RSEIS 2 to demonstrate that, even with increased compensatory mitigation, the overall project is still economically justified.

(a) Moist Soil Units

There are several uncertainties from construction of modified moist soil units. The first is the gain in wetland functions by the construction of moist soil units. The following paragraph has been inserted to Section 5.2.2.2 and changes have been incorporated in Table 2.2 and Table 2.7:

> Modifications would be made to the basic moist soil unit design. Moist soil units will be located adjacent to existing channels and within the two-year floodplain. A portion of the perimeter levee will be degraded to allow for surface water connectivity during out of bank events. These modifications would allow for benefits to mid-season fish rearing habitat. These modifications would likely provide additional gains to wetland functional capacity. The Arkansas Regional Guidebook (Klimas et *al*., 2004) limits wetland functional gains to reforestation techniques and does not include functional gains from the construction of moist soil units. Logic suggests that allowing surface water connectivity would result in gains at least equal to that of a farmed wetland and likely more. However, HGM cannot quantify the additional gains due to limitations of the

model. The FCU gains in Table 5.2 represent those of a farmed wetland.

An additional uncertainty over modified moist soil units is the expected benefits to mid-season fish rearing habitat. The potential benefits to mid-season fish rearing habitat are discussed in Section 5.4.2.2. Table 2.2 and Table 2.7 have been changed to reflect the uncertainty.

(b) Big Oak Tree State Park Hydrologic Restoration

There will likely be a significant gain in several wetland functions by restoring the hydrology to Big Oak Tree State Park. However, quantification of these gains would require additional study to designate the historic conditions as the baseline, existing conditions as the degraded environment, and future conditions as the restored environment. This cannot be conducted at this time because the specific design of the water delivery system has not been finalized. Therefore, TBD will remain.

Section 5.4.2.5 provides a discussion of the potential benefits to mid-season fish rearing habitat from the restoration of hydrology to Big Oak Tree State Park. Providing Mississippi River surface water to the park has the potential to result in a gain of 442 mid-season fish rearing AAHUs. Changes have been made to Table 2.2 and Table 2.7.

(c) Big Oak Tree State Park Perimeter Land Acquisition

Section 5.4.2.6 provides a discussion of the potential benefit to mid-season fish rearing habitat by acquiring and reforesting 1,800 acres of cropland surrounding the park. If fish have access to the park, the surrounding 1,800 acres of land could provide 504 mid-season fish rearing AAHUs. Changes have been made to Table 2.2 and Table 2.7.

2. Section 2.9 titled Mitigation Contingencies has been added to the Final RSEIS 2. The Corps reiterates that it is highly likely that fish will pass through the New Madrid Floodway box culverts, as designed. No modifications are recommended. Additionally, conservative estimates (little or no habitat value for mid-season fish rearing benefits were taken) have been made throughout this RSEIS 2 concerning benefits to fish usage (*i.e.,* Big Oak Tree State Park Hydrologic Restoration, Big Oak Tree State Park perimeter land acquisition, modified moist soil units). However, the Corps will monitor fish passage and usage of

mitigation sites. Please refer to Section 2.9 on a discussion of mitigation contingencies.

EPA Comment 2:

EPA would like to offer assistance in mitigation planning efforts as part of the proposed interagency mitigation team to address the issues identified above and subsequent development of site specific mitigation plans. Please contact Mr. Thomas Taylor, (913) 551-7226, to discuss EPA's representation.

Thank you for the opportunity to review this RDRIS 2. In accordance with our national rating system, a description of which is attached, we have rated this draft RSEIS 2 as "EC-2; environmental concerns – insufficient information". If you have any questions, please contact Mr. Joe Cothern, NEPA Team Leader, at (913) 551-7148.

Sincerely,

U. Gale Hutton
Director
Environmental Services Division

Enclosure

cc: Dru Buntin, MDNR

EPA Response 2: Comment noted. The Corps acknowledges and appreciates EPA's offer of assistance in mitigation planning. All aspects of compensatory mitigation, including planning, constructing, and monitoring, will be coordinated with EPA Region VII.

Missouri Department of Natural Resources

MDNR Comment 1:

Matt Blunt, Governor • Doyle Childers, Director

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

January 24, 2006

Mr. Daniel Ward
U.S. Army Corps of Engineers, Memphis District
Attn: Environmental Branch
167 N. Main Street, B-202
Memphis, TN 38103-1894

Dear Mr. Ward:

I am writing to offer the Missouri Department of Natural Resources' (department) comments on the Revised Supplemental Environmental Impact Statement 2 (RSEIS 2) for the St. Johns Bayou/New Madrid Floodway project.

The St. Johns Bayou/New Madrid Floodway is a flood control project along the Mississippi River near East Prairie in New Madrid County. The overall purpose of the project is to protect the region from backwater flooding from the Mississippi River and to reduce headwater flooding in the vicinity of East Prairie. On June 9, 2003 the department issued a Section 401 water quality certification (401 certification) for the project. The 401 certification agreed to by the Memphis District of the Corps of Engineers called for the purchase of 8,375 acres of mitigation lands, with 1,800 of those acres to be purchased around Big Oak Tree State Park. The Corps also agreed to design and construct a project to protect the hydrology of the mesic bottomland forest and swamp within the park.

The Missouri Coalition for the Environment and the national group, Environmental Defense, subsequently appealed the department's decision to issue the 401 certification to the Missouri Clean Water Commission. The Clean Water Commission then assigned the appeal to the Administrative Hearing Commission (AHC). On July 13, 2005, the Coalition for the Environment, Environmental Defense, the State of Missouri and the Corps filed a joint motion for dismissal of the appeal of the department's 401 certification. The environmental groups also filed suit in federal court challenging the project. That suit is currently pending. As a result of the suit in federal court, the Department of Justice encouraged the Corps to rescind the Record of Decision on the project and prepare this RSEIS 2 on which the comments that follow are based.

MDNR Response 1: Comment noted.

MDNR Comment 2:

Daniel Ward
January 24, 2006
Page 2

We are pleased that the Corps has now conducted a Hydrogeomorphic (HGM) analysis to quantify direct impacts to jurisdictional wetlands and indirect impacts to farmed wetlands. The HGM analysis provides a clearer description of the wetland impacts and gives the department a greater degree of confidence that the Corps' proposed mitigation will fully offset these impacts. In our review of the RSEIS 2, our primary focus was to insure that the proposed mitigation scenarios would comply with the previously issued 401 certification and the associated settlement agreement. Upon completing our review, it appears that all of the mitigation scenarios comply with spirit of the 401 certification and settlement agreement. We will, however, need to meet with the Corps in order to consider whether or not some of the references in the 401 certification need to be updated so that they reflect the latest National Environmental Policy Act document.

MDNR Response 2: Comment noted.

MDNR Comment 3:

We look forward to working with the Corps of Engineers in the creation of the monitoring plans required by the 401 certification and settlement agreement in coordination with the other resource agencies as quickly as possible. The early creation of those plans will allow proper documentation of impacts and reduce the possibility of conflict later in the project development.

MDNR Response 3: The Corps concurs. Monitoring plans will be developed as quickly as possible in coordination with the interagency mitigation team.

MDNR Comment 4:

We believe that this project will improve the hydrology of Big Oak Tree State Park and will financially benefit the citizens of this region. Attached for your consideration are the department's detailed comments on the RSEIS 2. We appreciate the Memphis District providing the Department of Natural Resources the opportunity to comment on this document. Please contact Dru Buntin in my office at (573) 751-3195 to arrange a meeting with representatives of the department and the Missouri Attorney General's Office to discuss whether or not we need to update the 401 certification.

Thank you.

Sincerely,

DEPARTMENT OF NATURAL RESOURCES

Doyle Childers
Director

DC:db

Attachment

MDNR Response 4: The Corps concurs.

<u>MDNR General Comments</u>

MDNR General Comment 1: We are pleased that the Corps has now conducted a Hydrogeomorphic (HGM) analysis to quantify direct impacts to jurisdictional wetlands and indirect impacts to farmed wetlands. The HGM analysis provides a clearer description of the wetland impacts and gives the department a greater degree of confidence that the Corps' proposed mitigation will fully offset these impacts. In our review of the RSEIS 2, our primary focus was to insure that the proposed mitigation scenarios would comply with the previously issued 401 certification and the associated settlement agreement. Upon completing our review, it appears that all of the mitigation scenarios comply with spirit of the 401 certification and settlement agreement. We will, however, need to meet with the Corps in order to update some of the references in the 401 certification so that they reflect the latest National Environmental Policy Act document.

MDNR General Response 1: Comment noted.

MDNR General Comment 2: We look forward to working with the Corps of Engineers in the creation of the monitoring plans required by the 401 certification and settlement agreement in coordination with the other resource agencies as quickly as possible. The early creation of those plans will allow proper documentation of impacts and reduce the possibility of conflict later in the project development.

MDNR General Response 2: Comment noted. The Memphis District will consult with the interagency mitigation team in the development of the monitoring plans.

MDNR General Comment 3: Big Oak Tree State Park

In the 401 certification and the settlement agreement, the department and the Corps of Engineers agreed that acquisition of mitigation lands immediately surrounding Big Oak Tree State Park would be a priority focus. While we understand that the Corps is currently prohibited from acquiring additional mitigation lands, the department requests that the Corps aggressively pursue acquisition from willing sellers of the 1,800 acres of land immediately surrounding the state park as soon as the Record of Decision is signed for the project.

MDNR General Response 3: Two tracts of farmland totaling 105 acres have been acquired on the northeast boundary of the park. These areas will currently remain in agricultural production in order to control undesirable vegetation. The Corps will begin negotiating for additional land surrounding the park once the ROD has been signed. The Corps will work closely with the Big Oak Tree State Park staff, as well as the interagency team, in the development of the site-specific monitoring plans surrounding the park.

MDNR General Comment 4: Page 16 fourth paragraph
We are pleased that the Corps has now conducted a Hydrogeomorphic (HGM) analysis of the wetland impacts. The use of a standardized tool to assess the wetland impacts adds credibility to the analysis and provides greater confidence in the mitigation determination. By subjecting their own project to an analysis similar to that conducts on other projects, the Corps also addresses equity issues on wetland mitigation.

MDNR General Response 4: Comment noted.

MDNR General Comment 5: Page 17 first paragraph
We encourage the Corps to begin discussions promptly on the monitoring plan for those forested wetlands that are part of their mitigation strategy upon the signing of the Record of Decision. By defining the monitoring plan in advance of mitigation, the Corps can help ensure that all parties are in full agreement on the expectation of the mitigation and avoid later conflicts.

MDNR General Response 5: Concur. The Corps will coordinate the development of the monitoring plan with the interagency team. As part of the WQ certification, the monitoring plan will be reviewed by the interagency mitigation team and submitted to your office prior to construction.

MDNR General Comment 6: Page 21 first paragraph
Again, we encourage the Corps to work with us, and the other resource agencies as appropriate, to develop the monitoring plan required by the 401 certification and settlement agreement as soon as possible. An early agreement on the monitoring protocols will promote easier implementation.

MDNR General Response 6: Concur.

MDNR General Comment 7: Page 35 fifth paragraph
In this section, the Corps discusses coordinating with the department on the design process for the proposed water delivery system at Big Oak Tree State Park. The water delivery system is only one component of the entire hydrologic restoration project at the park. We suggest that the Corps incorporate language into the RSEIS2 that expounds upon the department's coordination role in the entire project, rather than just the design process for the water deliver system.

MDNR General Response: All references to Big Oak Tree State Park water supply feature have been changed to. The Corps will coordinate all aspects of the Big Oak Tree State Park Hydrologic Restoration with your department, as well as the entire interagency mitigation team. The following paragraph has been inserted in the abstract section of the RSEIS 2:

> All aspects of the overall project including flood damage reduction, compensatory mitigation, and project monitoring will be coordinated with

the interagency mitigation team. The interagency mitigation team will be made up of members from the U.S. Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), Missouri Department of Natural Resources (MDNR), the Missouri Department of Conservation (MDC), the Corps of Engineers, and the St. Johns Levee and Drainage District. The interagency mitigation team will play a significant role in the acquisition and development of compensatory mitigation lands; the plan, design, and construction of the Big Oak Tree State Park hydrologic restoration; and the development and implementation of project monitoring plans.

MDNR General Comment 8: Page 39 third paragraph

If a flood duration of 5% yields 1.33 AAHU's, shouldn't a 31% flood duration yield 8.25 AAHU's?

MDNR General Response 8: No, the hypothetical mitigation tract that is used in the example in Section 2.6.2.2 would yield 17.89 AAHUs. A linear relationship cannot be used to determine compensatory mitigation because mitigation is calculated by habitat value (habitat suitability) and duration of flooding. Like habitat suitability, duration needs to be annualized over the project life (50 years). Flood duration needs to be considered without mitigation (area remains farmland) and with mitigation. Compensatory mitigation credit is calculated by subtracting the existing conditions (utilizing post-project conditions) from the mitigated conditions. Compensatory mitigation efforts that increase habitat and increase durations yield higher AAHUs.

MDNR General Comment 9: Pages 46 and 47

We encourage the Corps to retain flexibility in implementing the various scenarios to meet its obligations. This flexibility can provide the Corps with the ability to avoid properties where land owners do not wish to cooperate while providing a wider range of options for meeting the mitigation goals should monitoring show that additional needs exist.

MDNR General Response 9: Concur. Any mitigation plan adopted by a future Record of Decision must allow for flexibility. Flexibility needs to be retained throughout the mitigation process to ensure that compensatory mitigation measures are successful. Flexibility also allows for contingencies and adaptive management in the event that some mitigation measures are not producing the desired outputs.

MDNR General Comment 10: Page 64 paragraph 2

We agree on the importance of monitoring jurisdictional wetlands and encourage the Corps to begin this monitoring before project construction in order to assure that these lands are properly documented before any action that may threaten their status.

MDNR General Response 10: Concur. The monitoring plan will include pre-construction conditions.

MDNR General Comment 11: Page 74 paragraph 4

The Corps should conduct early and multi-seasonal monitoring of dissolved oxygen in the borrow pits created during the project construction. Past land use poses the risk of high primary productivity in these pits and the risk of hypoxia or anoxia. Such low oxygen conditions would significantly reduce the value of these water bodies as fisheries. The Corps should prepare options for fisheries mitigation in the event that low oxygen does restrict the use of these water bodies by fish.

MDNR General Response 11: Concur. Water quality parameters will be monitored monthly in the borrow pits. The following sentence has been added to Section 6.5:

> Water quality parameters would be measured monthly in permanent waterbodies, including borrow pits. Measured parameters would include temperature, dissolved oxygen concentration, turbidity, pH, conductivity, total suspended solids, and nutrients (nitrogen and phosphorus).

Additionally, Table 6.1 has been edited to reflect the change. Fish usage will also be monitored. Detailed monitoring will be addressed in the formulation of each site-specific detailed mitigation plan.

As presented in Section 5.4.2.7, borrow pits will be constructed to maximize floodplain fish usage. It is highly likely that borrow pits will provide significant floodplain fish habitat. Overall mitigation needs may be adjusted in the event that borrow pits are not producing desired outputs. Section 2.9 has been added to the RSEIS 2 that describes mitigation contingencies to meet mitigation goals.

MDNR General Comment 12: Page 131 paragraph 5

The last sentence in paragraph 5 is awkward and its meaning may be misconstrued. The department suggests a change in wording to, "Neither the New Madrid portion of the project nor the St. Johns Bayou portion of the project shall be operated until all mitigation lands for that respective portion of the project are acquired and all detailed mitigation plans approved."

MDNR General Response 12: Concur. The change has been made. The Corps wants to reiterate that it intends to construct the project concurrently with acquiring and implementing compensatory mitigation.

Missouri Department of Natural Resources State Historic Preservation Office

SHPO Comment 1:

STATE OF MISSOURI

Matt Blunt, Governor • Doyle Childers, Director

DEPARTMENT OF NATURAL RESOURCES

www.dnr.mo.gov

December 29, 2005

Commander
Memphis District Corps of Engineers
ATTN: CEMVM-PM-E
167 North Main, B-202
Memphis, Tennessee 38103-1894

Re: DRSEIS 2, Flood Control, Mississippi River & Tributaries, St. Johns Bayou & New Madrid Floodway (COE) New Madrid County, Missouri

Dear Sir or Madam:

Thank you for submitting information on the above referenced project for our review pursuant to Section 106 of the National Historic Preservation Act (P.L. 89-665, as amended) and the Advisory Council on Historic Preservation's regulation 36 CFR Part 800, which requires identification and evaluation of cultural resources.

We have reviewed the December 2005 report entitled *Revised Supplemental Environmental Impact Statement 2, St. Johns Bayou and New Madrid Floodway Project, Missouri.* Based on this review we have no additional comments at this time, as cultural resources surveys are to be conducted as project activities are scheduled.

SHPO Response 1: Comment noted. As project elements move through final design, construction, and operation, the Memphis District will complete compliance with the National Historic Preservation Act and related laws as project elements are fully designed, constructed, and operated. This will include continuing coordination with your office, Federally recognized tribes, and other parties; and inventory of historic properties, consideration of effects, and protection or other mitigative treatments of pertinent historic properties.

SHPO Comment 2:

Please be advised that, should project plans change, information documenting the revisions should be submitted to this office for further review. In the event that cultural materials are encountered during project activities, all construction should be halted, and this office notified as soon as possible in order to determine the appropriate course of action.

If you have any questions, please write Judith Deel at State Historic Preservation Office, P.O. Box 176, Jefferson City, Missouri 65102 or call 573/751-7862. Please be sure to include the SHPO Log Number (028-NM-05) on all future correspondence or inquiries relating to this project.

Sincerely,

STATE HISTORIC PRESERVATION OFFICE

Mark A. Miles
Director and Deputy State
Historic Preservation Officer

MAM:jd

c Jim McNeil, COE/M

SHPO Response 2: Comment noted.

Environmental Defense Comment 1

COMMENTS OF ENVIRONMENTAL DEFENSE,
THE NATIONAL WILDLIFE FEDERATION,
THE MISSOURI COALITION FOR THE ENVIRONMENT
REGARDING THE DECEMBER 9, 2005 DRAFT REVISED SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEEMENT FOR THE ST. JOHNS
BAYOU/NEW MADRID FLOODWAY PROJECT

January 30, 2006

The December 9, 2005 draft Revised Supplemental Environmental Impact Statement for the St. Johns Bayou/New Madrid Floodway project for the first time acknowledges that the value of reforested acres for mid-season fish rearing habitat, according to the model used for this project, depends on how often it is flooded. Acres the U.S. Army Corps of Engineers has identified as potential reforestation mitigation sites flood only a modest portion of the mid-season. As a result, the Corps previous commitment to reforest with 8,375 average daily flooded acres during the mid-season would require that the Corps purchase and reforest 124,000 comparably flooded acres, which would more than triple the costs of the project. What the Corps has previously characterized as a "minor" error involving the "transposition of units" therefore turns out to be a dramatic error.

Environmental Defense Response 1: See Bohlen Response 2. Conservative estimates have been made for flood durations of the mitigation sites. Actual flood durations of mitigation lands are anticipated to be somewhat higher than what was estimated for planning purposes in this RSEIS 2. As stated throughout the RSEIS 2, the Corps intends to mitigate for significant unavoidable impacts to habitat. The final number of mitigation acres will be determined through the application of techniques specified in the RSEIS 2 (Sections 2 and 5). Additionally, mitigation will include a variety of techniques, in addition to reforestation. Some of these techniques are more cost effective at producing habitat than reforestation. Therefore, it is incorrect to state that the Corps would be required to purchase and reforest 124,000 acres and the project costs would triple. Cost estimates of the additional techniques are provided in RSEIS 2 Appendix D. Your comment concerning the transposition of units is noted. However, the 2002 RSEIS calculated impacts based upon Habitat Units (HUs). This RSEIS 2 clarifies the transposition of units issue and calculates benefits from compensatory mitigation features using HUs, the same methodology by which impacts were quantified (RSEIS 2 Section 4.3.1.4).

Environmental Defense Comment 2:

In analyzing whether to proceed with a project, the Corps of Engineers is not supposed to be an advocate but to serve as an honest broker. In other words, it is supposed to determine appropriate mitigation, and if the costs of that mitigation result in an uneconomical project, it is supposed to reject it. This is particularly true because the economic test for a Corps of Engineers project is so minor, requiring only one penny of net benefit for every dollar of taxpayer cost. In 2000, an investigation by the Inspector General of the Army resulting from disclosures of wrongdoing on the Upper Mississippi

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River found that the Corps had improperly confused its mission and failed that obligation to serve as an honest broker and not an advocate. The analysis in the RSEIS2 indicates that the Corps is continuing to confuse this mission.

Environmental Defense Response 2: The Corps has determined the appropriate mitigation for unavoidable impacts from this project with extensive involvement by state and other Federal resource agencies and considering public comments previously received. Recommendations of these agencies have played heavily in the choice of methodologies used and the identification of critical values that drove the assessment of mitigation needs. It is the Corps' responsibility to consider not only the economic, social, and environmental needs of the project area, but also the most efficient and cost-effective means of meeting those needs. See Bohlen Responses 4. The Corps has recognized the environmental significance of the project area. This recognition is demonstrated by the Corps' commitment in previous NEPA documents, as well as this RSEIS 2 to mitigate for significant unavoidable impacts from project implementation. The Corps has diligently examined mitigation techniques, provided scenarios of different combinations of these techniques, and finds that the project is economically justified (RSEIS 2 Table 2.9).

Civil Works projects endure rigorous economic investigations and analyses that are governed by numerous regulations and guidelines (*e.g.*, Water Resources Development Acts, Engineering Regulation 1105-2-100, Budget Engineering Circulars). They are also subject to many phases of internal and public reviews and comments. The processes used by the Corps result in recommendation of projects that are sound economic investments and beneficial to the Nation's economy. These investments are required to return much more than "one penny" of benefit as stated in the comment. A project with a unity (1.0) benefit-to-cost ratio, by definition has an internal rate of return equal to the interest rate used in the analysis. The economic study analyzed all alternatives using the current interest rate of 5.125% (RSEIS 2 Tables 5.13-5.16). A unity benefit-to-cost ratio yields a return of 5.125% to the public. Since all alternatives had a benefit-to-cost ratio greater than unity, their returns were greater than 5.125%.

Environmental Defense Comment 3:

The new RSEIS2 finds that reforestation will generate only 2% of the mid-season fish rearing habitat required in the New Madrid Floodway and 17% in the St. Johns Bayou basin. But under the benefit cost analyses, these costs alone are almost sufficient to render the project not economic, even under favorable discount rate assumptions. The Corps has therefore endeavored to find alternative mitigation that is extraordinarily cheap.

Environmental Defense Response 3: As seen in RSEIS 2 Table 2.7, using reforestation as the only mitigation technique does not compensate for all of the impacts to mid-season fish rearing habitat. It is important to reiterate that precise gains in habitat from mitigation measures will be developed during the development of site-specific detailed mitigation plans. Table 2.7 provides several conceptual options that demonstrate that impacts to all significant resource categories are compensated. RSEIS 2 Table 2.9 demonstrates that these conceptual scenarios are economically feasible.

The RSEIS 2 analyzes techniques and methodologies to provide the required compensatory mitigation with approaches that in some cases are very efficient from a cost per mitigation value perspective (RSEIS 2 Table 5.12). In other cases, appropriate mitigation credit or the potential credit range has been added for project features. No mitigation credit had previously been taken for these features for example, in the case of borrow pits (See RSEIS 2 Section 2.6.1 and Table 2.2).

All alternatives presented are analyzed using the current interest rate of 5.125% (See RSEIS 2 Section 4.4.2 and Tables 5.13-5.16). Individual features of the alternatives were formulated or sized using their authorized interest rates. These rates are 2.5% for the Mississippi River Levee (MRL) portion and 7.375% for the remainder. When the individual pieces of the proposed alternatives were combined at the current interest rate, the benefit-to-cost ratio was above 1.0. There is nothing "favorable" or inappropriate about using the currently prescribed Federal interest rate. Regarding the comment about the mitigation alternatives being "extraordinarily cheap," the Corps always strives to find solutions that maximize benefits while minimizing costs, whether the need is for flood damage reduction or for compensatory mitigation. See Responses to Bohlen Comments 4 and 6.

Environmental Defense Comment 4:

The primary alternative mitigation it identifies involves artificial water level manipulation during the mid-season on existing wetlands – extending the average period of flooding in the sump areas for the New Madrid or St. Johns basins by 10% to 50% depending on the scenario. This approach is supposed to provide 98% of the New Madrid floodway mid-season fish rearing habitat for an extremely cheap price. This claim, however, is not scientifically supported. Indeed, the artificial manipulation of water levels on existing wetlands, which among other effects is expected to kill the existing trees in the area, is environmentally adverse in its own right.

Environmental Defense Response 4:

See Zedler Responses 5, 8, 10, and 14 and Sparks Responses 4 and 21. Creation of a spawning and rearing pool in the sump area of St. Johns Bayou or the New Madrid Floodway will provide significant mid-season fish rearing habitat. The statement "this claim is not scientifically supported" is unfounded. The Corps' approach is supported by sound science as detailed throughout the RSEIS 2 and in these and other comment responses.

A substantial portion of the increased value to the resource is derived from a change in the applicable habitat suitability index due to the mitigation technique employed. Under existing conditions the Mississippi River elevation drops leaving much of the Floodway dry during the mid-season fish spawning/rearing period. This drop in river elevation results in the desiccation of eggs and larvae that could result in year class failures. Mid-season fish will be allowed to enter the Floodway through the open box culverts located on Mud Ditch. The gates will be closed when the river reaches a certain elevation (*i.e.,* 284.4 foot NGVD) to decrease flood damages. The gates will be managed to create a spawning and rearing pool in the sump area. This spawning and rearing pool will provide adequate habitat throughout the entire mid-season rearing period (See Sparks Responses Comment 4-6).

Manipulating water levels has been recognized for years as an effective technique to increase fish reproductive success in reservoirs (Ploskey, *et al.*, 1984; Miranda, *et al.,* 1984), and this concept has been successfully applied to wetlands as well (Hoover and Killgore, 1998; Hoover, *et al.*, 2000). Benefits to mid-season fish rearing as shown in RSEIS 2 Tables 5.5, 5.6, and 5.7 were generated in the exact same manner as impacts were quantified. Additionally, gains in habitat were generated by subtracting post project conditions from mitigated conditions (the acres of habitat provided by nature were not credited towards mitigation).

As seen in RSEIS 2 Table 3.3, there are a total of 1,727 acres of land within the 284.0-foot NGVD contour. This area is 59% cropland (1,018 acres), 19% bottomland hardwoods (328 acres), and 6% fallow (98 acres). The remaining 16% consists of large

and small permanent waterbodies. There are approximately 800 acres of Wetlands Reserve Program (WRP) lands within the 284.0-foot NGVD contour. Flooding this entire area for 45 days during the mid-season is not likely to impact the existing vegetation. The bottomland hardwoods consist primarily of black willow. Black willow is an extremely flood tolerant species that is capable of withstanding the increased inundation (See Response to Sparks Comment 22).

Additionally, the NRCS stated that they did not plant the WRP sites in bottomland hardwoods. They allowed natural re-generation. A site visit conducted on February 2, 2006 revealed that areas that had re-vegetated naturally were predominantly black willows. A site visit report is included as Attachment 1 to Appendix F of the RSEIS 2 (See Response to Sparks Comment 22). In addition to the black willows, the majority of the WRP land appeared to have been seeded with grains. As stated in RSEIS 2 Section 5.2.3.5 compensatory mitigation will include acquiring the land and planting appropriate vegetation that can tolerate the expected flooding regime. In fact, removing agricultural products, creating microtopography, and planting appropriate vegetation to these areas will result in improvements to wetland habitat, resulting in an increase in the habitat value provided (See Responses to Zedler Comments 4, 5, 7, 8, and 11 and Dugger Comment 2).

Environmental Defense Comment 5:

The draft RSEIS2 supplements but does not replace the 2002 RSEIS and focuses on an alternative mitigation plan. It therefore continues to rely on the underlying environmental analysis set forth in the 2002 documents and earlier drafts and on the economic methodology set forth and used in the draft, updated to reflect changes in prices and the different mitigation options set forth in the RSEIS2.

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Environmental Defense Comment 5 (continued):

Environmental Defense, National Wildlife Federation and the Missouri Coalition for the Environment ("Conservation Organizations") now submit these comments. Conservation organizations have previously submitted extensive materials to the Corps challenging many of the key aspects of the analyses incorporated into the 2002 RSEIS and except as explicitly noted in these comments or incorporated additional expert reports, reaffirm those comments. These comments therefore incorporate, except as explicitly noted, the views expressed in comments submitted by the organizations for the 1999 DSEIS, the 2000 FSEIS, the 2001 draft RSEIS, and the 2002 RSEIS, associated expert reports and materials, the briefs submitted and the testimony of expert witnesses provided in the Missouri Clean Water Commission proceedings for the water quality certification related to this project along with associated exhibits (transcripts of whose testimony is in the possession of the Corps),[1] as well as the briefs and supplementary materials submitted to the U.S. District Court for the District of Columbia.[2] While the RSEIS2 in some places re-summarizes Corps positions regarding issues previously in dispute, these issues are addressed by our earlier comments and arguments, and nothing new changes our positions, which we reaffirm. Conservation organizations' new comments are therefore focused on the different mitigation proposals presented in the RSEIS2. The new comments include and

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[1] This testimony, setting forth the environmental and economic inadequacies of the project is fully applicable to the questions regarding the compliance of this project with the Section 404(b)(1) guidelines and the accuracy of the NEPA documentation.

[2] We also incorporate comments submitted by Environmental Defense and Missouri Coalition for the Environment on the scope of the proposed RSEIS2, which urged a reanalysis of project alternatives, which is necessary, among other reasons, because of changes in USDA conservation programs previously raised and because of the changes to the Corps' understanding of its mitigation calculations and other changes to its economic analysis.

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Environmental Defense Comment 5 (continued):

incorporate the views expressed in the expert reports attached to these comments by Dr. Joy Zedler, Dr. Christopher Woltemade, Dr. Richard Sparks, Dr. Curtis Bohlen, Dr. Bruce Dugger, and SCI Engineering. These comments assume that the earlier documents described above are also incorporated into the record and are in the possession of the Corps but counsel for Environmental Defense Tim Searchinger would be happy to provide copies of any such documents.

Environmental Defense Response 5: Comment noted. See Responses to specific commenters. Unless clarified by this RSEIS 2, nothing changes the Corps' previous responses and testimony to your previous comments and testimony. This RSEIS 2 incorporates all previous comments and responses by reference. The Corps has responded to the attached comments provided.

The Corps does not consider SCI Engineering, Inc.'s comments to be expert testimony. In fact SCI, Engineering states, "[o]ur findings are based on our general overview of available materials, and are not intended to serve as formal or professionally certified opinion." Therefore, it is incorrect to classify this report as an expert report (See Response to SCI Comment 9).

Concerning the second footnote, the 2002 RSEIS analyzed several different alternatives to determine the alternative that maximized net economic benefits and compensated for significant unavoidable environmental impacts to the extent justified (see DOI Response 1). Concerning the USDA conservation programs refer to RSEIS 2 Sections 4.4.3.1 and 4.4.3.2. The RSEIS 2 demonstrates that the concerns raised in this footnote can be and have been addressed without a reanalysis of alternatives.

Environmental Defense Comment 6:

The most basic reason the new, proposed mitigation is inadequate is there is now a scientific consensus about the critical importance of natural hydrologic variability to the functions of wetlands and floodplain habitats. Artificial hydrologic manipulation of existing wetlands so that they flood according to an unnaturally extended and invariable pattern is adverse in its own right and accordingly cannot provide mitigation, let alone the massive levels of mitigation claimed by the draft RSEIS2. These failings of the new proposal are discussed in depth in the report of Dr. Joy Zedler. Dr. Zedler is one of the nation's leading authorities on aquatic ecosystems, wetlands, and their mitigation. She is an accomplished practitioner of wetland mitigation, a leading author, and chaired the panel of the National Research Council of the National Academy of Sciences, which authored the report Compensating for Wetland Losses Under the Clean Water Act, which was commissioned by the U.S. Environmental Protection Agency and the Corps of Engineers. Its recommendations have been broadly embraced by both agencies.

Environmental Defense Response 6: See Zedler Responses 4 – 7. Hydrologic variability is of critical importance to the function of wetlands. However, natural hydrologic variability is not critical to compensate for mid-season fish rearing habitat. In fact, natural hydrologic variability can result in rendering potential spawning and rearing habitat useless. Habitat may not be available during prolonged dry periods or habitat may only be available during the wrong time of the year for fish to be able to use it. Modifying hydrologic variability provides stable spawning and rearing habitat, stable food availability for larval fishes, and higher growth rates and survivability for fishes (See Sparks Response 5).

The claim that "artificial manipulation of existing wetlands so that they flood according to an unnaturally extended and invariable pattern is adverse it its own right" is unfounded. The existing conditions in the sump area of both basins are a far cry from natural hydrology. The existing hydrology can be described as an area of intense farming practices in which hydrology consists of channelized streams, levees, water control devices, and extensive drainage structures. It is true that portions of the New Madrid floodway are subject to backwater flooding. However, this backwater flooding is attributed to an artificial condition as well. If it were not for the Mississippi River

Frontline Levee, the area would most likely be subject to headwater flooding from the Mississippi River, as occurs in the present-day batture area. Because of the frontline levee, it does not experience that Mississippi River headwater flooding. The landscape in the area is mostly soybean fields (See RSEIS 2 Table 3.1 and Figures 5 - 17), not a pristine, natural wetland or floodplain. With the exception of Big Oak Tree State Park, portions of the Ten Mile Pond Conservation Area, and the Bogle Woods tract that has been acquired, most of the New Madrid Floodway is an engineered system. Referring to the New Madrid Floodway as a natural system is simply incorrect. As can be seen by Table 2.2 and Table 2.7 in the RSEIS 2, the additional engineering proposed by the project, including compensatory mitigation, results in significant gains to most of the existing resource categories that are found in the Floodway today (See Zedler Responses 2, 4, 5, 8, 9, and 14, Sparks Response 5, and Bohlen Comment 27).

The declaration of Dr. Joy Zedler appears to be discussing wetlands mitigation through restoration, not mid-season fish rearing mitigation. Efforts will be made in restoring hydrologic variability for wetland mitigation. In fact, this project provides for restoration of the historic hydrologic cycles to Big Oak Tree State Park and restoring 1,800 acres of bottomland hardwoods surrounding the park that are currently farmland. These areas currently experience little if any hydrologic variability. Restoration of hydrology to the park and providing an additional 1,800 acres of bottomland hardwoods surrounding the park will significantly improve wetland habitat. Moreover, there is also an opportunity to provide significant spawning and rearing habitat for fish (See Zedler Responses 1, 2, 4 - 7, 10, and 14, Dugger Response 4, and Bohlen Responses 27, 54, and 63).

Additionally, reforestation in order to compensate for wetland losses will include restoration of hydrologic functions to the extent feasible by creating microtopography and planting appropriate vegetation suitable to site-specific conditions (See RSEIS 2 Section 5.2.2.1). Dr. Zedler points out "[r]estore or develop naturally variable hydrological conditions. Promote naturally variable hydrology, with emphasis on enabling fluctuations in water flow and level, and duration, and frequency of change, representative of other comparable wetlands in the same landscape setting. NRC. Compensating for Wetland Losses Under the Clean Water Act p. 125 (2001)." The Corps' proposed wetland mitigation will do exactly what the NRC report recommends (See Zedler Response 4).

Modifying the operation of the gates in the St. Johns Basin or the New Madrid Floodway to create a spawning and rearing pool will provide significant gains to fish spawning and rearing habitat, take farmland out of production, restore vegetation, and not impact the existing black willows in the area. Therefore, claiming that this would be "adverse" is unfounded (See Zedler Responses 5, 8, 10, 14 and Sparks Responses 5 and 22.

Environmental Defense Comment 7:

As Dr. Zedler explains, scientists now refer to hydrology as the "master variable" in driving the ecology of aquatic ecosystems, including floodplains, and its key components include not just average flooding conditions but variability in the magnitude

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of water, frequency, duration, timing and rate of change. The disruption of natural flow patterns is considered to be at the root cause of the great ecological distress facing the Everglades and coastal Louisiana, and scientific papers have demonstrated broad unintended adverse effects more generally of altering the hydrology of wetlands and riparian areas, including floodplains. Accordingly, the NRC report she chaired set forth the restoration or development of "naturally variable hydrologic conditions" as a core guideline for wetland mitigation. And the Corps of Engineers has embraced this recommendation, referring to such seasonal and yearly variation as a basic requirement of wetland mitigation.

Environmental Defense Response 7: See Zedler Responses 4 - 6, 8, 9, and 11. It is inappropriate to compare the Everglades and coastal Louisiana to the New Madrid Floodway. The only similarity is that natural hydrology has already been disrupted, although the manner of the disruption is dissimilar. It is accurate to say that the ecosystem and landscape of the Floodway is significantly impacted by human activity. The project will do much to restore the entire ecosystem in the project area, not just preserve remnants of the hydrologic regime called backwater flooding. As a result, most ecological functions will be much improved from the ecological functions that soybean fields provide under existing conditions.

Environmental Defense Comment 8:

This variability in hydrology is closely related to landscape position. Broad, contiguous, topographically diverse areas flooded according to a naturally variable pattern are not comparable, and are far more valuable for a broad range of functions, to small areas flooded artificially. The NRC Report notes that "landscapes have natural patterns that maximize the value and function of individual habitats," and that "slight differences in topography" result in significant changes. As a result, large, contiguously flooded areas with "heterogeneous topography" – such as the project area with countless subtle variations in elevation – cannot be replaced by small, highly managed areas. Again, the Corps of Engineers has embraced this recommendation as a critical wetland mitigation guideline.

Environmental Defense Response 8: See Zedler Responses 4, 7, and 8 and Bohlen Response 26. As seen in RSEIS 2 Table 3.1, over 85% of each basin is classified as cropland. A large portion of this cropland has been leveled and extensively drained to promote agricultural production resulting in homogenous topography. The only contiguous habitat within the Floodway is farmland (See RSEIS 2 Figures 5 – 17).

The Corps is not proposing to replace "large, contiguously flooded areas with heterogenous topography with small, highly managed areas. The Corps is proposing to replace lost ecological functions on a large, contiguous tract of homogenous farmland with a variety of diverse techniques that include restoration of thousands of acres of bottomland hardwoods, restoration of hydrology to Big Oak Tree State Park, 64 miles of vegetated buffer strips, a wildlife corridor, moist soil units, modified borrow pits that benefit multiple species of fish, and additional techniques that may include restoration of degraded floodplain lakes or the creation of a spawning and rearing pool in areas that are mostly farmland.

Not only has the Corps embraced the recommendation of heterogeneous topography as cited in the NRC report, this project will implement its recommendations to the extent feasible. This project will provide more heterogeneous topography than exist under current conditions.

Environmental Defense Comment 9:

In this case, the core of the proposed new mitigation is based precisely on the principle that a small, artificially ponded area can replace a large, variably flooded area 5
with heterogeneous topography. This approach fundamentally contradicts known science embraced by the Corps itself.

Environmental Defense Response 9: See RSEIS 2 Section 4.3.2.4, and Zedler Responses 5, 7, 8, 10 and 14, Sparks Comments 5 and 21, and Bohlen Comments 63. The proposed mitigation is not based on the principle that small artificially ponded areas can replace large, variably flooded areas. Proposed mitigation is based on outputs of the environmental models that were agreed to during the development of the project. Mitigation will ultimately be accomplished when impacted habitat is replaced, not when certain quantities of acres are procured.

As seen in Section S.3 of the RSEIS 2, rather than small, artificially ponded areas, the proposed mitigation includes the following:

- Supply Big Oak Tree State Park with Mississippi River surface water. Big Oak Tree State Park is experiencing drier hydrologic conditions due to adjacent facilitated drainage. Restoring hydrology to the park would require construction of culverts through the Mississippi River Mainline Levee System, water control structures at the park, and a canal. This action would restore historic vegetation and prevent additional damages to existing vegetation.
- Reforest 1,293 acres of cropland within the St. Johns Bayou Basin. There are currently 2,210 acres of forested wetlands below an elevation of 300 feet NGVD (300 feet NGVD has been used to delineate the project area because it is the upper limit of backwater inundation, which is greater than the 30-year flood event) in the St. Johns Bayou Basin. Reforesting 1,293 acres of cropland in areas below 300 feet NGVD would increase forested wetlands in this area by 59%.
- Reforest 4,126 acres of cropland within the New Madrid Floodway, including 1,800 acres of cropland surrounding Big Oak Tree State

Park. There are currently 3,854 acres of forested wetlands below an elevation of 300 feet NGVD in the New Madrid Floodway. Reforesting 4,126 acres of cropland would increase forested wetlands by 107% in these areas. Additionally, reforesting 1,800 acres of cropland surrounding Big Oak Tree State Park would nearly triple the size of existing bottomland hardwoods within the park.

- Construct 765 acres of moist soil units. There are currently 1,391 acres of herbaceous wetlands within the St. Johns Bayou Basin and the New Madrid Floodway below an elevation of 300 feet NGVD. Constructing 765 acres of moist soil units would increase herbaceous wetlands by 55% and moist soil units can be managed to maximize benefits to shorebirds and waterfowl.
- Provide vegetated buffer strips along 64 miles of New Madrid Floodway channels. Intense agricultural production to top bank of existing channels is a common practice throughout the New Madrid Floodway. These intense farming practices result in a lack of available habitat for local fish and wildlife populations and decreases in water quality. Decreases in water quality are attributed to increases in suspended sediments and nutrient loads. Providing buffer strips along 64 miles of channels would provide additional fish and wildlife habitat, improve existing runoff water quality, would benefit detrital input (leaves, twigs, branches), and provide shading in the littoral zone of streams and ditches.
- Create a wildlife corridor that connects Big Oak Tree State Park to the Ten Mile Pond Conservation Area. Due to intense farming in the area, local wildlife populations are isolated to relatively small tracts of bottomland hardwoods. There is little to no movement of wildlife between tracts. Creation of a wildlife corridor would connect two of the most significant isolated tracts of forested areas remaining in the New Madrid Floodway. Over time, this action would enhance populations of game animals such as white-tailed deer and wild turkey, as well as populations of migratory songbirds.
- Construct 387 acres of borrow pits that would benefit floodplain fish. There are currently 721 acres of open water habitat below elevation 300 feet NGVD within the St. Johns Bayou Basin and New Madrid Floodway. Constructing 387 acres of borrow pits would result in an increase to open water habitat by 54% and would also provide additional hunting and fishing opportunities to the local area.

Creation of a spawning and rearing pool can significantly increase mid-season fish rearing habitat. Refer to Environmental Defense Response 4 and Zedler Responses 5, 8, 10, 14, and Sparks Comments 5 and 21.

Restoration of floodplain lakes provides significant habitat for fish and is widely accepted as a habitat gain by the LMRCC. A similar restoration project has recently been completed on Tunica Lake Cutoff, Tunica County, Mississippi. Preliminary data

suggests that construction of a weir at the outlet of this lake has increased fish productivity (Keith Meals, Mississippi Department of Fisheries, Wildlife, and Parks, personal communication).

Environmental Defense Comment 10:

> Apart from the inadequacies of the new approach for fishery habitat, the new approach also remains inadequate for other separately analyzed functions previously addressed by conservation organizations including wetlands, shorebirds, and waterfowl. This is evident from the fact that apart from the artificially extended flooding on existing wetlands during the fish mid-season, the number of acres of mitigation have been reduced. Accordingly, all earlier comments on the adequacy of mitigation for these categories of species continue to apply.

Environmental Defense Response 10: For information about waterfowl and shorebirds, see Responses to Dugger. For wetlands, see Zedler Responses 1 and 7, and Bohlen Responses 30 – 37 and 43 - 47). The basic mitigation feature fully compensates for shorebird losses by the construction and management of 765 acres of moist soil units. The basic feature alone over-compensates impacts to waterfowl by 1,744,936 DUDs (See RSEIS 2 Table 2.2. and Dugger Response 2). These resources are further benefited by implementing the additional mitigation techniques that compensate for mid-season fish rearing losses.

The statement concerning the reduction in mitigation acreage is misleading. Mitigation is based on compensating for lost habitat not a certain quantity of acreage. The August 25, 2003, Record of Decision recommended the acquisition in fee or easement of a total of 9,140 acres of land for mitigation (See RSEIS 2 Section 2.2.). This RSEIS 2 analyzes several mitigation scenarios that entail the acquisition of real estate in fee or easement on a range of 9,877 acres to 10,412 acres (See RSEIS 2 Table 2.8). Mitigation acreages have not been reduced as the comment suggests. Mitigation acres have increased.

Environmental Defense Comment 11:

One of the major changes of the new analysis is the approach to Swampbuster. Instead of following its "don't ask, don't tell policy," the NRCS, according to the RSEIS2, has performed a new sample of farmed wetlands in the project area. This new sample, according to the Corps' summary of NRCS's views, confirms the NRCS analysis of wetlands present from 1980's analysis overall, which would place a mere 520 acres of farmed wetlands in the project area. Then, based on an HGM analysis of wetland functions, the NRCS has accepted the mitigation proposed by the Corps as adequate for Swampbuster purposes to avert violations of Swampbuster.

One of the basic flaws with this approach is that the new NRCS wetland analysis is technically inadequate. The Corps continues to report, based on hydrologic modeling developed from direct Mississippi River stage data, that more than 9,000 acres in the project area have 15 days of inundation during the growing season from Mississippi River backwater flooding. This is exceptionally, almost uniquely, strong data regarding

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Environmental Defense Comment 11 (continued):

compliance with farmed wetland criteria and is far more reliable than any result based on the indirect analysis from aerial photographs drawn by NRCS. Indeed, the entire economic and environmental analysis for the project, including the mitigation analysis, is based on the validity of this hydrologic analysis. Furthermore, the NRCS method, reflected in the applicable interagency mapping conventions, confirms the presence of wetland hydrology from impacts on crops through crop stress, delayed planting or unusual crop abundance in dry years. The whole premise behind the economics of the project is that the Mississippi River flooding has these impacts. Yet the NRCS acknowledged that its method did not pick up indicators of flood events on cropping. In a context in which flooding is known to occur, this statement amounts to an admission of the invalidity of its approach in this context. In fact, the approach by NRCS is not designed to pick up wetland impacts from Mississippi River backwater flooding and cannot be validly used in this context – let alone can it be viewed as sufficiently reliable to override the direct assessment of the hydrologic modeling.

Environmental Defense Response 11: Please refer to Section 4.4.3.1 of the RSEIS 2 for a discussion of the NRCS' involvement in the project.

The Corps has relied on the NRCS for a determination that project implementation will not cause area farmers to violate Swampbuster and lose their farm payments (See RSEIS 2 Section 4.5.1). The NRCS is responsible for this program. The Corps did not rely on NRCS to determine the amount of mitigation needed to compensate for unavoidable project impacts. The Corps, while it requested a statement of the adequacy of the proposed mitigation from NRCS and received such a statement, did not decrease the proposed wetland mitigation. The Corps stands by its hydrologic inundation analysis, regardless of NRCS' classification of those lands for its own program purposes. As the commenter points out, the Corps hydrologic analysis is "exceptionally, almost uniquely, strong data regarding compliance with farmed wetland criteria." It is precisely this analysis that is the basis for the proposed wetland mitigation. The Corps' mitigation plan for these lands that are either 'potential' farmed wetlands or prior converted croplands

fully meets Missouri guidelines for 1 to 1 mitigation for farmed wetlands (See Zedler Responses 1 and 7 and Bohlen Responses 43 – 47).

Environmental Defense Comment 12:

The NRCS judgment of acceptable wetland mitigation is therefore based on an incorrect analysis of wetland impacts. Dependent as it is on the HGM analysis, it is also invalid since it too was based on these wetland impacts and in other ways, it cannot be used appropriately in this context or to measure and offset all of the wetland functions lost. Indeed, an assumption behind the Corps's claims is that mitigation sites will all restore wetlands to non-wetlands. In fact, it appears that nearly all of the likely mitigation sites are already wetlands. In fact, much of the mitigation is likely to occur in areas that are dried as a result of the project and therefore may not have wetland

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hydrology at all, and if they do meet minimum hydrological criteria, they will not have full wetland hydrology comparable to impact sites. Indeed, even if the new NRCS analysis were accurate, Swampbuster still precludes reliance on mitigation funded by the federal government, which remains the proposal here. And there is no evidence that NRCS is insisting on the normal paperwork to assure that mitigation occurs and is compliance with Swampbuster.

Environmental Defense Response 12: See Environmental Defense Response 11. The Corps' mitigation plan requires that proper hydrology be provided to mitigation sites to obtain the appropriate habitat unit credit that is intended (See RSEIS 2 Section 2.6.1.1).

Swampbuster compliance is addressed in RSEIS 2 Sections 4.4.3.1, 4.4.3.2, and 4.5.1 and Bohlen Comments 30 - 37 and 40 - 47.

Environmental Defense Comment 13:

> There is a further suggestion for the first time that Corps approval provides Swampbuster compliance in accordance with NRCS acceptance of Corps mitigation judgments on the grounds that it is equivalent to a Section 404 permit. This novel view contradicts the plain language of the Swampbuster statute because the Corps is not issuing an actual Section 404 permit.

Environmental Defense Response 13: Under 16 USC §3822(f)(4), an action is exempted from Swampbuster where authorized by a section 404 Clean Water Act permit and where NRCS agrees that the converted wetland values, acres, and functions are adequately mitigated. The Corps does not process and issue permits for its own project, but it does follow all applicable legal requirements of the permitting for it projects. The Corps' own exemption from this requirement is set out in section 404(r). By letter dated October 5, 2005 (RSEIS 2 Appendix G), NRCS subsequently confirmed that the mitigation requirements would be sufficient under Swampbuster and this was further verified by the HGM assessment that is present in the RSEIS 2 indicating that farmed wetlands will be over-mitigated by the current project mitigation scenarios (See RSEIS 2 Sections 4.4.3.1, 4.4.3.2, and 4.5.1).

Environmental Defense Comment 14:

Another change is that the Corps claims for the first time, in an internally inconsistent explanation, that the grandfather provisions of the 1974 discount rate statute apply here because project sponsors had provided adequate assurances they would pay the local cost share requirement. This claim, contradicted by all earlier Corps assertions, is also contradicted by the fact that as of 1974, local sponsors had rejected the New Madrid levee closure, and that in any event, they could not have accepted the cost-share obligations that became applicable only as of the 1986 Water Resources Development Act. Indeed, local sponsors have still not committed to meet cost-share requirements, including mitigation requirements, either as required either by the 2986 WRDA or even prior to that Act. It logically follows that they could not have committed to the cost-share for the project now prior to 1974. The cost of those mitigation requirements,

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even as now estimated by the Corps, are in the many millions of dollars. The failure of the Corps to require local payment for land, easements and rights of way for mitigation is also a violation of cost-sharing requirements applicable under the 1986 WRDA as well as under prior applicable law.

Environmental Defense Response 14: See RSEIS 2 Section 4.4.1. Section 80(b) of WRDA '74 provides that the Corps may rely on the grandfather provisions if the non-Federal interests have prior to December 31, 1969 given satisfactory assurance to pay the required non-Federal share of the project costs. On January 30, 1959, the Corps accepted provisions of assurances of the St. Johns Levee and Drainage District to acquire flowage easements for the project in accordance with the FCA '54. See Administrative Record Volume 3, page 36.

Additionally, the levee closure portion of the project is not subject to cost-sharing as it is part of the Mississippi River Levee feature of the Mississippi Rivers and Tributaries Project originally authorized in the Flood Control Act of 1928. See 33 U.S.C. §702a. The authority for the gap closure at the lower end of the floodway was granted under the Flood Control Act of 1954. Since this project is not a separable element under the 1986

Water Resources Development Act, no cost sharing for this portion of the project is required. See 33 U.S.C. §2213(a)(1); (e)(1). The levee closure is not physically separable from the rest of the MRL feature as it is a part of a single structure – the levee that runs from Cairo, Illinois to the Gulf of Mexico and provides flood control for the Mississippi Alluvial Valley. Additionally, communications between the Corps and Congress indicate that Congressional understanding was that the New Madrid closure of the MR&T project would not be affected by the cost-sharing provisions of WRDA '86. This was based on two factors: (1) that separable elements of the MR&T project were defined as parts of the project that was located along tributaries to the mainstem Mississippi River and (2) that the New Madrid closure was a scheduled balance. Since the New Madrid closure is along the mainstem Mississippi and was a scheduled balance, the Assistant Secretary of the Army (Civil Works) wrote to the Chairman of the House Committee on Appropriations that the project would be exempt from cost-sharing requirements. See Administrative Record Volume 37, pages 161-65

Environmental Defense Comment 15:

The Corps should also learn from the recent experience of Hurricane Katrina regarding the critical public policy significance of prioritizing limited water resources dollars. In Louisiana, Corps and outside experts had long identified New Orleans levees as vulnerable to very large hurricanes that would cause catastrophic damage. Yet, dollars for analysis and improvements to the levee system were shortchanged even though Louisiana has long received the most dollars for Corps water projects of any state in the nation. Dollars were instead devoted to marginal navigation and flood control projects at best. Two articles in the Washington Post describe the Katrina situation and are included along with this submission.[5] There is already a backlog of more than $50 billion for authorized Corps projects. As a matter of public policy, it is only logical that the Corps consider the relative significance for the nation of approving of another project to compete for limited available funds whose benefits do not address remotely the kinds of property, human disruption and risk of lost life as many other critical flood control priorities.

Environmental Defense Response 15: The Corps does not have independent authority to implement its Civil Works Program as suggested in Comment 15. This would include

the Corps setting its own priorities for Katrina relief. The Corps carries out the Civil Works Program of the Department of the Army pursuant to Congressional (legislative branch) direction, which includes both authorization and funding. See U.S. Constitution, Article I, Section 1 (Legislative Powers reside in Congress) and Article II, Section 1, (the Executive Powers are vested in the President). The Corps, in carrying out the Department of the Army Civil Works Program, does so only at the direction of, and pursuant to, the authorities provided to the Corps, part of the Executive Branch, by the Legislative Branch.

Environmental Defense Comment 16:

It is also interesting that for the first time, the RSEIS2 mentions the Town of Pinhook and quotes with approval comments from the Pinhook Chamber of Commerce

[3] "The Slow Drowning of New Lreans," The Washington Post p. A1(Oct. 9, 2005); "Money Flowed to Questionable Projects: State Leads in Army Corps Spending, but Millions Had Nothing to Do with Floods," The Washington Post p. A1 (September 8, 2005).

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Environmental Defense Comment 16 (continued):

for the project. Pinhook is a community of roughly 30 structures that does not experience flooding directly from Mississippi River backwater. Instead, the main disruption to Pinhook from backwater flooding occurs through flooding of the most direct road connecting Pinhook to East Prairie. The costs of this disruption and damage to the road remain uncalculated. To the extent the Corps truly were focused on the needs of Pinhook, the obvious alternative would be to raise the road or otherwise improve passage during flood events, an alternative conservation organizations have repeatedly urged the Corps to analyze. Suggestions that Pinhook is economically dependent on agriculture and therefore would benefit enormously from the project are not only too vague to be meaningful but not substantiated. Obviously, there could be some benefit for Pinhook residents, but it would be extremely modest. The Corps does not expect the project to increase land in agricultural production, so labor and inputs to agricultural production will not significantly change and resulting increased demand for work that could be provided by residents of Pinhook is limited at best. Pinhook does not in any event include companies that provide agricultural inputs. According to established economic principles, the benefits of the project will flow to the owners of the agricultural land and any benefit to renters will be passed on to owners in the form of higher rents. Land plat maps indicate that most of the land in the New Madrid floodway is owned by a very small number of large landowners. How much land is owned by residents of Pinhook is unknown, but certainly small, and has been estimated in previous newspaper articles at around 600 acres.

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Environmental Defense Response 16: The comment indicates that this RSEIS 2 is the first mention of Pinhook. Many comments in support of the project were received from the late Mr. Jim Robinson (former Mayor of the town), many Pinhook residents, and the NAACP (both Charleston, MO and Missouri Chapters). These comment letters can be found in Appendix L of the 2002 RSEIS.

The comment is in error regarding the flooding situation at Pinhook. Although not quantified for the purpose of economic evaluation, Pinhook does experience backwater flooding directly from the Mississippi River. An approximate 50-year backwater flood begins to enter the resident's homes. Floods of much lesser magnitude surround Pinhook and isolate it causing many additional costs and increased dangers for the residents. Merely raising the roads as suggested by the comment, does nothing to keep the floodwaters out of the resident's houses or reduce the danger to a motorist who could accidentally leave the road and drive into the floodwaters.

Pinhook residents will also receive benefits due to the project's agricultural effects. The landowner directly involved in the farming operation will receive the direct benefit. But the local economy will also receive a portion of the indirect or secondary benefit as the landowner spends his or hers increased income. The farmer who rents benefited lands will receive a substantial portion of the economic benefit with the remainder going to the non-farming landowner.

How much goes to each will be a negotiating or bargaining process greatly influenced by the economic risk each assumes. Many of the benefits of the project require greater investments or changes in established practices. For instance, the farmer may plant earlier, use more inputs, or change to more valuable crops. Each time the farmer increases his or hers investment, he or she exposes themselves to the potential of an increased loss due to residual flooding, drought, hail, wind, frost, etc. These risks will require the farmer to keep a significant portion of the potential increased returns. The project area is dependent upon a farm economy. The increased benefits received by these farmers and landowners that are spent in the local economy will benefit the area's employers and employees, potentially increasing employment, personal income, taxes, etc.

Environmental Defense Comment 17:

Finally, criticism of the alternative that would use a modest levee to protect East Prairie from flooding from the St. James ditch is ridiculous on its face. The quoted statement suggests that this levee would increase Pinhook's isolation. East Prairie and Pinhook are now separated by the very large New Madrid setback levee, and any new levee would be far more modest. More important, even the setback levee has no real "isolating" effect on Pinhook but simply requires a barely perceptible rise and fall in the road separating it from East Prairie. As the concept applies to Pinhook, separation refers to the flooding of the road during very large floods not any levees that the road must pass over.

Environmental Defense Response 17: Prior studies analyzed the economic effects of a ring levee to protect East Prairie. All East Prairie ring levees had benefit-to-cost ratios of less than 0.5 to 1. The commenter has already recognized the importance of a positive benefit-cost ratio at comment 2, above (See 2002 RSEIS Section 2.4.1).

Environmental Defense Comment 18:

These comments of conservation organizations, including expert reports and associated documents, were provided based on the limited time available to analyze not only the RSEIS2 but critical documents necessary to analyze the RSEIS2 that were received by Environmental Defense in response to a Freedom of Information Act request. Critical documents received only on January 13th in the offices of Environmental Defense. There was also no advance indication that documents would be forthcoming on that day, a Friday, and counsel for Environmental Defense was out of town that day, so the organizations were not able to begin to review these documents and provide relevant documents to experts until January 16th. While the organizations and experts have worked hard to assimilate and evaluate this material in this limited time, they have not yet had time to review fully all parts of the analyses. Some review continues, and should we identify significant additional issues, further comments will be provided.

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Environmental Defense Response 18: This project has undergone three separate NEPA analyses since the mid-1990's. Many of the comments made, with the exception of comments specific to the details of this RSEIS 2 with respect to mitigation planning, have been made in some fashion before. Technical information requested under the Freedom of Information Act (FOIA) has been in Environmental Defense's possession for at least this comment period and in most cases since 2003 or earlier.

The public comment period was published in the Federal Register on December 9, 2005 and the commenter had the RSEIS 2 on that date. On December 14, 2005, the commenter gave notice to the Department of Justice that they would be making a FOIA request but said FOIA request was not received by the Corps until December 20, 2005. Aside from the FOIA attorney, the Corps employees who were needed to assemble documents responding to commenter's FOIA request were on vacation at that point and did not return until the first (and in some circumstances) the second week in January. The Corps provided most of the requested documents to the commenter on January 11, 2006, and the remaining documents on January 13, 2006. Additionally, the Corps did

extend the comment period an additional week to allow the commenter additional time to review and make comments on the project. The Corps considers all reasonable comments made by the public under NEPA, however, there is no requirement that the public comment period accommodate one group's personal schedule.

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ASSESSMENT OF WATERFOWL EFFECTS AND DISCUSSION
IN THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE ST. JOHNS BAYOU/NEW MADRID FLOODWAY PROJECT

Bruce Dugger
1-27-06

I have previously provided extensive comments and testimony regarding the St. Johns Bayou/New Madrid Floodway project and its impacts on waterfowl and shorebirds in particular. I have reviewed the December 2005 Revised Supplemental EIS2. In my view, nothing in the December 9, REIS2 draft alters the validity of these comments, except that there is now some proposal for managed impoundments, which I discuss below.

Dr. Bruce Dugger Comment 1:

For the first time, this draft suggests that some impoundments will be constructed to manage habitats to benefit waterfowl and shorebirds. In doing so, the draft for the first time proposes to create some small, managed areas in lieu of the current natural back water flooding that occurs. My understanding is that alternatives that did not rely on natural flood regimes were rejected by the Fish & Wildlife Service, among other reasons, because doing so would be inconsistent with the critical need to provide a large distribution of habitats over tens of thousands of acres to reflect the full range of waterfowl uses of the project area, including thousands of acres of shallow, temporarily flooded wetlands in a variety of cover types as flood waters recede (2002 RSEIS at E-151). As I understand it, the Fish & Wildlife Service maintains that mitigating for calorie loss, as calculated by the WAM, is a necessary but by no means sufficient criterion for mitigation, and I agree.

Dugger Response 1: This draft clearly restates the commitment from earlier reports to construct and manage impoundments to benefit waterfowl and shorebirds. Regarding the statement that USFWS rejected mitigation alternatives that do not rely on natural flood events, that is counter to USFWS formulation of alternatives that rely on man-made compensation measures such as the creation of moist soil areas (RSEIS 2 Section 4.3.4). We concur that large scale natural flooding regimes contribute to large distribution of habitats as stated in the referenced 1998 WAM report. Following project construction, flooded areas will be more concentrated. However, post-project there will still be flooding of agricultural lands from headwater events and ephemeral ponds will still be present throughout the project area. Diversity of waterfowl habitat will be provided by the thousands of acres of newly reforested areas, from shorebird moist soil areas, and the avoid and minimize measures such as riparian and wildlife corridors. Additionally, the operation of the spawning and rearing pool in retaining water to 284.4 each year will result in deeper water areas that will provide feeding habitat for diving ducks. Finally, up

to 6,400 acres of primarily agricultural lands will be flooded during the winter waterfowl season. See 2002 RSEIS Section 5.5.

We concur that mitigation based on calorie loss alone is not sufficient for waterfowl mitigation. However, the final recommended waterfowl mitigation plan far exceeds, both in type and acres of habitat, that recommended by USFWS as being necessary to compensate for unavoidable losses. See RSEIS 2 Section 4.3.4 for a complete discussion of the caloric effect of reforesting agricultural fields. See 2002 RSEIS Appendix E for the calculation of the effects of impacts and mitigation on waterfowl.

Dugger Comment 2:

Apart from the other concerns outlined in my testimony, the micro topographic variation important to shorebirds that occurs over 70,000 flooded acres, which is critical to the area's value to the variety of shorebirds it supports, is difficult to replicate or maintain on smaller areas, even when managed. Nothing in the new draft EIS indicates how this micro topographic variation would be achieved. For waterfowl, there are also additional problems using a managed habitat approach even for calorie replacement. Creating managed units that are flooded for long periods of time during winter may have reduced value in February and March because seeds produced in the fall have been depleted. The WAM indicated that acorns in bottomland hardwoods would decline each day of flooding and be depleted after 11-28 days (depending on the % of red oaks; Table 2, page B-9, Appendix B, 1998 WAM analysis). Thus, flooding a specific number of managed acres for one month would not provide the same foraging conditions provided by natural flooding where rising water levels continue to flood new habitat. That is, while some number of acres is flooded less than two feet deep on the current floodplain

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each day, the location of those acres will change as river level changes and thus provide fresh new food supplies, so the likelihood of depletion is reduced in a naturally flooded floodplain. To mimic this pattern with managed habitats, you would need a much larger total acre value. Thus – again in addition to other problems raised in my testimony – the model's reported mitigation acreage requirements can not be applied to managed habitat without adjustments that would increase the number of acres required.

Dugger Response 2: The comment is very misleading in that it speaks to the value of micro topographic variation occurring in over 70,000 flooded acres. First of all, if this amount of area was flooded, only a small percentage would be shallow enough to be of value to shorebirds. Secondly, a flood that would impact this many acres would be a rare (over a 25-year) event. A more realistic assessment would be to evaluate impacts on about 17,000 acres that occur within the two-year flood frequency in the New Madrid Floodway. This flooding currently occurs primarily on agricultural lands (11,843 acres) rather than bottomland hardwood wetlands (3,354 acres) as the comment suggests (See RSEIS 2 Table 3.3). Even so, only a small portion of these acres (about 1,300 cumulative

acres less than 24"deep) is available for waterfowl and shorebirds on average at any given time during the November 1 to March 31 waterfowl season. See 2002 RSEIS Section 5.5.1. Little to no microtopographic variation exists in the project area because the majority of the area has been extensively leveled for agricultural production. See Zedler Response 8. However, the limited amount of microtopographic variation that still exists in the project area would still provide valuable habitat for shorebirds and waterfowl post-project due to headwater flooding and rainfall. Further, microtopography is readily implementable in mitigation site development and will be created to mimic dimensions present in nearby reference sites (See RSEIS 2 Section 5.2.2.1).

Regarding the contention that managed areas may have reduced food values during February and March, the intent of managing moist-soil and bottomland hardwoods for winter and spring habitat is to maximize food availability for winter and spring migrants. Also, experience and data from the University of Missouri Gaylord Memorial Laboratory show that much spring food use is of invertebrates which mature over winter and only become available by spring (because of detrital decomposition processes) regardless of whether the moist-soil or bottomland hardwoods area was flooded all winter or not (Dr. Mickey Heitmeyer, personal communication). In fact, longer flooding promotes some spring foods such as invertebrates (See 2002 RSEIS Appendix E, E-149).

The commenter is incorrect that more acres are required for mitigation. USFWS through its CAR indicated that more bottomland hardwood and moist soil habitat is being proposed than is shown to be necessary by the model. See RSEIS 2 Table 2.2 (showing overmitigation of 1.7 million DUDs for waterfowl). See 2002 RSEIS 2 Appendix E, U.S. Fish and Wildlife Service CAR.

Dugger Comment 3:

> **While some hydrologic restoration is now included in the current plan; I question the proposed value of several mitigation features. Specifically, from maps, it appears that proposed reforested buffer strips and wildlife corridors would be above the areas still allowed to flood as a result of the project, and thus would not be in a position to produce significant flooded habitat for waterfowl, and isolated, linear corridors of trees would have limited value to waterfowl even if flooded.**

Dugger Response 3: Buffer strips and wildlife corridors were proposed throughout the New Madrid Floodway. However, benefits these areas provide were not quantified in the 2002 RSEIS. This RSEIS 2 quantifies benefits these areas provide (See RSEIS 2 Section 2.6 and Tables 2.2 and 5.11). Some of these areas would still be exposed to interior flood events and those in the lower project area would be exposed to springtime modified gate operation. Minimal value was calculated for waterfowl in these areas. Detailed mitigation plans will be submitted pursuant to the requirements of the State Water Quality Certification setting forth the benefits to waterfowl that will be provided by each mitigation site. See Water Quality Certification at 3(b) (RSEIS 2 Appendix G).

Dugger Comment 4:

> I also question the increased benefits assigned to Big Oak Tree State Park for waterfowl. It may be true that the site is drier than it used to be; however, the area already floods, so those acres currently provide waterfowl benefits when flooding occurs. While there may be some enhancement of natural flooding, the area contributes to mitigation only to the extent of this enhancement, and according to the Waterfowl Assessment Model, only when flooded less than two feet. There is no estimate of how much of a habitat increase that would be. This concern applies to all proposed mitigation sites. Additionally, simply preserving existing habitat should not count as mitigation. Finally, the water quality certification requires that Big Oak Tree not be subject to artificial flooding but instead to be allowed to flood according to the rise and fall of the river. Given this stipulation, it is not clear you could establish and maintain red oaks or that habitats would be flooded in March.

Dugger Response 4: The Corps did not assign a waterfowl benefit for Big Oak Tree State Park (see RSEIS 2 Table 2.2). However, based on development of a water management plan that mimics natural, historic flooding conditions which would increase springtime flooding over existing conditions, it would have been appropriate to do so.

Also, there is an incorrect assumption regarding the existing flood frequency of Big Oak Tree State Park in this comment (See RSEIS 2 Section 2.6.1.5). The enhancement provided by the hydrologic restoration system will return the park to a more natural flood frequency pattern. Currently MDNR is concerned that the park is drying from drainage caused by the surrounding cropland (2002 RSEIS Section 4.9). In its present state, the park is changing from wet-mesic bottomland hardwoods to drier forest types. Therefore, the Big Oak Tree hydrology project is not merely preserving the present vegetation at Big Oak Tree State Park but restoring the historic hydrological conditions of the park and the habitat those conditions produce. It is appropriate to take mitigation credit for this restoration.

Dugger Comment 5:

> The new draft suggests the sump area may provide additional benefits to ducks because the duration of the flooding in the sump area will be increased in April and May. Those months are outside the primary migration season for waterfowl. As I have previously stated, the value of a relatively stable sump area is not comparable to that provided by the dynamic flooding events that currently characterize the project area. Finally, the new report indicates that this modified sump operation will provide feeding habitat for diving ducks between 2 and 4 feet deep. My previous testimony concurred that habitats greater than 2 ft deep have value to waterfowl (both feeding divers and resting dabblers). However, these water depths were not considered in the WAM analysis and no mitigation was assigned for them. If the Corps would like to claim value for sump habitats created between 2-4 feet, they then should include those depth categories in their estimate of waterfowl habitat eliminated by the project (currently they only include habitats < 2 feet deep). There is no quantitative reason to believe that the

Dugger Comment 5 (continued):

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modest number of acres in the sump area can replace the loss of all acres flooded 2-4 feet deep under current flooding conditions.

Dugger Response 5: The RSEIS 2 did not calculate impacts to diving ducks. The interagency teamed determined that diving ducks are not significant users of the floodway and that the proposed project therefore would not significantly impact them (RSEIS 2 Section 4.3.4). Since impacts have not been calculated, mitigation credit is not being claimed either. In the interest of full disclosure, the RSEIS 2 does point out that the spawning and rearing pool may provide potential benefits to waterfowl species as a whole. The benefit of this 2,000 acre spawning and rearing pool is that it creates habitat for thousands of duck use days resulting in a net plus in waterfowl habitat even without other mitigation.

Dugger Comment 6:

There are also additional arguments in the new draft emphasizing that flooded hardwood forests are overall better for mallards and other forest using ducks than flooded crop fields in spring. I agree and have always agreed. Among the reasons this is true, is that they provide a variety of enhanced functions, including certain kinds of food sources, not reflected in the WAM model. I also agree that mitigation goals should seek to restore some historic vegetation and wetland communities rather than to flood more cropland --- again, among other reasons, because historic communities provide functions not reflected by the WAM model. These comments overall support my view that application of the WAM model without regard to other functions, including those provided by large variably flooded natural areas, is improper.

I declare under penalty for perjury that the foregoing is true to the bet of my knowledge, information and belief.

Bruce Dugger
Assistant & Mace Professor

Dugger Response 6: In summary, the Corps plan fully mitigates the assumed waterfowl and shorebird habitat losses in all regards. The acreage proposals are generous and include a diversity of habitats including reforestation and management of bottomland hardwoods, construction and management of moist-soil impoundments, and allowances

of spring flooding up to 284.4 feet NGVD elevation in the New Madrid Floodway. The DUD increases, based on caloric analyses clearly exceed losses in all seasons. Further, the text is clear in stating that bottomland hardwoods management will seek to emulate natural seasonal and annual patterns of flooding dynamics and attempt to sustain the health of this valuable community. While not all bottomland hardwoods will be flooded each spring, the large acreage planned, coupled with more predictable resources in moist-soil impoundments (regardless of whether they are targeted to shorebirds or waterfowl), will provide more than adequate replacement foods for assumed losses that frequently flooded agricultural areas provide during the spring migration.

SCI Engineering, Inc. Comment 1:

SCI ENGINEERING, INC.

[illegible]

www.sciengineering.com

January 27, 2006

CONSULTANTS IN DEVELOPMENT, DESIGN, AND CONSTRUCTION
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Mr. Tim Searchinger
Environmental Defense
1875 Connecticut Avenue
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RE: Proposed Riley Lake Expansion
St. John's Bayou / New Madrid Floodway Project
New Madrid County, Missouri
SCI No. 2006-2021.30

Dear Mr. Searchinger:

INTRODUCTION

As you requested, SCI Engineering, Inc. (SCI) has prepared the following letter summarizing our findings regarding the proposed expansion of Riley Lake. As we understand, the Riley Lake expansion project is proposed as a means of providing compensatory mitigation for the St. John's Bayou / New Madrid Floodway (SJB/NMF) Project. The proposed plans for the expansion of Riley Lake are generally described in the Revised Supplemental Environmental Impact Statement 2 (RSEIS), prepared by the U.S. Army Corps of Engineers (CE) and dated December 2005. According to the RSEIS, Riley Lake is proposed to be increased from approximately 36 permanently inundated acres to (up to) approximately 680 permanently inundated acres. This increase in permanently inundated acres would provide a portion of the compensatory mitigation required for the loss floodplain wetlands, seasonal waterbodies, and wildlife habitat that will result from the SJB/NMF Project. The proposed method for increasing the size of Riley Lake is through the construction of a weir or impoundment approximately 980 feet in length across the northern end of the lake and its adjacent area.

SCI has reviewed portions of the RSEIS and other documents prepared by the CE concerning the proposed expansion of Riley Lake. In addition, we have researched aerial photographs, soil survey information, and other limited resources. Based on our review of this information, we offer the following comments.

RESULTS

SCI reviewed the Scenario C & E – 288 Riley Lake Cost spreadsheet prepared by the CE (October 17, 2005). In addition, we reviewed undated volumetric calculations given for 10-foot intervals for the length of the proposed impoundment, as well as a conceptual cross-section and other data. Specific construction details or site-specific plans for the impoundment structure and footprint were not available. Based on the information available to us, it appears that the construction costs for the impoundment structure itself generally reflect industry standards. However, we believe that the overall impoundment design as proposed warrants further discussion regarding issues related to function or intended benefit. These issues may affect costs and subsequent benefit values beyond those shown on the October 17, 2005 Riley Lake Cost spreadsheet.

[illegible]

SCI Response 1: The Corps concurs that the Riley Lake restoration project required further conceptual consideration regarding function and benefits. Such consideration has occurred and is discussed in the responses to comments as follows.

SCI Comment 2:

Soils

The mitigation value of the proposed Riley Lake expansion is based upon the capability of the expanded lake to provide mid-season fish-rearing habitat. In order to provide this habitat, the lake must provide a suitably inundated aquatic habitat for the duration of the mid-season fish rearing period. The proposed pooling elevation of Riley Lake given in the various documents we reviewed ranged from 285 feet to 289 feet. For our review, we assumed a maximum pooling elevation of 288 feet. The RSEIS indicates that at a pooling elevation of 288 ft., 538 acres will be permanently inundated. This elevation was also used in the Scenario C & E cost evaluation and Mitigation Scenario C from Appendix E of the RSEIS. SCI used the 288-foot elevation to develop an approximate boundary for the expanded lake on the USGS 7.5-minute series topographic map (see enclosed SCI Figure 1). Our estimated boundary contained approximately 597 acres, which is slightly larger but similar to the 538 acres given in the RSEIS. This boundary was then used to determine the soil types contained within the approximate lake expansion area. Since a soil survey for New Madrid County was not readily available at the time of our research, the soil types within this boundary were researched using the Center for Agricultural, Resource and Environmental Systems (CARES) on-line interactive mapping system (www.cares.missouri.edu). The CARES data reveals that the site is composed predominantly of Commerce silty clay loam, Sharkey silty clay loam, Cooter silty clay, and Crevasse loam. These soils are described in the *Soil Survey of Pemiscot County, Missouri* (1971) and the *Soil Survey of Cape Girardeau, Mississippi, and Scott Counties, Missouri* (1981) prepared by the Natural Resource Conservation Service. The Crevasse soils are described as being excessively drained and sandy, with rapid permeability. While surface layers contain sandy loam, substratum layers contain predominantly sand. The permeability of Crevasse soils varies, but can be up to 10 inches of water per hour.

Approximately 151 acres within the 288-foot boundary are shown on the CARES soil map to contain Crevasse loam. We have illustrated the approximate extent of the Crevasse loam within the 288-ft. pooling area in the enclosed SCI Figure 3. This area represents an estimated 25percent of the 597-acre area below the 588-foot elevation (as determined by SCI) and 28 percent of the 538-acre area listed by the CE. For other proposed scenarios (ex. 286-foot maximum pool, 432 acres), the percentage of permeable soil becomes much higher. The Crevasse soils predominantly exist on the site at elevations ranging from 280 feet to 285 feet. Should the Mississippi River occur below this elevation for extended periods, it maybe likely that the Crevasse soil could serve as a seepage outlet through which the lake would drain. Assuming no significant recharge from precipitation and high permeability of subsoils, drainage would likely occur until water levels recede below the lowest elevation of the permeable soil (approximately 280 feet). If this were the case, the acres of permanent inundation would be limited to an estimated 100 acres or fewer. This has been shown on the enclosed Figure 2 prepared by SCI.

In order to achieve the permanent inundation (and hence the mitigation value) proposed by the RSEIS, it may be necessary to remediate the area containing the Crevasse soil to reduce its permeability. Methods for reducing soil permeability could include the installation of a mineral liner such as Bentonite enhanced clay, or the importation of less permeable soils from elsewhere on the site. These activities could significantly add to the project budget. A typical Bentonite application rate for sandy soils is 10 lbs/ft^2. Using an estimated cost of $84.00 per ton, the materials costs for remediating 151 acres of permeable soil could exceed 2.75 million dollars. The Scenario C & E – 288 Riley Lake Cost spreadsheet shows that the unit price for clearing and grubbing is projected to be $1,000.00 per acre. Remediation of highly permeable soils would require clearing and grubbing of existing forested area occurring on permeable soils (see enclosed Photograph 1). Using the CE cost estimate, this could potentially add an additional $151,000.00 to the project budget. Added to the overall costs would be the expense of equipment and labor necessary to actually move the material and install it over the permeable soil.

SCI Response 2: The Corps recognizes that detailed plans and design work would be necessary prior to installing a weir at this or any other location. An important part of this design work would entail geotechnical review, including soil borings. This work will be performed before the weir is built to ensure that the lake will function as designed. If soil borings reveal that the lake will not hold the levels of water envisioned without a substantial expenditure of additional resources, the Corps will consider restoration of other batture lakes. See RSEIS 2 Section 2.6.2.3.

The Corps has extensive geotechnical experience with many batture waterbodies in the Lower Mississippi River. Historically, Mississippi River floodplain and batture waterbodies experience a substantial amount of sedimentation that includes relatively impermeable fines and organic material. This material facilitates water retention. The Corps' experience in working with these impermeable sediment layers enhances confidence that Riley Lake will also hold water at the level planned. This is confirmed by Corps contacts with local residents. See RSEIS 2 Section 2.6.2.3 and Sparks Response 10. In the late 1980's, local interests dug a ditch in the lake's outlet channel to drain the lake and allow farming around the lake. If there were a sand lens, as the comment supposes, then this additional drainage measure would not have been necessary. Local interests have informed the Corps that Riley Lake maintained a higher water level before the drainage ditch was dug.

SCI Comment 3:

Maintenance

The proposed method for impounding water within the Riley Lake basin is through the construction of a weir or dam with a height at the desired maximum pooling elevation. The impoundment is assumed to have an outlet or discharge in order to allow controlled flow back to the Mississippi or adjacent low-lying areas. Discharge would presumably occur when the lake exceeded its design capacity. The Scenario C & E – 288 Riley Lake Cost spreadsheet and Table 5.12 from the RSEIS make no mention of long-term maintenance costs for this structure. However, we believe that it is likely that the lake and its discharge would require significant annual or otherwise periodic maintenance in order to function as designed. For example, sections of the area proposed to be inundated contain large quantities of driftwood and accumulated cleared woody vegetation (see enclosed Photograph 1). This material presumably is deposited as drift during the recession of floodwaters, and may also be carried from the site during subsequent flooding events. The lake will likely fill with water from the Mississippi during flood events (water levels greater than 290 feet). As the water recedes below 290 feet and becomes slack water, the debris contained within will be trapped within the lake. As the lake drains toward the Mississippi through its discharge, significant amounts of debris could be carried to the discharge. This debris may be required to be removed from the discharge regularly in order for the lake to function as designed. Additional activity may be necessary for keeping the impoundment structure itself stable and in good repair considering the high-water flows that it would be subjected to. The top-of-bank elevation of the Mississippi River adjacent to the project area is shown on the USGS topographic map to be 290 feet. Should the impoundment be constructed to an elevation of 288 feet, the impoundment may be likely be subject to frequent overtopping and erosive current forces. It appears reasonable that some maintenance of rip-rap and vegetation may be necessary to keep the impoundment functioning as designed. .The RSEIS and other documents which we have reviewed do not appear to account for these or other long-term maintenance costs.

SCI Response 3: Certainly, as is currently the case, there will be instances when, as the river falls, debris will become trapped in Riley Lake and around the weir structure. The Corps intends to transfer mitigation lands and structures to the USFWS. The Service may turn the lands and structure over to a state agency such as MDC for operation and maintenance. The responsible resource agency may choose to perform routine maintenance, or may choose to let a more natural condition develop. If the debris accumulates near the outlet, it could provide substantial large woody debris habitat. The value of such habitat for fish and wildlife is widely recognized. If routine maintenance of the structure or outlet is required, it would be a normal part of the operation of the area and the responsibility of the operating agency.

SCI Comment 4:

General Remarks

The results of SCI's review raise questions from a broader perspective regarding the overall ability of the Riley Lake project to provide fish- rearing habitat as intended. Currently, Riley Lake exists at an elevation of approximately 276 feet (as shown on the USGS topographic map). At the lake's northern end, it is only approximately 400 feet from the right-descending bank of the Mississippi River. The USGS topographic map shows the elevation of the bank in this area to be approximately 280 feet. Furthermore, the northwestern end of the lake contains a nick-point in the surrounding swale that appears to serve as a high-water inlet/out connection with the Mississippi River. It is likely that fish readily enter and exit the lake at this point when the Mississippi reaches water elevations of approximately 280 feet or higher. This point occurs north of the proposed impoundment structure, and will be blocked off from the lake body by the impoundment. We assume that the proposed impoundment is intended to permanently maintain water at elevations up to 288 feet. While the impoundment may or may not be successful at accomplishing this, it seems certain that the frequency with which water and/or fish are exchanged between the Mississippi River and Riley Lake will be significantly reduced. This in turn may be counter-productive from the standpoint of creating fish-rearing habitat.

The proposed maximum water elevation of 288 feet is just below the adjacent top-of-bank elevation of 290 feet. Therefore, it seems likely that the lake will only exchange water with the Mississippi River during significant high-flow events. If these events do not occur with regular frequency, fish will be "trapped" within the lake following recession of the water. Provided the lake does not draw down and kill the fish or substantially reduce their numbers, it could potentially be some length of time before the fish are returned to the river. This lack of connectivity may reduce the fisheries value of the expanded lake.

SCI Response 4: Please refer to SCI Comment 3 above, which contains the statement "[s]hould the impoundment be constructed to an elevation of 288 feet, the impoundment may be likely be subject to frequent overtopping." Either there will be frequent connection to the river as indicated there, or the "lake will only exchange water with the Mississippi River during significant high-flow events" as stated in this comment.

Please see Bohlen Response 12 and Sparks Response 10. Fisheries access between the Mississippi River and the lake will occur more frequently than the 2-year event.

Fish will have frequent opportunities to enter the lake and disperse into the Mississippi River. Fish will not be "trapped" in the lake as the comment implies. A pulsed

hydrograph provides numerous opportunities during the winter and spring to access the river and adjacent floodplain habitat (RSEIS 2 Section 4.3.2.2).

SCI Comment 5:

SCI earlier references that the proposed expanded lake footprint includes highly permeable soil types. If the lake draws down significantly due to soil percolation, acres of fish-rearing habitat are lost and the mitigation value becomes substantially less. In addition, it seems likely that a significant draw-down of the lake following an exchange of fish with the Mississippi River or an in-lake spawn would concentrate fish populations into a progressively smaller area of water. This would likely increase predation and reduce resources available to fish retained in Riley Lake, further reducing its value as fish-rearing habitat.

SCI Response 5: See SCI Response 2 above regarding the sand lens and potential for a "significant" drawdown. The Corps agrees that water levels in a restored Riley Lake could decline due to low Mississippi River stages and evaporation. However, this will only occur to a limited degree. Riley Lake does not currently dry out, and there is no reason to expect that it will do so upon completion of the restoration project.

Any drawdown due to low stages or evaporation is likely to occur in the late summer or fall. Fish rearing habitat is appropriately calculated during the spring. Periods of connection and disconnection between batture lakes and the Mississippi River occur naturally. As explained in Sparks Response 10, each phase of connectivity has ecological importance and it would be inappropriate to uniformly state that a drawdown will reduce a lake's value as fish-rearing habitat. For example, periodic drawdowns create numerous foraging opportunities for fish as well as numerous species of birds including the Federally endangered least tern.

SCI Comment 6:

Table 2.4 in the RSEIS (pg. 41) indicates that area proposed for impoundment contains roughly equal amounts of bottomland hardwood and farmland. It is our understanding that the proposed project area contains some fallow farmground. However, we believe that significant amounts of the area assumed to be farmland actually exist as densely-planted cottonwood trees (see enclosed Photograph 2). It is unclear to SCI whether this has any bearing on the fisheries potential of the proposed lake expansion. However, it does not seem to be addressed by the CE, either. For example, the standing timber would likely be killed after prolonged inundation. In addition, the existing vegetation may trap other organic debris and hold it within the lake (much of the timber would be in 5 feet of water or less). Anaerobic decomposition of vegetation and organic matter is known to reduce the amount of available dissolved oxygen in water. Low dissolved oxygen is also known to be detrimental to fish and other aquatic life. It is our opinion that the questions surrounding the effects of the existing biomass on the habitat quality of the proposed lake should be addressed prior to implementation of the plan.

SCI Response 6: See Sparks Response 22. The comment states that a significant part of the area consists of densely planted cottonwood trees. The trees were planted circa 2001 for pulp production and will be harvested (Robert Riley, Jr., landowner, personal communication). A site visit to the area conducted on February 2, 2006 confirmed that a cottonwood plantation has been planted in the vicinity of the expanded Riley Lake footprint (See site visit report, RSEIS 2, Appendix F, Attachment 1). However, this plantation is located above the 290-foot contour. Therefore, it appears that the comment

provided incorrect information about the land cover of the proposed Riley Lake restoration and no further response to the comment is necessary.

SCI Comment 7:

SUMMARY

As requested, SCI has reviewed the projected costs associated with the construction of the Riley Lake impoundment structure. The cost projections prepared by the CE specific to the construction of the proposed impoundment structure did not generally appear to be inaccurate. However, having reviewed the overall project design, we do believe that there are questions regarding site suitability (based on soils) and project effectiveness.

SCI Response 7: See previous responses above regarding soils and project effectiveness. As stated in Section 2.6.2.3 of the RSEIS 2, Riley Lake is used only as an example. RSEIS 2, Table 2.3 identifies additional opportunities for restoration of Mississippi River floodplain lakes within southeastern Missouri.

SCI Comment 8:

SCI has assisted in the submittal and approval of numerous mitigation plans required by the CE. It has been our experience that Section 404 Permits are not authorized until all aspects of the proposed mitigation plan have been addressed in detail for projects that have more than minimal environmental effects. The CE requires clear illustration that the environmental benefits of a proposed mitigation plan provide adequate compensation for the proposed impacts. The plan is also required to include enough detail to provide reasonable evidence of the likelihood of success. It has also been our experience that questions regarding mitigation design must be resolved prior to the commencement of the activities for which mitigation is required. Therefore, if you have questions or concerns regarding the proposed Riley Lake expansion plan, we recommend that you contact the CE for additional information or clarification. We also recommend that the proposed plan be reviewed by a qualified, professional fisheries biologist to answer questions specific to the successful creation of fish habitat at Riley Lake.

SCI Response 8: The Corps has addressed comments regarding the differences between private 404 applicants and federal civil works projects elsewhere. See RSEIS 2 Sections 4.4.3.1 and 4.5.2. The Corps has also addressed comments that suggest a detailed mitigation plan is required. See Bohlen Responses 48, 49, and 51. The Corps' mitigation proposal, with its requirements for monitoring and adaptive management is set out in Section 6.0 of the RSEIS 2. Monitoring is also included as a requirement in the WQ certification. All aspects of the project, including impacts and mitigation, have been thoroughly reviewed by fisheries biologists who have been fully involved in the development of the plan and will continue to be involved in its implementation and monitoring.

SCI Comment 9:

LIMITATIONS

This report and the findings contained therein have been prepared for exclusive use by Environmental Defense. SCI is not responsible for independent conclusions or recommendations made by others. SCI is not responsible for surveys, calculations, or plans that were prepared by others. Our findings are based on our general overview of available materials, and are not intended to serve as a formal or professionally certified opinion.

SCI Response 9: No response required.

SCI Comment 10:

We appreciate the opportunity to work with you on this project. If you have any further questions about our findings, please do not hesitate to contact us.

Respectfully,

SCI ENGINEERING, INC.

Matthew S. Shively
Project Scientist

Scott D. Harding, CPSS/SC
Vice President

MSS/MRH/tlw/bv

Enclosures

Figure 1 – Estimated Lake Footprint – 288 Feet
Figure 2 – Estimated Lake Footpring – 280 Feet
Figure 3 – Crevasse Loam Within 288-Feet Lake Footprint
Photographic Summary

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(Maps and Figures Omitted)

SCI Response 10: Noted.

DECLARATION OF DR. JOY ZEDLER

Dr. Joy Zedler declares as follows.

1. I am Professor of Botany and Aldo Leopold Chair of Restoration Ecology at the University of Wisconsin-Madison. I am an expert in wetland ecology. I obtained my Ph.D. degree from the University of Wisconsin-Madison in Botany in 1968. I have published about 200 papers in the peer-reviewed literature (CV attached).

2. A major area of my research has concerned wetland mitigation and wetland restoration in other contexts. My expertise derives in part from direct field experience in evaluating the outcomes of wetland mitigation efforts and in designing, implementing, and evaluating wetland restoration efforts with a strong science base. I have also taught seminars on wetland mitigation and published two dozen articles on wetland mitigation. I organized and edited a forum on wetland mitigation that was published in *Ecological Applications* in 1996. I chaired the National Research Council committee that evaluated compensatory mitigation under the Clean Water Act.

3. I have been selected to serve on three panels established by the National Research Council of the National Academy of Sciences to examine important wetland policy issues of direct relevance to the Section 404 Clean Water Act program - panels that were established at the request of the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers. One panel explored and issued a report the definition of wetlands and the criteria for identifying and delineating wetlands. A second panel evaluated and made recommendation for restoration of aquatic ecosystems generally, which deals with essentially the same scientific issues as those involved in mitigating adverse effects on those ecosystems under Section 404 of the Clean Water Act.

4. From 1999 to 2001, I chaired a third panel formed by the National Academy of Sciences at the request of the Environmental protection Agency to evaluate wetland mitigation both scientifically and from a policy perspective. As part of this

panel, we heard extensive testimony and reviewed extensive documentation about actual mitigation policies and procedures utilized by the Corps of Engineers as part of its permit program under Section 404, including input from Corps officials. Our report was issued in 2001 and entitled *Compensating for Wetland Losses Under the Clean Water Act.*

5. The findings were embraced by the U.S. Army Corps of Engineers, which issued a report to the field in 2003 instructing it to follow the ten key recommendations, including those most relevant to the St. Johns Project discussed in my report.

6. I have reviewed the Draft Revised Supplemental Environmental Impact of the Corps of Engineers for the St. Johns Bayou/New Madrid Flood Control Project dated December 9, 2005 (Draft Supplemental EIS). I have also reviewed relevant portions of the Revised Supplemental Environmental Impact Statement for the project dated June, 2002, a Declaration of Dr. Richard Sparks regarding the project dated July 10, 2003, maps of the project showing flood elevations in the New Madrid Floodway both pre- and post- project.

7. The attached report contains my important conclusions regarding the analysis of the Draft Supplemental EIS and the adequacy of the proposed mitigation.

I declare subject to the penalty for perjury that the foregoing and the views of the attached report represent my true views to the best of my knowledge, information and belief.

Dr. Joy Zedler

January 24, 2006

Joy B. Zedler

Aldo Leopold Professor of Restoration Ecology
Botany Department and Arboretum
University of Wisconsin
Madison, WI 53706

PROFESSIONAL EXPERIENCE and EDUCATION

1998-	Professor of Botany, Univ. of Wisconsin, Madison
1980-98	Professor of Biology, San Diego State University (SDSU)
1985-	Director, Pacific Estuarine Research Laboratory, SDSU
1997	Associate Director, Environmental Science Program, SDSU
1991-3	Director, Coastal and Marine Institute, SDSU
1969-80	Asst. and Assoc. Professor, SDSU
1968-69	Instructor in Botany, Univ. of Missouri, Columbia
1968	Ph.D. in Botany (Plant Ecology), Univ. of Wisconsin, Madison
1966	M.S. in Botany, Univ. of Wisconsin, Madison
1964	B.S. in Biology, Augustana College, Sioux Falls, So. Dak.

RESEARCH INTERESTS

Wetland ecology: structure and functioning of wetlands; restoration ecology (especially adaptive restoration, which is the design and implementation of restoration as phased field experiments, learning while doing); interactions of native and exotic species, use of mesocosms in controlled experiments, effects of rare, extreme events on wetland ecosystems; use of scientific information in management of wetlands.

PROFESSIONAL SOCIETIES AND EDITORIAL BOARDS

Ecological Society of America
ESA Vegetation Section Chair, 1996-7
ESA Editorial Board, *Ecological Applications*, 1992-4; reappointed 1999-2005
Estuarine Research Federation
ERF Vice President, 1987-89
ERF Program Chair, 10th Biennial International Conference, October 1989
ERF Editorial Board, *Estuaries*, 1984-89
Society for Ecological Restoration
Editorial Board, *Restoration Ecology*, 2004-
Society of Wetland Scientists
American Ecological Engineering Society
Editorial Board, *Ecological Engineering: The Journal of Ecotechnology*, 1991-2005
Non-society international journals:
Editorial Board, *Wetlands Ecology and Management*, 1988-2005
Editorial Board, *Ecosystems*, 1997-2000

HONORS

Career Achievement Award, Augustana College, 2004
William A. Niering Outstanding Educator Award (first recipient): Estuarine Research Federation, International Biennial Conference, Tampa, Fla., November 2001
Southern California Wetlands Recovery Project: First Award for Achievements in Regional Wetland Conservation, October 2000
Environmental Defense (formerly EDF) Board of Trustees, 1998-
Wisconsin Chapter of The Nature Conservancy, Board of Trustees, 2004-
The Nature Conservancy Governing Board, 1995-2004
Invited to prepare the Society of Wetland Scientists' Position Paper on the Definition of Wetland, 1999.
National Wetlands Award (Environmental Law Inst. & Environmental Protection Agency) for Science Research, demonstrating "an extraordinary commitment to the conservation and restoration of the nation's wetlands," May 1997
SDSU Biology Department Teacher-Scholar Award, May 1997
SDSU Alumni Association Award for Outstanding Faculty Contributions to the University, 1997
National Oceanic and Atmospheric Administration, Sanctuaries and Reserves Division, Special Award for outstanding contributions to the understanding of estuarine ecology and for contributions to the Tijuana River National Estuarine Research Reserve, March 1997
Society for Ecological Restoration, Theodore M. Sperry Award, 1993
National Research Council
Committee on Wetland Characterization, 1993-4
Water Science and Technology Board, 1991-4
Committee on Restoration of Aquatic Ecosystems, 1990-92
Planning Committee for the Second National Forum on Biodiversity, 1995-6
Committee on Wetland Mitigation (chair), 1999-2001
Chancellor's Distinguished Lecturer, University of California, Irvine, April 1992
Phi Beta Kappa Lecturer, SDSU, Fall 1992
Roger Revelle Perpetual Award, Oceans Foundation, 1991
Fellow, San Diego Natural History Museum, 1989
SDSU Meritorious Performance and Professional Promise Awards, 1985, 1988

ADVISORY COMMITTEES

State of Washington Salmon Restoration Validation Monitoring Panel, 2000-
UW University Ridge Research Steering Committee, 1999-
Wisconsin Department of Natural Resources, Natural Area Preservation Council, 1998-
National Wetlands Awards Selection Committee, US EPA and Environmental Law Institute, 1997-98
National Wetlands Newsletter Advisory Board, 1997-
Pro Esteros, Board of Directors, 1990-91; Advisory Board 1995-
National Parks: Research Program Reviewer, Exotic Species Invasions in Everglades National Park, 1995-7
Wetland Advisory Board, City of San Diego, 1992-6
California Coastal Commission, Technical Review Committee for Developing State-Wide Standards for Mitigation Performance, 1994-5.
American Society of Civil Engineers Task Committee on Physical Processes in Tidal Wetland Restoration, 1995-8

National Wetlands Awards (Environmental Law Inst. & Environmental Protection Agency) Honorable Mention, 1994; Review panel member, 1995
U.S. Environmental Protection Agency Science Advisory Board Consultant, 1995-6
President Clinton's Forum on Science and Technology, Invitee, March 1994
Technical Panel, Environmental Protection Agency Global Change Program, 1993-95
National Water Research Institute, Research Advisory Board, 1992-3
Wetland Advisory Board, City of San Diego (Mayoral Appointee), 1992-6
California Sea Grant College, Coastal Resources Research Coordinator, 1992-6
Ecological Society of America ad hoc Committee on Wetlands Delineation, 1991
City of San Diego, Famosa Slough Guidance Committee, 1991
National Wetland Technical Council (13 members nationwide), charter member
Review Panel, US Dept. of Agriculture Competitive Grants Program for Water Quality, 1991
Scientific Advisory Committee, NOAA Estuarine Habitat Research Program, 1990-3
Tijuana River National Estuarine Research Reserve, Research and Education Committee Chair, 1982-93; Restoration Committee, 1993-8
Public Affairs Committee, Ecological Society of America (ESA), 1988-91
SDSU representative to the California Sea Grant Committee, 1980-1990
Los Peñasquitos Lagoon Foundation, Technical Advisory Committee, 1985-87
Congressman Jim Bates Environment Subcommittee, 1985-86

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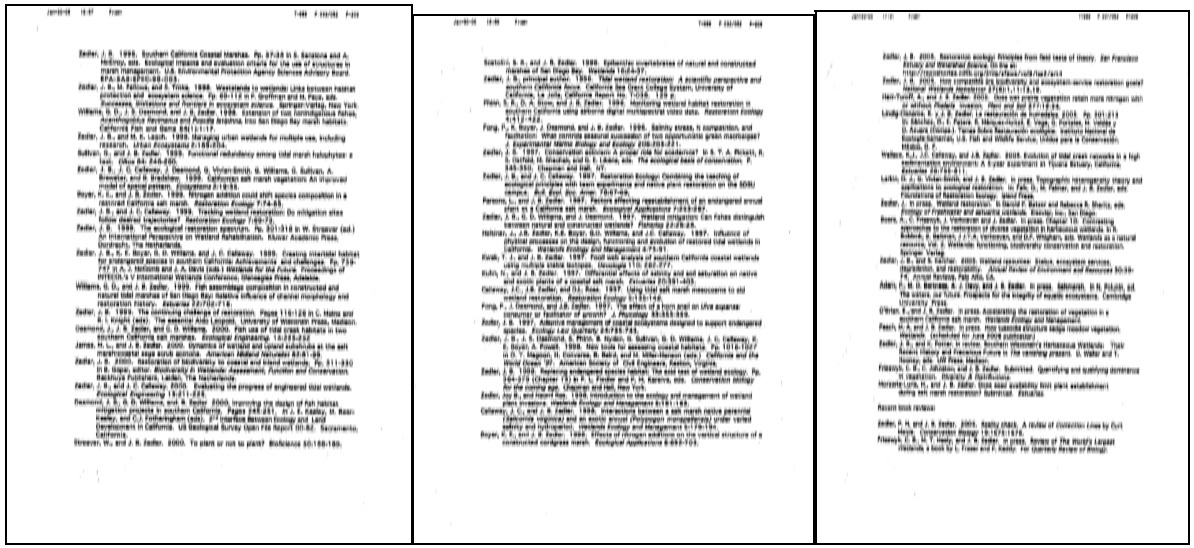

Zedler Response: Curriculum vitae is noted.

Dr. Joy Zedler Comment 1:

REPORT OF DR. JOY ZEDLER ON
THE MITIGATION PROPOSAL
FOR THE ST. JOHNS BAYOU/NEW MADRID FLOODWAY PROJECT

Dr. Joy Zedler (January 2006)

The U.S. Army Corps of Engineers has issued a Draft Supplemental Environmental Impact Statement for the St. Johns Bayou/New Madrid Floodway project dated December 9, 2005 (RSEIS2). This project would close a levee gap in the New Madrid Floodway on the lower Mississippi River that allows tens of thousands of acres to flood on a two- or three-year basis. It would also install pumps to drain water out of the floodplain, and install a pump on the closed St. Johns basin to drain water out of it. Today, according to analysis by Dr. Curtis Bohlen, more than 80,000 acres flood on a regular basis, with the precise amount depending on the flood frequency. Under various versions of environmental impact statements for the project, the Corps itself has estimated that roughly 18,000 acres of wetlands within the two-year flood elevation and more than 30,000 acres of wetlands when wetlands at higher elevations are included, would have their backwater flooding from the Mississippi River either eliminated or greatly reduced. My understanding is that under the proposed plan (exclusive of mitigation), only two small sump areas of roughly 2,500 acres combined would remain undrained and therefore still be allowed to flood by Mississippi River backwater.

Zedler Response 1: The Corps is unable to determine the source of the commenter's 80,000 "regularly flooded" acres. The Corps' analysis indicates that the 10-year event, which is not a "regular flood", inundates 87,674 acres (2002 RSEIS, Table S-1). The 2-year flood frequency, which is a "regular flood", inundates 27,372 acres.

See Responses to Bohlen Comment 30 - 32 for an explanation on the number of acres of wetlands and prior converted cropland that would experience a decrease in inundation from Mississippi River backwater.

There are not 18,000 acres of wetlands within the two-year flood elevation. Please see Table 4-1 and 4-2 of the 2002 RSEIS. The 2002 RSEIS stated that there are 6,461 acres of wetlands (3,514 acres of which are farmland) in the St. Johns Bayou Basin and 11,659 acres of wetlands (6,186 acres of which are farmland) in the New Madrid Floodway at or below an elevation of 300 feet NGVD. The elevation of 300-feet NGVD corresponds, not to the two-year floodplain, but to an approximate 30-year event in the New Madrid Floodway and 70-year event in the St. John's Basin. See Response to Bohlen Comment 42 for the significance of the 300 foot elevation. For a discussion of the Corps' wetland analysis see RSEIS 2 Section 4.2.1 and Bohlen Response 38.

NRCS determined that there is a total of 520 acres of farmed wetlands within the project area for the purpose of this RSEIS 2. Therefore, the 2002 RSEIS overestimated Swampbuster jurisdictional wetlands. Utilizing the NRCS' farmed wetland determination, there is a total of 8,940 acres of wetlands within the project area below an elevation of 300 feet NGVD.

It is also incorrect to state that only the sump areas would experience Mississippi River flooding. The recommended plan includes allowing the Mississippi River to flood 6,400 acres of land during winter to benefit waterfowl inclusive of the 2,000 acre sump area. Additionally, this project specifically recommends restoring hydrology to Big Oak Tree State Park and expanding the park's boundaries by a minimum of 1,800 acres. Therefore, depending on river stages, the Mississippi River would inundate up to 9,191 acres (6,400 acres for winter waterfowl, 991 acres of existing Big Oak Tree State Park, and 1,800 acres of expanded parkland) of floodplain habitat.

The project does not "drain" any wetlands. See Bohlen Responses 32.

Zedler Comment 2:

The RSEIS2 for the project offers four separate, but ultimately similar, mitigation scenarios and states that the final, actual mitigation plan will be left to further decision-making.

The RSEIS2 includes some acres of reforestation and manipulation of other tracts on 6,571 acres. RSEIS2 p. 217. However, many of these acres will generally be above the sump area and will therefore be in areas that are at least substantially drained by the project. Accordingly, the RSEIS2 in Appendix C and at page 104 indicates that many reforestation sites will flood only 5% of the time, and that reforestation sites within the New Madrid Floodway will flood only 6% of the time on average. To mitigate for fish impacts, all of the plans rely primarily on the unnatural extension of flooding on a relatively small number of acres of already existing wetlands.[1] The Corps would do this by artificially extending

[1] The 2002 EIS gave a flood elevation of roughly 290 feet for acres that would meet hydrologic wetland criteria, even for farmed wetlands. All of the sump acres are below 290 feet and therefore would qualify as wetlands according

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Zedler Comment 2 (continued):

flooding first on a range from slightly more than 1,000 to 2,800 acres in the sump area of either the New Madrid Floodway, the St. Johns Basin, or some of both. These are the areas behind either the existing levees or levees to be built by the project and that would not be drained by the pumps at least before May 15th each spring. The Corps would extend flooding in these areas by closing gates to trap water behind the levees and keep it from receding into the river from April 1st to May 15th. The Corps proposes to do something similar on 430 to 700 acres of land outside the levees (known as Riley Lake) by constructing a weir to block flow out of the "lake," which is described as an old oxbow lake, only a small portion of which is flooded year-round. Under three of the four scenarios analyzed for the New Madrid Floodway, artificial ponding would provide 98% or more of the mid-season habitat for fish, and under the fourth scenario, it would provide 93% of that habitat. Table 5.7, RSEIS 2 p. 117.[2]

In short, under the now proposed EIS, the project would drain more than 75,000 acres of frequently flooded floodplain and eliminate or greatly reduce backwater flooding on thousands of acres of wetlands, and would mitigateprimarily by artificially extending flooding (using levees) on something between 2,000 and 3,000 acres.[3] All or nearly all of these mitigation sites are already wetlands and flood now under variable conditions that are relatively natural in that they turn on the rise and fall of the Mississippi River. This mitigation result allegedly derives from a so-called Habitat Evaluation Procedure model for fish habitat (HEP model).

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to this analysis. Riley Lake is also below 288 feet and according to analysis in the 2005 EIS is part of Donaldson Point, floods even more frequently than the project area and therefore would also qualify as wetland.

[2] The Corps presents a range of additional mitigation measures that also involve artificially manipulating flooding on other sites to be reforested. For example, one option would reforest 100 acres of cropland and increase flood duration, presumably through levees and pumps, to 31% of the mid-season for fish, while another would create fallow habitat and flood it 95% of the time. RSEIS2 p. 197-98. These possible mitigation options are subject to the same problems with artificial flooding that are set forth in this report.

[3] The Corps also proposes some acres of reforestation, but most of these acres would rarely be flooded, RSEIS2 p. 104, so they too are not subject to natural hydrologic variability or any semblance thereof. The apparent exception is land around Big Oak Tree State Park, which now floods but which will be subject to some kind of hydrologic enhancement intended to flood according to relatively natural patterns. This effort affects 1,800 acres, but it is dependent on long-term active management, whose problems I discuss below.

Zedler Response 2: This project does not intend to "drain" any land. Closing the gap in the New Madrid Floodway will prevent backwater flooding. For Clean Water Act purposes, outside of direct impacts, forested jurisdictional wetlands will not lose their status because of closure of the levee as they will still receive headwater inundation (See RSEIS 2 Section 4.2.1.3 and 2002 RSEIS Appendix D, pages D-9 and D-10).

The project will not "drain more than 75,000 acres of frequently flooded floodplain". Although the Corps is uncertain of the source of this number, there are 75,000 acres in the New Madrid Floodway below the elevation of the 30-year event. The 30-year flood is not a "frequent" event. There are 17,315 acres below the elevation of the 2-year flood event in the Floodway. This is the Corps' definition of "frequently flooded" (See 2002 RSEIS Appendix L, Sections 6.1 and 10.2). See also Bohlen Response 29 for a description of why the Corps chose the 2-year event to evaluate fish impacts, how the Corps determined the appropriate elevation of that event, and the number of acres below that elevation. See RSEIS 2 Table 3.3 for a stage area curve that lists acres of land cover types by elevation. Project induced impacts to these acres are set out in Section 5 of the RSEIS 2.

The percentages of inundation that were cited in the comment and the RSEIS 2 (5% and 6%) indicate the duration of flooding on potential mitigation sites from April 1 to May 15. These flood percentages are very conservative (that is they may underestimate the duration of flooding on the potential mitigation tracts during the mid-season fish rearing period). Actual flood durations will be calculated during the development of site-specific mitigation plans and verified through monitoring. These areas will be inundated during other periods of the year, not just 5% or 6% during April 1 to May 15, due to various factors including backwater flooding, headwater flooding, high groundwater table, and precipitation.

The comment states, "… and would mitigate primarily by artificially extending flooding (using levees) on something between 2,000 and 3,000 acres." The issue of "artificial" vs. "natural" flooding is discussed in Sparks Response 4 and Zedler Response 8 below. Creation of spawning and rearing pools in either the New Madrid Floodway or the St. Johns Bayou Basin, or the restoration of a floodplain lake, such as Riley Lake, are only parts of a much greater compensatory mitigation plan. The "Habitat Evaluation Procedure for fish habitat" was not the only technique used to describe impacts and determine compensatory mitigation. The Corps, along with the interagency team made up of members of the Missouri Department of Natural Resources, Missouri Department of Conservation, Environmental Protection Agency, and the U.S. Fish and Wildlife Service, defined significant resource categories that would be unavoidably impacted by construction of the flood damage reduction project. These resource categories were wetlands, terrestrial wildlife, waterfowl, shorebirds, and fish spawning and rearing habitat. Appropriate models were developed and used to describe and quantify impacts. Compensatory mitigation is based on the results of these models and input from the interagency team, and public comments. As can be seen by Table S.1 of the RSEIS 2,

creation of a spawning and rearing pool is only one part of the overall compensatory mitigation plan. In addition to creation of a spawning and rearing pool, the plan also includes the following features:

- Placement of riprap at channel intersections and installation of channel improvement structures
- Restoration of 1,293 acres of bottomland hardwoods in the St. Johns Bayou Basin
- Restoration of 2,326 acres of bottomland hardwoods in the New Madrid Floodway
- Restoration of approximately 1,800 acres of bottomland hardwoods surrounding Big Oak Tree State Park
- Restoration of the hydrology to Big Oak Tree State Park
- Provision of 64 miles of vegetated buffer strips along New Madrid Floodway channels
- Creation of a wildlife corridor that connects Big Oak Tree State Park to Ten Mile Pond Conservation Area
- Construction of 387 acres of modified borrow pits in farmland
- Other techniques that include additional reforestation, increasing flood durations during April 1 to May 15, and restoration of small waterbodies

Zedler Comment 3:

For the reasons described below, the claim that this mitigation fully offsets project impacts on aquatic resources is completely inconsistent with scientific understanding of wetland functioning, wetland replacement, wetland restoration, and mitigation of other aquatic areas, as well as inconsistent with established practice under the Section 404 program.[4] The claim is so outside the range of reasonable scientific understanding that it cannot be seriously advanced as science-based. It therefore should be disregarded.

[4] I also note that the RSEIS2 attempts to minimize the description of impacts on wetlands. For vegetated wetlands, it only discusses as wetland impacts those that would be directly filled, disregarding the elimination or substantial reduction in flooding of thousands of acres of forested and other vegetated wetlands. For farmed wetlands, it claims that only a few hundred acres count even though the Corps' own hydrologic analysis indicates thousands of acres of cropped areas meet the 15-day inundation requirement. Under the 1987 wetland manual used by the Corps, this kind of direct hydrologic analysis establishes wetland hydrology.
[5] This report explicitly addresses wetland mitigation. However, it

Zedler Response 3: The proposed mitigation not only fully offsets impacts on aquatic resources but overcompensates for most resources. Please refer to Tables 2.2 and 2.7 in

the RSEIS 2. The numbers are based on sound scientific principles and professional opinion from an interagency team of scientists that are familiar with ecological resources in the project area.

The comment states that the proposed mitigation is inconsistent with established practice under the Section 404 program. The proposed mitigation over-mitigates in comparison to what is typically required under the Section 404 program. Section 404 does not regulate impacts to or require mitigation for impacts to prior converted cropland (See http://www.mvm.usace.army.mil/regulatory/regulations/clean_water.htm). The current mitigation proposal compensates for all significant unavoidable impacts to fish and wildlife including direct impacts from channel widening and deposition into waters of the United States and indirect impacts from reduced flooding, whether on jurisdictional wetlands or prior converted cropland. All compensatory mitigation for impacts to waters of the United States, including jurisdictional wetlands, is consistent with, and in most cases exceeds, the Section 404(b)(1) Guidelines.

The claim that mitigation "is so outside the range of reasonable scientific understanding that it cannot be seriously advanced as science-based" is unfounded. The habitat models were based on relevant science that was conducted within the study area and the Lower Mississippi River. Additionally, the habitat models were agreed to by the mitigation team and experts who have visited the study area and are familiar with the existing habitat (2002 RSEIS Section 5).

The fourth footnote incorrectly states that the RSEIS 2 attempts to minimize the description of impacts on wetlands. All direct and indirect impacts to wetlands were appropriately analyzed (See 2002 RSEIS Section 5). All direct and indirect impacts (*i.e.*, due to channel widening and fill and due to a reduction in backwater flooding) to jurisdictional vegetated wetlands, farmed wetlands, and prior converted cropland were analyzed by the fish spawning and rearing HEP. Additional impacts due to a reduction of flooding were analyzed by the U.S. Fish and Wildlife Service's Waterfowl Assessment Methodology. As the Corps has made clear, the Corps is not mitigating based on wetland jurisdictional status but on significant unavoidable impacts to fish and wildlife resources due to reduced inundation from the project operation.

Zedler Comment 4:

> My comments draw heavily on a 2001 report by the National Research Council of the National Academy of Sciences, *Compensating for Wetland Losses Under the Clean Water Act*, prepared by a panel that I chaired. [5] This report has been broadly embraced by the U.S. Army Corps of Engineers, which issued a memorandum to the field in 2003 highlighting key recommendations, reaffirming them, and calling the recommendations of this report either a "basic requirement for mitigation success" or a "guide for mitigation site selection." U.S. Army Corps of Engineers, Memorandum to the Field on Adaptation of NAS Guidelines (Oct. 29, 2003).

Zedler Comment 4 (continued):

[5] This report explicitly addresses wetland mitigation. However, the same scientific principles apply to any mitigation activity required to offset impacts on aquatic ecosystems, including floodplain habitat for fish whether or not they qualify as wetlands. The Clean Water Act Section 404(b)(1) guidelines require that impacts on fish habitat be offset in general, as well as impacts on wetlands.

Zedler Response 4: The report *Compensating for Wetland Losses Under the Clean Water Act* (2001) was extensively used as a guide during the formulation of compensatory mitigation.

The October 29, 2003 memorandum to the field is titled Model "Operational Guidelines for Creating or Restoring Wetlands that are Ecologically Self-Sustaining" for Aquatic Resource Impacts Under the Corps Regulatory Program Pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act. This guidance is intended to serve as a technical support for 404 permit applicants preparing compensatory mitigation plans to offset impacts to aquatic resources authorized under the Clean Water Act Section 404 and the Rivers and Harbors Act Section 10 programs. This Civil Works project has followed the Section 404(b)(1) Guidelines and implemented NAS' ten recommendations to the extent practical to achieve justifiable mitigation and not violate Federal law, specifically WRDA 1986, 906(b)(1). These recommendations are the following:

A.1. Wherever possible, choose wetland restoration over creation.

Restoration of bottomland hardwoods, including hydrology, comprises the vast majority of the proposed compensatory mitigation features. The project area was historically bottomland hardwood wetlands. However, the overall majority of the historical bottomland hardwoods have been cleared, and the wetlands drained and leveled to provide for agricultural production. Restoration will return these areas to pre-agricultural conditions where possible.

Additionally, even though restoration of floodplain lakes is not intended to compensate for wetland impacts, compensatory mitigation may include restoration of floodplain lakes, in particular Riley Lake, to historical conditions.

A.2. Avoid over-engineered structures in the wetland's design.

The wetland mitigation features will not rely on over-engineered structures. Because the goal of the Corps' proposal is to restore historic wetlands and not to create wetlands where they did not exist before, only simple engineering is required in most cases. However, the project area has been modified so extensively due to decades of intense

farming that some engineered structures are a necessity in some mitigation features to replace lost hydrology. See Zedler Response 6.

The Corps will take advantage of engineered structures that are a necessary part of the project including the borrow pits and the sumps behind the levee closures. A spawning and rearing pool for fish will be created behind the Floodway closure and borrow pits will be engineered to create shallows, deep areas, islands, and sinuous shorelines.

A.3. Restore or develop naturally variable hydrological conditions.

Compensatory mitigation features include the restoration of variable hydrological conditions. Restoration of hydrology to Big Oak Tree State Park encompasses a significant portion of the overall mitigation plan. Restoring the hydrology to Big Oak Tree State Park will significantly restore bottomland hardwood habitat to pre-frontline levee conditions (See RSEIS 2 Sections 2.6.1.5 and 5.2.2.4). Additionally, most mitigation features include the restoration of hydrology to the extent practical (See RSEIS 2 Section 5.2). Further discussion concerning this specific NAS recommendation is found in Zedler Responses 5-9.

A.4. Consider complications associated with creation or restoration in seriously degraded or disturbed sites.

The project area is a degraded environment due to decades of intense agricultural practices. Detailed coordination with the interagency mitigation team is being undertaken to develop, implement, and monitor mitigation. Coordination will include overall site selection, methods to control invasive species, methods to promote natural rates of redevelopment, and methods that achieve maximum benefits to fish and wildlife resources.

A.5. Conduct early monitoring as part of adaptive management.

Monitoring is a critical element of the overall mitigation strategy. Monitoring includes an assessment of baseline conditions (RSEIS 2 Section 6.5). All mitigation areas will be monitored to ensure that the sites are functioning as designed. Aspects of monitoring mitigation sites will be formulated during the development of the site-specific detailed mitigation plans that will be coordinated with the interagency mitigation team. This is a requirement of the water quality certification (RSEIS 2, Appendix G, Water Quality Certification, Paragraph 3).

Additionally, aquatic biological communities, freshwater mussels, jurisdictional wetlands, fish passage, and fish spawning and rearing habitat will be monitored throughout the project area to ensure that impacts to fish and wildlife resources were properly modeled and that compensatory mitigation techniques are effective. Overall mitigation will be adjusted through adaptive management as necessary (RSEIS 2 Section 7).

B.1. Consider the hydrogeomorphic and ecological landscape and climate.

The Corps intends to provide compensatory mitigation within the project area. The project area was historically bottomland hardwood wetlands. The proposed bottomland hardwood restoration is suited to the area's hydrology, soils, ecology, and climate. Therefore, bottomland hardwood restoration, including restoration of hydrology, makes up the majority of compensatory mitigation acreage. Hydrogeomorphic considerations will be addressed in the formulation of site-specific detailed mitigation plans. These considerations include reversing the practices of intense agricultural production. This will include the restoration of hydrology to the extent feasible by removal of farm drains, plugging drainage ditches, and restoring microtopography to a more heterogeneous condition.

B.2. Adopt a dynamic landscape perspective.

The October 29, 2003 memorandum to the field states the following:

> Consider both current and future watershed hydrology and wetland location. Take into account surrounding land use and future plans for the land. Select sites that are, and will continue to be, resistant to disturbance from the surrounding landscape, such as preserving large buffers and connectivity to other wetlands. Build on existing wetland and upland systems. If possible, locate the mitigation site to take advantage of refuges, buffers, green spaces, and other preserved elements of the landscape. Design a system that utilizes natural processes and energies, such as the potential energy of streams as natural subsidies to the system. Flooding rivers and tides transport great quantities of water, nutrients, and organic matter in relatively short time periods, subsidizing the wetlands open to these flows as well as the adjacent rivers, lakes, and estuaries.

A dynamic landscape perspective has been adhered to throughout mitigation planning. Compensatory mitigation includes the restoration of 64 miles of buffer strips on New Madrid Floodway channels and the creation of a wildlife corridor that will connect two of the most critical remaining habitats within the New Madrid Floodway (Big Oak Tree State Park and Ten Mile Pond Conservation Area). Additionally, compensatory mitigation includes restoring hydrology to Big Oak Tree State Park and acquiring 1,800 acres of cropland surrounding the park that will be restored to bottomland hardwood habitat.

B.3. Pay attention to subsurface conditions, including soil and sediment geochemistry and physics, groundwater quantity and quality and infaunal communities.

The Corps' mitigation strategy is to restore the mitigation sites to conditions that more nearly approximate historic conditions. Since the strategy restores formerly existing conditions rather than attempts to create new conditions, the project area should be receptive to the planned activities. Nevertheless, subsurface conditions will be analyzed once potential mitigation tracts are identified. Compensatory mitigation will include planting appropriate vegetation that can thrive in the existing soils and tolerate the expected flood frequency and duration of the site. Detailed mitigation plans will be closely coordinated with the interagency mitigation team and will rely on expert judgment from those with experience in mitigation/restoration efforts in the project area.

B.4. Pay particular attention to appropriate planting elevation, depth, soil type, and seasonal timing.

Section 5.2.2.1 of the RSEIS 2 provides mitigation measures that will be adhered to for restoration of bottomland hardwoods. Appropriate vegetation to be planted in mitigation sites will be coordinated with the interagency mitigation team and be based upon reference sites in the project area. Vegetation will be planted at the appropriate time of the year and undergo annual maintenance until it has become established.

B.5. Provide appropriately heterogeneous topography.

The project area can be considered a homogenous topographical landscape due to the clearing, leveling, and draining that has been conducted to provide for agricultural production. Compensatory mitigation includes measures to restore a more heterogeneous landscape. See Zedler Responses 7 and 8.

Additionally, the NRC (2001) lists five wetland functions that warrant attention. These functions have received a great deal of attention in the development of compensatory mitigation for the proposed St. Johns Bayou and New Madrid Floodway Project.

(1) Hydrologic Function – The basic mitigation feature includes bottomland hardwood restoration on a minimum of 6,356 acres (1,293 acres in the St. Johns Bayou Basin, 2,326 acres in the New Madrid Floodway, 671 acres of vegetated buffer strips, 266-acre wildlife corridor, and 1,800 acres surrounding Big Oak Tree State Park – see RSEIS 2 Table 2.2). There will likely be more acres of bottomland hardwood restoration with the inclusion of the additional mitigation techniques that restore mid-season fish rearing habitat (see RSEIS 2 Table 2.7). Bottomland hardwood restoration includes restoration of hydrologic conditions to the extent justified (*i.e.,* hydrologic restoration will include reasonable measures that are cost effective without inducing economic damages to adjacent landowners). This includes removal of farm drains, plugging drainage ditches, and constructing microtopography to mimic reference areas. These measures will ensure that jurisdictional wetland hydrology will meet the jurisdictional hydrology criterion as outlined in the 1987 Wetland Delineation Manual and reaffirmed by NRC (2001). Hydrology of most sites will be well above the

minimum threshold due to existing soil types, frequency of over-bank flooding, precipitation rates, high groundwater table, planned microtopographical features, and planted vegetation.

Additionally, a major component of the basic mitigation feature includes restoration of hydrology to Big Oak Tree State Park. This feature will restore the park's hydrology and preserve and restore historic vegetation and biological communities to natural conditions to the extent practical.

As the NRC (2001) report recommends, hydrologic functions will be a critical restoration component for all wetland mitigation.

(2) Water-Quality Improvements – NRC (2001) states that it is entirely possible for the restored or created site to have water-quality functions superior to those of the impacted site. Additionally, the report states, "If a mitigation site is restored riparian wetland located between a stream and a non-point pollution source (either urban or agricultural) the mitigation wetland will have a water-quality function superior to the impact site." The proposed mitigation entails 64 miles of riparian buffer strips along New Madrid Floodway streams. An additional riparian wildlife corridor will be established between Big Oak Tree State Park and Ten Mile Pond Conservation Area. These activities are precisely what the NRC (2001) report recommended and will provide the water quality improvements noted.

(3) Support of Vegetation – NRC (2001) states that wetlands fail to support plant biodiversity when the environment is extremely hostile or when one or a few species dominate the site. Invasive species control has been incorporated into the mitigation plan. Black willow, although a native species, can become established on mitigation sites and can out-compete more desirable planted vegetation. Potential mitigation sites will remain in agricultural production primarily to control black willow until the site can be properly prepared and planted to the desired plant community.

Species to be planted on mitigation sites will depend on site-specific hydrologic conditions. Species to be planted will be determined during the formulation of the site-specific mitigation plan with input from the interagency team. Sites will have to be prepared to promote vegetation. Areas may have to be deep-disked or a sub-soiler may have to be used to break up the hard pan that has resulted from decades of intense agricultural production. Routine maintenance will be conducted on reforested mitigation sites to control invasive species as necessary.

As stated in the NRC (2001) report, the support of vegetation will be accomplished on proposed mitigation sites.

(4) Habitat Supports for Fauna – The NRC (2001) report stated that none of the compensatory mitigation projects visited by the committee included design evaluation criteria for animals. However, all proposed mitigation for the St. Johns Bayou Basin and New Madrid Floodway Project has extensively modeled and designed mitigation based on a variety of animal habitats including terrestrial resources that represented guilds of all mammals, birds, amphibians, and reptiles that are found throughout the complete range of habitats in the project area (See RSEIS 2 Sections 4.3.3 and 5.5). Mitigation for waterfowl resources was based on dabbling ducks that make up a significant percentage of migration numbers in the project area which is a part of the Mississippi Flyway (See RSEIS 2 Sections 3.3.2, 4.3.4 and, 5.6; and 2002 RSEIS Appendix E). Shorebird habitat mitigation was based on likely changes to agricultural practices (See 2002 RSEIS Appendix E), and fish habitat mitigation focused on the mid-season rearing impacts (See RSEIS 2, Sections 4.3.1 and 5.4, and 2002 RSEIS Appendix G).

The NRC (2001) report also emphasized the importance of considering migratory pathways and upland buffers in the design of a compensatory mitigation plan. The proposed mitigation plan includes the establishment of a wildlife corridor that will connect Big Oak Tree State Park to the Ten Mile Pond Conservation Area (see RSEIS 2 Section 2.6.1.4). Due to the intense farming in the project area many species of wildlife are isolated to these two tracts of state owned and managed lands. It is likely that there is little movement of wildlife populations between the two areas. The wildlife corridor will allow for wildlife migrations/movement (*i.e.*, numerous species of reptiles and amphibians; large mammals such as white-tailed deer, fox, mink, etc.; and numerous avian species such as wild turkey, waterfowl, and neotropical migrants) as recommended in the NRC (2001) report.

(5) Soil Functions – Many of the recommendations in the NRC (2001) report concerning soils will not be a critical factor in the restoration of wetlands because much of the soil in the project area is hydric that is well suited for wetland restoration. However, as previously stated, the existing soils have been leveled and have had years of intense agricultural production. All mitigation sites will be prepared to reverse the effects of years of farming. Preparation includes deep disking/sub-soiling and the creation of microtopography.

Zedler Comment 5:

1. Inconsistency with Accepted Understanding of the Importance of Natural Hydrology

Aquatic and wetland ecologists agree that natural hydrologic patterns are critical to the ecological functions of rivers and wetlands. In a report on riparian areas that include floodplains, the National Research Council has called hydrology the "master variable" in driving the ecology of river riparian areas, whose key components include not just broad averages but magnitude of water, frequency, duration, timing and rate of change. National Research Council, Riparian Areas, Functions and Strategy for Management (2002).

Zedler Comment 5 (continued):

The focus on preserving and or restoring natural hydrologic patterns reflects humility about the limits of our understanding of the role played by each variable for different ecological functions and hard-taught lessons about how alterations of natural hydrology have often had strong effects that were not well understood. For example, disruption of natural flow patterns, and the timing and amount of wet and dry conditions, of Florida's Everglades are believed to be the root cause of the great declines of its fish and wildlife, and the restoration of these natural patterns of flow is the principal goal of a more than $8-billion restoration plan authorized by Congress. The disruption of natural hydrology caused by levees is believed to be the root cause of the disappearance of more than a million acres of wetlands in coastal Louisiana and a significant contributor to increased hurricane damages. The Corps has proposed an even more expensive plan to restore natural hydrology to reverse the losses of these wetlands. And while these are two of the most high-profile examples of unintended negative consequences of altering natural hydrological conditions, hundreds of papers on rivers and wetlands have demonstrated adverse ecological consequences from hydrologic alteration for countless other rivers and wetlands. Numerous other papers have demonstrated that efforts to restore wetland and river habitat without restoring natural hydrologic patterns nearly always fail to reproduce key aquatic functions.

For this reason, the report of the National Research Council of the National Academy of Sciences, prepared by the committee that I chaired, strongly emphasized the importance of naturally variable hydrological conditions. One of the major guidelines it set forth for wetland mitigation was as follows:

> "Restore or develop naturally variable hydrological conditions. Promote naturally variable hydrology, with emphasis on enabling fluctuations in water flow and level, and duration, and frequency of change, representative of other comparable wetlands in the same landscape setting." NRC, Compensating for Wetland Losses Under the Clean Water Act p. 125 (2001).

The report also stated, "Hydrology is most often cited as the primary driving force influencing wetland development, structure, functioning, and persistence. Proper placement within the landscape of compensatory wetlands to establish hydrological equivalence is necessary for wetland sustainability." Ibid p. 45. Elsewhere, the report stressed, "Hydrological variability should be incorporated into wetland mitigation design and evaluation. . . . Hydrological functionality should be based on comparisons to reference sites during the same time period." Ibid p. 45. The reference to "reference sites" is to provide a mechanism for imitating natural hydrology.

Zedler Comment 5 (continued):

The Corps has officially embraced this recommendation in its 2003 Mitigation Memo. This memo states: "Natural hydrology is the most important factor in the development of successful mitigation. Wetlands and other waters are very dynamic, and dependent on natural seasonal and yearly variations that are unlikely to be sustainable in a controlled hydrologic environment." This memo goes on to refer to our recommendation to establish natural hydrology as a "basic requirement."

The Corps' claim for this project that the loss of a vast area of seasonally flooded aquatic habitat could be replaced by unnaturally extended flooding on a small area of already existing wetlands would be an extreme example of what the NRC report recommended against.

Zedler Response 5: Please see the discussion of "artificial" vs. "natural" flooding in Zedler Response 8 below and Response to Sparks Comment 4. For a discussion of replacement of a "vast area of seasonally flooded aquatic habitat" with "a small area of already existing wetlands," see Zedler Response Comment 2 above and Bohlen Response 63. Creation of a spawning and rearing pool for fish is only a part of the overall mitigation plan. Creation of a spawning and rearing pool will extend flooding over the entire 45-day mid-season fish rearing period in most years. This action will result in significant gains to mid-season fish rearing habitat. It is not appropriate to take a narrow view and only look at one part of overall mitigation and make the claim that the overall mitigation strategy is an extreme example of what the NRC report recommended against.

As recommended in the NRC (2001) report, natural hydrology is being promoted to the extent justified (See Zedler Response 4, Paragraph (1) Hydrologic Function) in the potential mitigation sites (See Zedler Response 4, Paragraph A.3 above). The guidelines have been used extensively throughout mitigation formulation. Compensatory mitigation features also include the restoration of a minimum of 6,356 acres of bottomland hardwoods, creation of moist soil units, and the restoration of hydrology to Big Oak Tree State Park.

As stated in Section 5.2.2.1 of the RSEIS 2 forested wetland mitigation will include (1) the restoration of hydrologic functions to the extent practical. This may be accomplished by removing existing farm drains or plugging drainage ditches; (2) preparation of the area for vegetation through deep disking or the use of a sub-soiler; and, (3) creation of microtopography based on the geomorphic setting. Dimensions will be based on patterns that occur in nearby reference sites. These practices are consistent with the NRC's recommendations.

Mitigation in shorebird areas (See RSEIS 2 Section 5.2.2.2) will involve the use of groundwater pumps to provide the desired hydrology in the area. These areas are designed to be intensively managed to promote the desired output for shorebirds and waterfowl. However, the overall design of shorebird areas is modified to allow for natural hydrology. This modification includes degrading the perimeter levee to allow out of bank flood events (and fish) to enter the area. Shorebird areas will be managed in a similar fashion to existing moist soil units in the Ten Mile Pond Conservation Area.

The hydrologic restoration of Big Oak Tree State Park (See RSEIS 2 Section 5.2.2.4) will provide natural hydrology to the park and additional 1,800 acres of reforested cropland that will be acquired. This significant portion of compensatory mitigation will restore hydrological conditions in a fashion that the NRC (2001) report recommended.

Zedler Comment 6:

Related to the biological importance of natural hydrology is a strong recommendation against the reliance on engineering structures even to establish natural hydrology, let alone to distort it. Our report discussed problems with use of engineering structures to establish hydrology, and stated "natural hydrology should be allowed to become reestablished rather than finessed through active engineering devices to mimic a natural hydroperiod," i.e., naturally variable hydrology. The Corps has accepted this recommendation as well, and writes in its memo regarding adoption of NAS recommendations, "Artificial structures and mechanisms should be used only temporarily. Complex engineering and solely artificial mechanisms to maintain water flow normally will not be acceptable in a mitigation proposal."

Because the Corps' proposed mitigation relies on these kinds of artificial engineering structures, not just for fish but also for waterfowl and shorebirds, this proposed mitigation also violates these established principles.

Zedler Response 6: See Zedler Responses 4 and 5 above for a detailed discussion of how this recommendation was implemented in the RSEIS 2. The Corps acknowledges that engineering structures will be necessary to achieve the desired output in some cases. In fact, a "complex" engineering structure is critical to restore natural hydrology to Big Oak Tree State Park. The past impacts to the project area are so extensive that some engineering will be required at most mitigation sites. These past impacts are attributed to Corps projects (*e.g.*, construction of the Mississippi Mainline Levee System) and non-Corps projects (*e.g.,* wide scale channelization of natural waterways, clearing large tracts of bottomland hardwoods, leveling of virtually all topographical features for farming, excessive drainage, etc). However, as recommended by the NAS report, over-engineered structures have been avoided. Most engineered structures will be very simple, such as perimeter levees, drain plugs, stop-logs, and groundwater pumps (moist soil areas).

As an example, bottomland hardwood restoration will rely on natural hydrology to the extent practical. However, restoration measures will have to ensure that adjacent properties are not inadvertently flooded. Therefore, perimeter levees may have to be established around mitigation sites and existing drainage may have to be re-routed.

Engineering structures will be a necessity in the restoration of floodplain lakes, such as Riley Lake. Local interests excavated the outlet of Riley Lake in the past to promote agricultural production in the area. This excavation resulted in a lower lake elevation and thus decreased fish habitat (See RSEIS 2 Section 2.6.2.3). A simple engineering structure, such as a rock weir, will be required to plug the modified outlet of the lake to restore surface water elevations and fish habitat.

The Corps will take advantage of engineered structures that are necessary to the project as set out in Zedler Response 4, Paragraph A.2 above, such as using the operation of the levee closure to create the spawning and rearing pool. The NRC (2001) report states, "Avoid hydraulic control structures and other engineered structures that are vulnerable to chronic failure and require maintenance and replacement." The closure levee and associated outlet gates are the critical components of the flood damage reduction project and these structures will be built to appropriate engineering design that limits vulnerability and failure. These areas will also undergo routine monitoring and maintenance to ensure they are functioning as designed. Required maintenance will be conducted as necessary to maintain the integrity of the levee system. It is highly unlikely that the structure will be vulnerable to chronic failure. Therefore, it is highly likely that the creation of spawning and rearing pool will provide the expected mitigation benefits to mid-season fish rearing habitat.

Zedler Comment 7:

The importance of preserving or reestablishing natural hydrologic variability is closely related to the importance reflected in landscape position. The NRC report notes that "[l]andscapes have natural patterns that maximize the value and function of individual habitats." The report also encourages the preservation of "large buffers and connectivity to other wetlands," and generally recommends locating mitigation sites in comparable landscape positions and with comparable hydrology as the impact site. NRC Report p. 124. Noting that "slight differences in topography," i.e., elevation, have major impacts on hydrology and resulting plants and animals, the report also calls for providing "appropriately heterogeneous topography." Ibid p. 127. The Corps has endorsed this recommendation as well in the 2003 Mitigation Memo. For example, it writes, "attempting to place mitigation in a dissimilar ecological complex than that of the impact water is expected to result in a wetland/water unlikely to replace the

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functions of the wetland/water that was lost." Memo p. 6. It also emphasizes the need for varied topography Memo p. 8-9.

For this project, the Corps has proposed to create small areas to be managed in uniform ways as replacement for lost functions on an extensive expanse of wetlands and floodplain habitats with varied topography, extensive contiguity and, for much of the land, open hydrologic connectivity. This proposal violates the NRC panel's recommendations as well.

Zedler Response 7: See Response to Zedler Comment 4 above. The comment is inaccurate in three ways.

(1) There is no extensive expanse of wetlands under pre-project conditions. Please refer to Table 3.1 and Figure 4 of the RSEIS 2. There are extensive expanses of soybean fields, not wetlands (See RSEIS 2 Figures 4 – 17). NRCS has stated that 0.4% of this farmland is classified as farmed wetlands (See RSEIS 2 Sections 4.2.1 and 4.5.1).

(2) The Corps concurs that it is floodplain habitat; however, the floodplain consists of leveled farmland. Most of the historical characteristics of floodplains such as bottomland hardwoods, varied topography, and a network of streams, bayous, and wetlands have been cleared, plowed, leveled, and drained to promote production of agricultural commodities (RSEIS 2, Figures 4-17).

(3) The only extensive contiguous habitat within the project area is cleared farmland. Existing high valued habitat in the New Madrid Floodway consists of Big Oak Tree State Park, Ten Mile Pond Conservation Area, and the Bogle Woods tract that the Corps has acquired for compensatory mitigation, but these areas are not contiguous under pre-project conditions (RSEIS 2, Figures 1-17).

The open hydrologic connectivity that is currently found in the project area consists of the 1,500-foot gap and a network of channelizied drainage ditches.

The Corps concurs with the NRC report and intends to implement its recommendations on the majority of mitigation sites. The mitigation plan recommends 64 miles of buffer strips and a wildlife corridor to create contiguous habitat. Furthermore, the Corps intends to establish microtopography to create heterogeneous topography (See RSEIS 2 Section 5.2.2.1) and conduct mitigation activities in the project area as the NRC report recommends.

The Corps does propose to manage relatively small areas in uniform ways to replace lost functions to fish and shorebirds (RSEIS 2, Section 2.6.1.2).

Zedler Comment 8:

The rationale for the NRC panel's recommendations applies fully to the proposed project. The project area, according to the 2002 EIS, supports a wide range of fish, bird and amphibian species. These diverse species will use different kinds of habitats affected heavily by variable flood regimes, are adapted to take advantage of natural flood variability, and will therefore benefit from different aspects of that natural hydrology. Artificial flooding, even if it were to benefit some species, will almost certainly disadvantage others. The levees and water control structures designed to achieve ponding will obviously serve to obstruct fish passage. Extensive flooding over a large number of acres for many days, as occurs today, will also do more to trigger water quality filtration functions than somewhat longer flooding over a very small number of acres. Existing flooding will create a range of microhabitats, and interactions between floodplain and stream networks, that could not be mimicked by extended ponding on a small number of acres. The NRC has recommended the importance of these variations in microhabitat explicitly on floodplains:

> "River-floodplain systems have a lateral structure that begins at the main channel and progresses through undefeated and vegetated channel borders and floodplain habitats (backwaters and seasonally flooded vegetation types. Backwaters and large-scale eddies provide refuges from the high velocities and colder winter temperatures of the main channel. Within each of the border and floodplain areas, there are distinct patches, usually determined by small differences in land elevation, that in turn determine the period of inundation (or water depth, in permanently flooded areas) and soil saturation."

National Research Council, Restoration of Aquatic Ecosystems p. 181 (citation omitted). The NRC emphasized the importance of this patchiness, writing that "restoration necessarily involves maintenance or recreation of the original patchiness." p. 183, and emphasizing that floodplain connectivity is critical because "[a]nother way in which the character of rivers is drastically altered is by cutting off interactions with the riparian zone and floodplains." Ibid p. 169.

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Zedler Response 8: The backwater flooding that occurs within the New Madrid Floodway cannot be described as "natural." The backwater flooding is due to the

construction of the Mississippi River Mainline Levee System. Flooding backs into the Floodway from a 1,500-foot gap in the levee system. The area would experience Mississippi River headwater or overland flooding, as presently occurs in the batture area, if it were not for this levee. See Responses to Sparks Response 4 and Bohlen Responses 26.

Additionally, virtually every water course has been channelized and the vast majority of the area's bottomland hardwood wetlands have been drained, cleared, leveled, and are intensively farmed (RSEIS 2, Figures 4-17). As the 2002 RSEIS states, the area still supports a wide range of fish, bird, and amphibian species. However, the species residing in the project area are not dependent upon a natural flooding regime; they are adapted to a highly modified environment that is characteristic of intense farming and habitat fragmentation. Compensatory mitigation, including the creation of a spawning and rearing pool, will significantly benefit the remaining fish and wildlife resources found in the project area.

The comment concerning "artifical flooding" is misleading since all flooding; natural or artificial adversely impacts some species. The Corps intends to flood areas to mimic natural hydrology and to provide significant habitat for fish and wildlife resources. The Corps intends to prolong flooding events in the sump area to create a stable spawning and rearing pool for fish. Additionally, groundwater pumps will be used to ensure that moist soil management areas are flooded. Flooding both of these areas will result in significant gains to fish and wildlife habitat. Obviously, prolonged flooding on farmland may impact some area species that thrive in soybean fields. However, this effect is not significant and mitigation is not intended for these species. Mitigation is intended to enhance populations that naturally occur or have historically occurred in the project area.

The closure gates in the St. Johns Basin or the New Madrid Floodway will be operated to allow for fish passage while providing the economic benefits to the area (See Sparks Responses 6-9).

The Corps' mitigation will improve water quality in the project area. See RSEIS 2 Section 5.3 and Woltemade Responses 5 and 7.

The Corps acknowledges the importance of floodplain variation and microhabitat as cited in the NRC report (1992). However, these variations are found only to a very limited extent in the New Madrid Floodway. There are very small differences in land elevations because the majority of land has been leveled for agriculture. Additionally, the area has extensive drainage features that remove floodwaters very efficiently after floods recede. Therefore, the distinct patches the comment mentions are already largely absent from the project area. Proposed mitigation entails creating these distinct patches as the NRC report emphasizes. This will be accomplished by removing drains, plugging ditches, and creating microtopography that will result in converting thousands of acres of homogenous soybean fields into highly functioning bottomland hardwood habitat with

heterogeneous topography and patches (RSEIS 2 Section 5.2.2.1 and Zedler Response 4 above).

Zedler Comment 9:

> There is also the real risk of a range of additional unintended adverse environmental consequences. Artificially prolonged flooding could also result in a range of biochemical impacts that are hard to anticipate. In the face of the limitations of our understanding, and the repeated demonstration that alterations to natural hydrologic variability tend to have highly adverse consequences, the accepted understanding is that mitigation and other forms of environmental restoration should focus on reestablishing natural hydrologic variability.

Zedler Response 9: As previously stated, there is little remaining natural hydrologic variability in the New Madrid Floodway (See Zedler Response 8 above). Mitigation activities will accommodate hydrologic variability to the extent practical (see Zedler Response 4 Paragraph (1)). Mitigation activities will be monitored to ensure that they are producing the desired outcomes. Through adaptive management, mitigation activities may be modified in the event of unanticipated (and the Corps believes unlikely) biochemical impacts. Additionally, monitoring will also determine any other impacts such as unanticipated impacts to jurisdictional wetland status, bottomland hardwood survivability, aquatic biological communities, and fish access.

Monitoring is a requirement of the WQ Certification. The certification states that "[i]f monitoring reflects that any additional wetland acres are impacted by the project (other than those already planned for mitigation), additional mitigation shall be required." (See RSEIS 2 Appendix G, Water Quality Certification, paragraph 5 a).

It is interesting to note that creation of a spawning and rearing pool could result in a range of biological and biochemical improvements that are also hard to anticipate. Creation of a spawning and rearing pool will take a significant amount of agricultural land out of production. The generally accepted understanding is that taking farmland out of production usually results in environmental benefits. As an example, taking farmland out of production usually results in benefits to water quality due to a reduction of fertilizer application and reduced soil erosion. Additionally, depending on vegetation present, creating a spawning and rearing pool will most likely create additional areas for shorebirds. Monitoring will also quantify these unanticipated benefits.

Zedler Comment 10:

> In this matter, the Corps has proposed to do the opposite of these recommendations. It would dramatically reduce or eliminate flooding according to a relatively natural pattern on tens of thousands of acres of wetlands and other valuable floodplain areas, and replace them primarily by artificially manipulating the hydrology on a small number of acres of already existing wetlands. According to established understanding, that mitigation should itself be viewed as harmful, and according to accepted scientific understanding, it cannot offset the impacts of this project.

Zedler Response 10: See Zedler Response 4 above. As previously stated, there are not tens of thousands acres of wetlands in the project area. The project will reduce or eliminate backwater flooding on thousands of acres of soybean fields (See RSEIS 2 Figures 4-17). Utilizing NRCS' estimate of farmed wetlands in the project area, there are a total of 8,940 acres of wetlands below an elevation of 300 feet NGVD, which corresponds to a 30-year event. See Zedler Responses 1 above. For a response to the "small number of acres of mitigation" assertion, see Sparks Response 21.

This mitigation proposal cannot reasonably be considered "harmful" considering any reasonable examination of the facts. See Sparks Response 22. Wetland mitigation alone will convert a minimum of 7,121 acres of cropland (prior converted) into jurisdictional wetlands (RSEIS 2 Section 5.2) resulting in a net increase of 6,499 acres of jurisdictional wetlands. As stated in Section 2.6.1 of the RSEIS 2, mitigation includes reforesting 3,619 acres of cropland, creating 765 acres of moist soil units, restoring vegetative buffer strips along 64 miles (671 acres) of channels, creating a 266-acre wildlife corridor, and reforesting 1,800 acres of cropland surrounding Big Oak Tree State Park. Additionally, compensatory mitigation involves restoration of hydrology to Big Oak Tree State Park. The additional mitigation techniques that are intended to compensate for mid-season fish rearing impacts will most likely increase the overall acreage and functions of restored wetlands. As seen in the previous responses, mitigation measures comply with the NRC's recommendations.

Zedler Comment 11:

2. Inappropriate Use of Habitat Models

A related flaw with the Corps analysis is its misuse of its habitat models, which go under the general category of Habitat Evaluation Procedures or HEP. By using these models to quantitatively estimate mitigation acreage requirements for dramatically different kinds of habitat under dramatically different hydrologic conditions, the Corps has used these models beyond any scientifically accepted level.

HEP models attempt to evaluate habitat for animals on the basis of very few criteria. For example, the fish model used by the Corps for this project is based entirely on numbers of average daily flooded acres and the different kinds of vegetation on those acres. In and of itself, it does not factor in such obviously critical factors as extent of contiguous habitat, hydrologic variability, microhabitats, temperature, water velocity, relationships among habitat types, and conditions under extreme flooding or drought. It also ignores the values of habitat diversity for the broad range of species being evaluated.

Because of their simplicity, HEP models have generally come into disrepute, particularly if used for more than one target game species. The HEP models for this report are intended to cover a range of species that in reality have different needs. Thus, when the National Research Council evaluated analytical tools for wetland mitigation, it noted that HEP models have often been used in the past, but did not recommend their continued use. *Compensating for Wetland Losses*, ch. 7. The National Research Council has recommended the use of

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assessment techniques that meet eight conditions, few of which are met by HEP models.[6]

Zedler Comment 11 (continued):

> [6] Key recommendations include that the assessment technique "includes reliable indicators of the important wetland processes (hydrology, sedimentation and primary production)"; that it "incorporates effects of position in landscape"; that it "assess all recognized functions"; that it is "sensitive to changes in performance over a dynamic range" (such as differences in conditions in both very large and very small floods). *Compensating for Wetland Losses* p. 136-137. None of these conditions is met by the HEP models used by the Corps for this project. The RSEIS2 also provides a separate analysis using a different wetland assessment model, the so-called HGM. But there is no need to address the results of this model, since it assessed only the direct filling of vegetated wetlands, and therefore disregarded the thousands of acres of vegetated wetlands that would be impacted through drainage, and it also assessed only a small number of acres of cropped wetlands.

Zedler Response 11: See Bohlen Response 28. HEP has been cited as applicable in all 50 states by the report referenced in the comment. Please refer to page 131 of *Compensating for Wetland Losses Under the Clean Water Act*.

> "Some procedures, such as habitat evaluation procedure (HEPs) (USFWS 1980, 1981, Sousa 1985), have become operationally codified in regulatory procedures as either required or recommended elements of wetland assessment. HEP was one of the two functional assessment procedure that Bartoldus (1999) considered applicable in all 50 states."

Contrary to the comment, the model did not account for contiguous habitat, hydrologic variability, microhabitats, temperature, water velocity, relationship among habitat types, and conditions under extreme flooding and droughts. The fishery HEP model did account for all of these conditions (See RSEIS 2 Section 4.3.1.1).

Impacts to fish spawning and rearing were quantified by Envirofish and HEP. Envirofish addressed overall landscape (farmland, fallow, bottomland hardwoods, large and small permanent waterbodies), hydraulics (depth and duration of flood events including extreme droughts and floods), and hydrological conditions (flows) over the 32-year period of record. Envirofish provided average daily flooded acres for the existing conditions of the project area and several project alternatives. HEP was used to assign a Habitat Suitability Index to the different habitat types produced by Envirofish. HSI values were assigned from evaluation species that were made up of distinct guilds of fishes common to the project area. Many factors went into the development of the HSI values that included life history of selected species (spawning and rearing requirements, timing of reproduction, temperature), field data from Lower Mississippi River Valley floodplains (Yazoo Basin, Mississippi), and professional opinion of an interagency team that is familiar with the project area (Delphi technique). Please refer to Appendix A of the RSEIS 2 for further information concerning Envirofish and HEP.

See Sparks Response 17 on the use of Envirofish and the availability of other models. Envirofish was specifically developed to compare different habitats and flood regimes within the 2-year floodplain. The Corps is not aware of any models that meet the recommendations referred to in footnote 6 and the commenter provides no alternatives. The Corps has already responded to the mischaracterization of "thousands of acres of vegetated wetlands that will be drained" mentioned in this footnote. See Zedler Responses 2 and 10 above.

For a discussion of artificial flooding see Zedler Responses 4-7 above. For a discussion of fish access, see Sparks Responses 6-9.

Zedler Comment 12:

To illustrate the problem, imagine an accurate model used to assess the number of annual calories needed by adults of different weights and heights. Such a model would not imply that adults would be equally healthy regardless of whether they received those calories through balanced meals or through candy bars. Neither would it imply that adults would be healthy whether they eat these calories in three meals a day or in one meal in a single day.

Zedler Response 12: Your illustration is noted. However, this simple illustration misses many points of the complex fish model. Envirofish and HEP accounted for many variables to account for fish habitat quantity, quality, transition periods, and availability that your simple illustration misses (see Response to Zedler Comment 11 above).

Zedler Comment 13:

There is no evidence that the fish HEP model was peer-reviewed. At best, the Corps is attempting to use a habitat model for fish that was developed by comparing sites with comparable hydrology and landscape to evaluate mitigation sites with completely different hydrology and landscape position. Even if the HEP model has validity when used properly, it lacks scientific validity when used in this manner.

Zedler Response 13: See Response to Zedler Comment 11 above and the references therein for a transferability discussion. The HEP model that was used to quantify impacts and develop mitigation for this project was developed by a consensus of fish and wildlife biologists from several resource agencies who are familiar with the project area. This RSEIS 2 calculates benefits from compensatory mitigation features precisely the same way in which impacts were quantified. The Corps has diligently sought review from responsible resource agencies such as USFWS, MDNR, and (See RSEIS 2 Section 8.4, last comment).

Zedler Comment 14:

> 3. Incorrect Understanding of Restoration
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> Restoring natural hydrology is considered to be a, and perhaps the, critical component of mitigation. But as the above discussion implies, artificial manipulation of one aquatic habitat, even if intended to benefit a particular target species, is not considered proper mitigation either by the National Research Council panel's report or by the Corps memo endorsing the panel's views. Artificial hydrologic manipulation is normally considered an environmental harm because even if, in some circumstances, it might benefit one particular species, it can have a range of adverse effects. The RSEIS 2 states (p. 40) that "[r]estoration usually involves replacing the existing habitat with another habitat that is of greater benefit to the target species." This is not an accurate representation of the field of ecological restoration. Rarely is a single species the target, and even if it were, it would not be considered "restoration" to replace thousands of acres of habitat by making a fraction of that area artificially wetter.

Zedler Response 14: For this project, compensatory mitigation will accommodate natural hydrology (See Zedler Responses 4-7). As previously stated, the overall compensatory mitigation proposed by this project involves many different aspects (such as reforestation, buffer strips, wildlife corridor, restoration of hydrology to Big Oak Tree State Park, moist soil units, and borrow pits) in addition to the creation of the spawning and rearing pool (See RSEIS 2 Table 2.2 and 2.7).

The Corps agrees that restoration does not usually involve a single species and the fisheries compensatory mitigation for this project included guilds of species intended to represent the majority of species present in the project area. The Final RSEIS 2 (page 40) has been modified to state that "Restoration usually involves replacing the existing degraded habitat with a habitat appropriate to the site that is of greater benefit to the target community."

Artificial hydrologic manipulation may be considered an environmental harm in some circumstances, such as the attempt to replace an upland ecosystem with a wetland. Such attempts are often unsuccessful. However, creation of a spawning and rearing pool in the sump of either the St. Johns Basin or New Madrid Floodway will take a significant amount of cropland out of production, plant appropriate vegetation that can tolerate the flooding regime, and significantly increase fish spawning and rearing habitat for fish. Additionally the spawning and rearing pool will offer greater amounts of habitat for amphibians, reptiles, birds, and mammals than the current frequently flooded soybean fields provide.

Additionally, restoration of a floodplain lake includes restoring the permanent water habitat. It is a natural phenomenon for floodplain lakes to gradually fill in and become terrestrial habitat. However, many floodplain lakes are "filling in" rapidly due to anthropogenic factors that are contributing to high sediment loads in the nation's

waterways. The LMRCC has published a list of potential restoration sites, including floodplain lake restoration similar to that which is proposed for Riley Lake.

Conversion of thousands of acres of predominantly cropland (See RSEIS 2 Figures 5-17) to areas such as reforested areas, borrow pits, restored floodplain lakes, buffer strips, wildlife corridors, and moist soil units that is of greater ecological significance to numerous fish and wildlife resources is considered to be an environmental improvement by the Corps and many individuals in the scientific community as well as the general public. See RSEIS 2 Tables 2.2 and 2.7.

Zedler Comment 15:

4. Failure to Specify Particular Mitigation Site or Other Attributes of Detailed Mitigation Plan

Virtually all assessments of wetland mitigation, as summarized in *Compensating for Wetland Losses Under the Clean Water Act*, have found that most wetland mitigation projects have shortcomings to differing degrees, in that the target wetland mitigation has not fully replaced the lost wetland area and functions. The reasons for their shortcomings include the fact that compensating for wetland losses is technically very challenging and subject to a range of difficulties for even the most promising projects. Another reason is that the degree of commitment to wetland mitigation sites tends to wane once the underlying project has gone forward. The degree and likelihood of a project achieving its stated objective depends on the characteristics of the proposed mitigation sites.

One of the questions addressed by the panel in *Compensating for Wetland Losses* was whether mitigation projects should therefore be completed prior to authorizing project impacts. The panel rejected this requirement on practical reasons, while noting that this level of certainty is one of the potential benefits of wetland mitigation banks. But the report emphasized the critical importance of providing a detailed mitigation plan before approval of project impacts. NRC Report p. 101.

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Review of a specific mitigation site and reasonably detailed restoration plans are critical to any assessment of the likelihood of mitigation compliance and the degree of that compliance. These are not minor details that can be resolved later. Given the challenges facing mitigation, there can be no legitimate determination that mitigation is likely to offset project impacts without this information. The NRC panel also recognized that mitigation ratios i.e., the amount of mitigation, needed to be adjusted to reflect the prospects for achieving compliance. NRC Report p. 150. That too cannot occur properly without detailed advance information about mitigation sites and restoration plans.

Zedler Response 15: The Corps concurs with the findings summarized in *Compensating for Wetland Losses Under the Clean Water Act.* The Corps cannot identify precise locations at this time because mitigation lands have to be obtained from willing sellers. Willing sellers cannot be identified until there is an authorized and appropriated project. Federal Law dictates how a Civil Works project is constructed and unavoidable impacts compensated.

WRDA 1986 directs that the acquisition of lands to mitigate losses to fish and wildlife shall be undertaken or acquired either: (1) before any construction of the project commences; or (2) concurrently with acquisition of lands and interests in lands for project purposes; and (3) that mitigation measures will generally be scheduled for accomplishment concurrently with other project features in the most efficient way. Section 906(b) of WRDA 1986 provides authority for the Secretary of the Army to mitigate damages to fish and wildlife without further specific Congressional authorization but limits post authorization acquisition or interests in lands for mitigation to willing sellers.

Compensatory mitigation will occur concurrently with project construction. To comply with Federal Law and to address the concerns of not only Environmental Defense but the interagency mitigation team the WQ certification states the following:

> Neither the New Madrid portion of the project nor the St. Johns Bayou portion of the project shall be operated until all mitigation lands for that respective portion of the project are acquired and all detailed mitigation plans approved.

Therefore, construction of the project will commence as mitigation planning, acquisition, and implementation commences. The interagency mitigation team will vote on potential tracts of mitigation lands. The site-specific tract will be acquired if it is desirable to the interagency mitigation team. Once acquired, a site-specific detailed mitigation plan will be coordinated with the team and submitted to MDNR for approval. The flood damage reduction project can not be operated (closing gates or pumping interior flooding) until all lands are acquired and all detailed mitigation plans have been approved that demonstrate that all unavoidable impacts to fish and wildlife resources have been compensated.

For example, the first item of work consists of partially constructing the closure levee (a section will be left open) and box culverts across Mud Ditch. This specific construction item will impact 12 acres of wetlands and its associated habitat value (*i.e.,* terrestrial AAHU). This construction item will not be built until the Corps has developed and MDNR has approved a detailed mitigation plan that shows that the 12 acres of wetlands and its associated habitat value are compensated. The remaining section of levee, closure of the gates, and the operation of the pumps will not take place until MDNR has approved detailed mitigation plans that demonstrate all significant impacts (*i.e.,* wetlands,

terrestrial wildlife, waterfowl, shorebirds, and mid-season fish rearing habitat) have been compensated.

Additionally, monitoring will be conducted on all mitigation sites to ensure that they are functioning as designed. Monitoring will also be conducted to ensure that impacts described in previous NEPA documents and this RSEIS 2 were adequately quantified. Overall mitigation needs may be increased if monitoring reflects additional impacts. Therefore, the Corps will mitigate for all unanticipated impacts that is reflected by monitoring (See RSEIS 2 Appendix G, WQ Certification, paragraph 5 a). Proposed monitoring includes biological communities, extent of jurisdictional wetlands, freshwater mussels, fish passage, and fish spawning and rearing usage. Monitoring will be developed and coordinated with the interagency mitigation team.

In regard to the "waning degree of commitment to mitigation" your comment references, the Corps believes that the existing water quality certification provides sufficient language to ensure that all significant unavoidable impacts are compensated prior to the operation of the project. See Bohlen Responses 48-52.

Zedler Comment 16:

In the RSEIS2, the Corps does not propose a specific mitigation plan but instead proposes a range of conceptual options. In effect, the sites and restoration plans remain up to future decision-making. Even the four mitigation scenarios specifically analyzed are only some of the possible mitigation options permitted under the analysis. Moreover, even the scenarios are highly general and fail to specify for the most part specific mitigation sites or to offer detailed mitigation plans about the work to be performed on those sites. This uncertainty would remain until well after the decision to proceed on the project, and even until after heavy investment in project construction. Such levels of details do not support any legitimate judgment about the extent to which mitigation will truly offset project impacts, and it is inconsistent with Corps-recommended practice as represented to the NRC panel.

Zedler Response 16: The proposed mitigation methodology is consistent with Civil Works regulations and guidance and Federal Law. The RSEIS 2 provides four conceptual mitigation scenarios that demonstrate that compensatory mitigation is achievable and the project is economically justified. Please see Zedler Response 15 for further discussion. The mitigation will proceed concurrently with construction, not "after heavy investment" in project construction. In fact, some investment in mitigation has already taken place, before any construction at all. See Section 1.4.6 of the RSEIS 2. To date the Corps has acquired 1,657 acres of land for mitigation. The Corps was in the process of formulating site-specific detailed mitigation plans for these tracts prior to the ROD being withdrawn.

In summary, the Corps of Engineers intends the following:

- The Corps is committed to mitigate for all unavoidable impacts to significant fish and wildlife resources.
- Compensatory mitigation is based on the same relevant science and methodology that was used to determine impacts. Impacts were based on the best scientific tools and models available. These models were developed and coordinated with an interagency team that has expertise with Lower Mississippi River ecological functions.
- Mitigation techniques are based upon recommendations and guidelines developed by the National Research Council (2001).
- Mitigation planning, implementation, and monitoring will be coordinated with an interagency mitigation team.
- The flood damage reduction project will not be operated until MDNR approves all site-specific detailed mitigation plans that demonstrate that all impacts from the flood damage reduction project are adequately compensated.
- Adaptive management and monitoring will be conducted to ensure that impacts were adequately quantified and mitigation is functioning as intended.
- Additional mitigation will be required if monitoring reflects additional impacts.

Literature Cited

National Research Council. 1992. Restoration of aquatic ecosystems: science, technology, and public policy. National Academy Press. Washington, D.C. 552 pp.

National Research Council. 2001. Compensating for wetland losses under the Clean Water Act. National Academy Press. Washington, D.C. 322 pp.

Dr. Richard Sparks Comment 1:

REPORT OF DR. RICHARD SPARKS ON THE DECEMBER 9, 2005 REVISED SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT 2 (RSEIS2) FOR THE THE ST. JOHNS BAYOU/NEW MADRID FLOODWAY PROJECT

(27 January, 2006)

I currently serve as the Research Director of the National Great Rivers Research & Education Center in Godfrey, Illinois. I have previously submitted comments on the St. Johns Bayou/New Madrid Floodway project, which described my qualifications and included my curriculum vitae. I have also testified extensively under direct and cross-examination regarding my opinions about the project before the Missouri Clean Water Commission. I submit this report to supplement these comments in response to a new Draft Supplemental Environmental Impact Statement issued by the U.S. Army Corps of Engineers dated December 9, 2005. Except as otherwise addressed, all my prior comments remain applicable.

Sparks Response 1: Noted.

Sparks Comment 2:

In general, the proposed changes to the mitigation, although they mostly fix the most prominent basic math error, continue to contradict the requirements and assumptions of the fish model used by the Corps to estimate needed mitigation for fish. The judgment that the mitigation plan would fully offset fish impacts is also scientifically unjustified and in critical respects contradicts common sense when fully understood.

Sparks Response 2: Mitigation as calculated by the model was initially based on impacts to spawning habitat. The model used depth and duration of flooding to delineate functional habitat. However, through negotiations with USFWS, rearing habitat was eventually used to provide the maximum number of mitigation acres (See RSEIS 2 Section 4.3.1.1). The HEP team defined spawning habitat as the acres that are flooded 8 consecutive days and at least one foot in depth. This requisite depth and duration is necessary for river fish to move onto the floodplain, construct nests, and for fry to develop. See 2002 RSEIS Page G-8. Conversely, rearing habitat, which is habitat necessary for yolk-sac and post yolk-sac larval phases, was defined as any inundated area at any depth for at least one day. Since larval fish can potentially use any area of the floodplain as long as there is some water on it, there were no hydrologic restrictions used to delineate rearing habitat. By delineating fish habitat based on rearing instead of

spawning criteria, the model over-compensates impacts to fish because it looks at the most conservative criteria (potential larval-use habitat) that resulted in the maximum number of impacted acres for the project. See, Tables 9 and 11, 2002 RSEIS at G-19 and G-21.

This RSEIS 2 remedies the inconsistency in how habitat units were expressed for compensatory mitigation measures. As the RSEIS 2 demonstrates, all significant unavoidable impacts to fish and wildlife resources can be compensated by implementing various mitigation techniques as outlined in the document. These techniques are based on relevant science and an understanding of the project area. This understanding is not confined to the Corps since the development of the fisheries model used to quantify impacts and calculate potential mitigation was coordinated with an interdisciplinary team of scientists who were familiar with the project area.

Sparks Comment 3:

I. CHANGES TO THE MITIGATION PLAN

The 2005 Draft RSEIS2 fixes the basic mathematical problem associated with the prior proposed fish mitigation. It recognizes that the Corps is required, if it wishes to use reforestation as a mitigation technique for fish, to provide 8,375 average daily flooded acres not just 8,375 actual acres that may not be flooded and accessible to fish in a given year. That similarly means the Corps is required to provide a certain number of habitat units as a daily average not merely as a total. How many average daily flooded acres or how many fish habitat units a mitigation site provides depends on how often it floods. For example, a mitigation sites flooded only 5% of the mid-season only provides 5% of average daily flooded acres, and only 5% of the average daily habitat units. Having corrected this result mathematically, the Corps now reports that the mitigation it proposes through reforestation alone would provide an insufficient number of fish habitat units.

Sparks Response 3: The calculations provided in the RSEIS 2 concerning compensatory mitigation for mid-season fish rearing habitat are clearly presented and follow methodology consistent with the project impact calculations. The Corps is committed to compensating for impacts to habitat (appropriately expressed as FCU, AAHU, DUD: please see Table 2.2 and Table 2.7 in the RSEIS 2 and appropriate descriptions that were used to describe impacts in previous NEPA reports) not to providing a certain quantity of acres, average daily flooded acres, or daily flooded acres. The number of mid-season fish rearing habitat units a mitigation site provides is based on habitat quality (HSI) and quantity (ADFA). The comment refers to "average daily habitat units." This is not a unit of measure defined or used in the RSEIS 2. It appears, therefore, this comment confuses the defined terms.

Sparks Comment 4:

According to each of the four different mitigation scenarios now actively contemplated, reforestation of 2,326 acres in the New Madrid Floodway would still be part of so-called base mitigation (RSEIS2 at 118), but it would only

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provide around 2% of the required fish mitigation habitat units according to the Corps' analysis (basic mitigation provides 51 mid-season fish habitat units out of 2,246 to 2,469, depending on scenario, RSEIS2 at 117, Table 5.7). These mitigation sites provide little fish habitat in part because these mitigation sites are rarely flooded. Reforestation sites in the St. Johns Basin would flood more frequently and therefore provide a little more habitat value, according to the Corps, but they would still provide only 15% of the mid-season fish rearing habitat units (281 out of 1,884 required, Table 5.6, page 116).

To make up the deficiency, the Corps now proposes to obtain between 93% and 98% of its mid-season fish mitigation by artificially and unnaturally extending the flooding on a limited number of acres (between 1,854 and 2,430 acres, depending on the scenario, Table 5.7, page 117 RSEIS2). Every year, these acres would be flooded every day during the 45-day mid-season (Table 5.7, page 117 RSEIS2).

The Corps would accomplish this by closing gates to the Floodway and/or St. Johns Basin after they flood, when water would otherwise be running out of the floodplain during the mid-season rearing period for fish (April 1st to May 15th). In two of the four scenarios, the Corps would also build a levee or weir to block water from receding after flooding 430 to 700 acres of cropland outside the levees in a backwater area known as Riley Lake.

All of these sites that would be permanently flooded already provide fish habitat whenever they are flooded by the Mississippi River. The premise behind this mitigation is that this artificial flooding will dramatically increase the fish habitat value of each acre. For example, the unnaturally extended flooding in the New Madrid Floodway would, according to the Corps, increase the habitat value of these acres by 2.7 to 4 times, compared to the habitat value for the same acres in the plan (Alternative 3-1B) originally recommended in the 2002 RSEIS.[1]

Sparks Comment 4 (continued):

[1] The method for calculating the increase in fish habitat is described in § 5.4.3.5.1 on page 115 of the RSEIS2 and the results are shown for the New Madrid Floodway in Table 5.5 at page 116. The text on page 115 states that gate operations will "provide 1 ADFA (average daily flooded acre) for every 1 acre of pooled habitat behind the structure." For this to be true, all acres must be flooded all 45 days of the mid-season every single year. It also states that habitat scores (so-called HSI values) "for large, permanent waterbodies were used because of the intentional management of water depth and duration, and the recognized importance of these habitats for rearing, feeding, and survival of fishes." In other words, by keeping these acres flooded all 45 days during the mid-season, the RSEIS2 assumes that it can assign these acres the habitat value of permanent water bodies, which the RSEIS2 further assumes are the score of oxbow lakes in the original fish model. The mathematical calculation presented here for the New Madrid Floodway follow these assumptions.

Sparks Response 4: Conservative estimates (*e.g.*, assignment of low estimates of flood duration during the mid-season fish rearing period) of the number of mid-season fish rearing AAHUs provided by reforestation have been made throughout the RSEIS 2. It is likely that sites will provide a greater amount of AAHUs than what is stated in the RSEIS 2. Actual gains in habitat will be calculated during the development of site-specific detailed mitigation plans and verified through monitoring.

The reference location and the percentage and quantity of mid-season fish rearing habitat provided by the St. Johns Bayou Basin through reforestation is incorrect. Reforestation of 1,293 acres of cropland in the St. Johns Bayou Basin is estimated to provide 312 AAHUs, which is 17% of the required mitigation for mid-season fish rearing impacts in the St. Johns Bayou Basin. The information is provided in Table 2.7 of the RSEIS 2.

The RSEIS 2 utilizes a variety of techniques to compensate for significant impacts of the flood damage reduction project. The mitigation plan includes restoration of bottomland hardwoods, restoration of hydrology to Big Oak Tree State Park, construction of borrow pits, construction of moist soil units, and additional techniques that restore/create Permanent Waterbody habitat or increase flood durations during the mid-season fish rearing period.

Regarding the reference to 2,246 AAHUs as provided in Table 5.7 of the Draft RSEIS 2, the draft document provided an incorrect value. The correct number should be 2,505 AAHUs as presented in Table 2.7 of the Draft RSEIS 2. The Final RSEIS 2 has been revised to reflect this correction.

As previously stated in numerous locations in the 2000 FSEIS, the 2002 RSEIS, and this RSEIS 2, nothing is natural about existing hydrology in the project area. It has been manipulated due to wide scale clearing, draining, channelization, and levee construction (RSEIS 2 Figures 5 through 17). The existing backwater flooding condition in the New Madrid Floodway exists only because of the construction of the levee system. While some historical Mississippi River backwater flooding existed into the mouth of St. Johns Bayou, the historical flooding of the area prior to the construction of levees was due to headwater flooding.

Additionally, 85% of the project area is agricultural lands (See RSEIS 2 Table 3.1 and 3.2). Clearing historical bottomland hardwood habitat has further degraded the existing hydrology in the area by the construction of extensive drainage features to promote agriculture. These hydrologic manipulations and the construction of the Mississippi River Levee System have altered hydrology in remaining high quality habitat areas such as Big Oak Tree State Park. Big Oak Tree State Park is experiencing an altered hydrologic regime that has led to the regeneration of species that prefer drier as compared to historical habitat. The hydrology restoration aspects of this project will preserve and restore historical habitat.

The use of the phrase "artificially and unnaturally extending the flooding," implies that a "real and natural flood condition" presently exists. It does not. However, to maximize the aquatic habitat value of the area, the RSEIS 2 proposes creation of a flood regime that will increase the chances of successful fish rearing. Without the project there is a higher probability that premature dewatering will strand eggs and larvae. The spawning and rearing pool will provide significant mid-season fish rearing habitat throughout the entire mid-season rearing period.

Restoration of Riley Lake is intended to restore the lake elevation to historical conditions. Restoring floodplain lakes to historical levels results in significant gains to mid-season fish rearing habitat.

Regarding footnote #1, there is a misinterpretation concerning the analysis. The quote "provide 1 ADFA (average daily flooded acre) for every 1 [acre] of pooled habitat behind the structure" is incomplete. The complete sentence from Section 5.4.3.5.1 of the RSEIS 2 reads: "Continuous duration, therefore, will provide 1 ADFA for every 1 acre of pooled habitat behind the structure." The RSEIS 2 utilized EnviroFish to calculate mitigation benefits from modifying the gate operation to create a spawning and rearing pool at various elevations. The same period of record data that was used to quantify impacts of the flood damage reduction project was used in the current analysis. As can be seen in Table 2.5 of the RSEIS 2 creating a spawning and rearing pool at an elevation of 284.4 feet NGVD in the New Madrid Floodway provides 1,531 ADFAs. The actual acreage at and below an elevation of 284.4 feet NGVD is about 2,000 acres. If the assumption had been made that the entire sump would be flooded for the entire 45 day mid-season fish rearing period in every year, then the ADFAs reported in Table 2.5 would be 2,000.

Sparks Comment 5:

According to the Corps, this artificially prolonged flooding provides a large increase in fish habitat for two reasons. First, the structures and operations of the gates will extend flooding somewhat longer, depending on the scenario, from around 50% longer to 10% longer on average during the mid-season. That would, under the Corps' model, increase the amount of fish habitat by increasing the number of average daily flooded acres (2005 RSEIS2 at 116). But even more significantly, by flooding these areas every day (all 45 days) during the mid-season, the Corps claims these areas are thereby transformed from floodplains into "permanent lakes." According to the Corps fish model, floodplain lakes that are truly flooded year-round regardless of water from the river, have dramatically greater habitat value for rearing fish in mid-season than even flooded forests. In the New Madrid Floodway, for example, creating a lake, according to the model, provides 5.9 times as much additional habitat.[2] The enormous added value claimed by the Corps comes from multiplying these two benefits – longer flooding and the alleged transformation in the kind of habitat by doing so. In short, by extending the flooding artificially, the Corps not only claims more habitat days, but also much more valuable habitat.

There are a number of fundamental flaws with these claims, both from the standpoint of logical consistency with the fish habitat model and from the standpoint of basic biology.

[2] According to the Corps fish model, reforesting an acre of flooded cropland in the New Madrid Floodway (or outside the levees) provides an extra .33 habitat units for each day flooded. For example, see 2005 RSEIS2, p. 70, Table 4.3. The cumulative score for three evaluation species (smallmouth buffalo, white crappie and freshwater drum) goes from .37 to .70, an increase of .33. By contrast, turning such land into a a large permanent lake would increase habitat value by 1.83 units -- the cumulative score goes from .37 to 2.20, an increase of 5.9 times (Ibid.). The original Corps fish model has the same numbers but labels the larger score "permanent oxbow lakes" (2002 RSEIS at G-13). Thus, creating a "permanent oxbow lake" from cropland provides nearly six times as much habitat value per acre for each day flooded, according to the Corps, and under the new RSEIS2, the same would be true simply by extending flooding during the mid-season to 45 days even though those acres would dry up subsequently and thus are not actually permanent.

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Sparks Response 5: Creation of a spawning and rearing pool provides a greater number of ADFAs by providing Permanent Waterbody habitat during the mid-season fish rearing period. The period of flooding is a critical point in establishing impacts of the flood damage reduction project. The methodology used to evaluate impacts in the project area focused on mid-season spawning and rearing, which encompasses 45 days from April 1 to May 15 (2002 RSEIS Appendix L Section 8.2).

The comment (and many subsequent comments) suggests that a "lake" will be created, but this is only one of several kinds of permanent waterbody on the Mississippi River floodplain. Lakes are permanent waterbodies but not all permanent waterbodies are lakes.

There are numerous kinds of habitat that can be classified as permanent waterbodies (see Baker *et al*. 1991 and references therein). Habitat classification schemes have been developed that refer to oxbow lakes, borrow pits, crevasse lakes, batture lakes, manmade lakes, vernal pools, floodplain depression lakes, sloughs, scatters, and brakes as permanent waterbodies. However, there are common characteristics of Permanent Waterbodies in the floodplain of the Mississippi River applicable to the proposed creation of the 2,000 acre spawning and rearing pool behind the levee closure. These include the following:

1. Waterbodies form or are replenished during rising water levels but retain water on the floodplain after floods recede as river stages fall
2. Portions of the waterbodies remain sufficiently deep to retain significant volumes of water for a prolonged period that are useful for floodplain fish
3. Reduced occurrence of rapid decreases in water levels as floods recede so that stranding of eggs and displacement of larvae are less likely
4. Warmer water temperatures that result in higher primary productivity (biomass produced per unit area) than the river (due to isolation and shallow littoral zone) thus providing an abundant food supply (phytoplankton and zooplankton) for fishes
5. Periodic connection to the mainstem river either prior to or during the rearing period to provide access by spawning adults
6. Depositional material forming a nutrient rich substrate that leads to higher chlorophyll *a* content and rapid biochemical cycling
7. Structural diversity of the littoral zone

Because of these characteristics, a Permanent Waterbody has high spawning and rearing suitability for many species of commercial and recreational importance (*e.g*., buffalo, crappie, paddlefish, and sunfishes) as well as the state endangered golden topminnow and a commensurately high HSI index. It provides food, shelter from predators, and stable habitat conditions as compared to temporary or transiently flooded lands. The spawning and rearing pool as described in the RSEIS 2 will provide these characteristics and is a Permanent Waterbody because:

1. Water will be retained during the mid-season rearing period after Mississippi River water recedes
2. Water depths will vary from shallow littoral zones to deeper pelagic zones exceeding twenty feet deep

3. Stable water levels during the peak spawning period of fish thus reducing the likelihood of stranding and desiccation of eggs and displacement of larvae
4. Conditions created by intentional pooling will provide an abundant food supply for larval fishes due to higher primary productivity than the transient conditions that currently exist
5. Periodic connection to the mainstem river will be provided either prior to or during the rearing period for access by spawning adults
6. Depositional material will form a nutrient rich substrate to further increase the productivity of the waterbody
7. Appropriate vegetation will be planted or naturally re-established providing structural diversity in the littoral zone

Aquatic habitat will persist in the spawning and rearing pool throughout the early and late spawning seasons although water levels may be considerably lower than mid-season. Conversely, "temporary" or transiently flooded lands are those created by rising water levels in the floodplain during rising stages in the river and which do not retain water as river stages fall. The portions of the waterbodies that are remote from the river are flooded later for shorter durations and flooded less continuously than those closer to the river. Receding water levels near the water's edge result in stranding and desiccation of eggs and in displacement of larvae into sub-optimum habitats before they reach full development resulting in increased mortality. The HSI value of these transiently flooded lands is based on the underlying land use. Suitability of temporary flooded lands for individual fish species is highly variable with densities of invasive species (*e.g.*, gizzard shad, common carp) predominating in disturbed habitats (*e.g.*, agricultural and fallow land), and minnows, suckers, darters, and sunfishes in undisturbed habitats (*e.g.*, extensive bottomland hardwood forests). The spawning and rearing pool created by the modified gate operation as described in the RSEIS 2 does not have these characteristics and therefore would not be characterized as a temporary waterbody.

Converting frequently flooded agricultural areas that provide HSI values of 0.37 (New Madrid Floodway) to a spawning and rearing pool that provide HSI values of 2.2 (New Madrid Floodway) provides significant gains to mid-season fish rearing habitat (see 2002 RSEIS page G-13). The significant gains are provided by increasing habitat value (HSI – see RSEIS 2, Section 4.3.1.3) and increasing quantity (ADFAs – see RSEIS 2, Section 4.3.1.1).

Sparks Comment 6:

II. REASONS THE NEW MITIGATION WOULD NOT OFFSET EVEN MIDSEASON FISH HABITAT

1. The Corps Mitigation Would Bar Fish Access

Habitat is only useful to fish if they have access to it, and the greatest flaw in the Corps' mitigation proposal is that the gates into the New Madrid Floodway will be closed much of the time during the spawning and rearing season. Under the Corps' plans, gates to the Floodway must be closed whenever water would extend beyond the sump area (284.4 feet NGVD in elevation). When the river stage exceeds 284.4 feet, the gates must be closed. When the river stage is low enough for water to recede from the Floodway, the Corps claims in the RSEIS2 that fish could move through the culverts (fighting the current) to access the Floodway. But under the Corps' new proposal, the gates would be closed to keep water in the sump area. In other words, under this new proposal, the gates will be closed when water would otherwise be above the sump area (284.4 feet) and also when water drops below that level for the entire duration of the mid-season. The Corps proposes five alternative water levels, which would require gate closures whenever the river was lower than the target water level: 284.4 (the maximum level, at which water begins to extend beyond the sump area); 283.4; 283; 282; and a combination of 284.4 from April 1 to April 30 and 283.4 from May 1 to May 15 (pages 116-117, Tables 5.5 and 5.7, RSEIS2).

Sparks Response 6: Fish will have ample opportunities to access the Floodway prior to and during the reproductive season (See RSEIS Section 5.4.3.5). The comment does not take into account the variety of habitat preferences of fish in selecting areas for reproduction. There are over 100 species of fish that can potentially utilize Mississippi River floodplains for spawning and rearing (See 2002 RSEIS Appendix G, Tables 1 and 2). These species can be separated into three major groups based on their spawning behavior (Baker and Ross, 1981; Baker et al., 1991; Hoover and Killgore, 1998):

> Facultative floodplain spawners are those that move onto the floodplain for short periods to spawn. Eggs and larvae remain for extended period during development if water levels are conducive, and then juveniles move back into the river to complete their development (*e.g.*, gars, shad, buffalo, and carpsuckers).
>
> Backwater or wetland species are those that thrive in shallow, slackwater environments and spawn in littoral zones. Eggs and larvae develop into juveniles and adults which rarely move into the river during any phase of

their development (*e.g.*, topminnows, pygmy sunfishes, pirate perch, and bantam sunfish).

Obligate riverine species are those that spawn and rear in the river, and rarely move into floodplains for spawning purposes (*e.g.*, shovelnose sturgeon, skipjack herring, speckled chub, freshwater drum). The reproductive success of these species will not be significantly impacted by the project.

The gates will be operated to maximize periods of access for the first two groups of species. The gates do not have to be open continuously, only intermittently before and during the mid-season rearing period to provide suitable access for spawning adults. Intermittent access is a naturally occurring hydrologic characteristic of large floodplains with a pulsed hydrograph (i.e., stages that rise and fall over the season). Depending on Mississippi River stages, gates may be open during the winter for waterfowl (managed to provide waterfowl habitat) and continue to remain open during early and mid spring if a flood event does not occur. At higher water levels, the gates may be closed, but those fish that have previously accessed the floodplain will spawn and rear. Depending on Mississippi River stages, gates may be reopened during or after the mid-season fish rearing period. Therefore, adult and young of the year fish will be able to access the mainstem river. Best Management Practices (BMP) for gate operation will be developed to maximize access during the entire reproductive period of fishes.

The 2002 RSEIS recommended that the gates be closed when the Mississippi River reaches an elevation of 284.4 feet NGVD. Additionally, the 2002 RSEIS stated pumps would be used to evacuate interior water down to an elevation of 283.4 NGVD. Gates would be opened when the Mississippi River fell below an elevation of 284.4 feet NGVD (See 2002 RSEIS Table 2-1). Under these conditions, the sump area would drain during the mid-season fish rearing period reducing habitat quality for floodplain fishes.

This RSEIS 2 modifies the gate operations to maintain water levels throughout the mid-season fish rearing period. This action provides significant spawning and rearing habitat for fish that have accessed the Floodway prior to gate closure. Depending on river stages, gates will be opened during or after the reproductive season to allow for dispersal into the Mississippi River. This modified gate operation converts a transient habitat into a Permanent Waterbody. See Sparks Response 5.

Fish do not necessarily "fight the current" during spawning movements. As water recedes and flows out of backwater areas and other permanent waterbodies, fish often congregate and move into the waterbody feeding on abundant plankton and forage fishes. Therefore, outflows of backwater generally attract high numbers and diversity of fish. While swimming through a culvert or other swift water areas, most fish species seek areas of low velocity (*i.e.*, boundary layers along the bottom and sides of culverts) and have sufficient burst swimming speeds (1 meter/sec or greater) to move against a strong current for short distances. Therefore, fish are well adapted to move among habitats of

varying velocities (Adams 1998; Boyd and Parsons 1998; Parsons and Smiley, 2003; Smiley and Parsons 1997). See RSEIS 2 Section 4.3.2.1.

Sparks Comment 7:

> What this means is that in a year when the entire sump area (up to 284.4 feet) could actually be flooded for the entire mid-season, the gates will be closed the entire mid-season. According to analysis by Dr. Curtis Bohlen of Corps data, that would occur in 18 of the 32 seasons analyzed. These are precisely the years when the sump area could be flooded all 45 days – precisely the years when the conditions would exist that according to the Corps transform these areas into the equivalent of permanent lakes. In other words, in any year in which the project area would naturally be the equivalent of a permanent lake, according to the Corps, the gates would never be open to allow fish access during the actual midseason. Even if fish can and will move through the culverts that will be constructed in the New Madrid levee (and I have earlier testified that the box culverts may restrict access), they obviously cannot do so when the culverts are closed.

Response 7: The comment assumes that access is required during, and only during, the entire 45-day rearing period, but this is not a valid assumption. By analyzing the 32-year period of record and utilizing an elevation of 284.4 feet NGVD gates have the potential to be open for 68% of the time over the period of record in February, 54% of the time over the period of record for March, 51% of the time over the period of record for April, and 62% of the time over the period of record for May 1 – 15. Additionally, based on an elevation of 280 feet NGVD, gates have the potential to be open for 59% of the time over the period of record for May 16-31 and 80% of the time over the period of record for June 1-30 (2002 RSEIS Table 2.1). The potential to be open means that there would be no flood damage reduction rationale to close the gates when the river stage was below those elevations. A histogram is provided as RSEIS 2 Appendix F, Attachment 3 that illustrates periods when the outlet gates have the potential to be open. See RSEIS 2 Section 5.4.3.5.

Therefore, fish will have ample opportunities to access the area prior to and during the reproductive season. Intermittent access is a naturally occurring hydrologic characteristic of large floodplains with a pulsed hydrograph. Consequently, the gates do not have to be open continuously, only intermittently before and during the mid-season rearing period to provide suitable access for spawning adults. The creation of a spawning and rearing pool will provide significant mid-season fish rearing habitat even though the closure will limit access during certain river stages.

With the exception of borrow pits and restoration of a floodplain lake such as Riley Lake, the mitigation strategy does not propose to transform areas into lakes. The modified gate operation creates a spawning and rearing pool by transforming an area made up of mostly farmland into Permanent Waterbody habitat. Please see Sparks Response 5.

As part of the management of the spawning and rearing pool, the gates will be operated in a fashion that balances periods of fish access with the need to reduce flood damage. Best Management Practices (BMP) will be developed during formulation of site-specific detailed mitigation plans with input from the interagency mitigation team. BMP will include the development of guidelines for gate operation to maximize access during the entire reproductive period of fishes. Consideration will be given to the purpose (waterfowl or fish), time of year (*i.e.*, temperature-based rules coinciding with spawning activities), controlling stage elevations (*i.e.*, identifying all combinations of interior and exterior stages to maximize length of gate openings), minimizing high water velocities through the structure, and providing stable sump elevations to ensure successful rearing.

Sparks Comment 8:

> If the gates are not open during the mid-season, then the opportunity for the mid-season spawners to utilize the habitat is lost for that year. To my knowledge, it is universally accepted among Mississippi River fish biologists that the majority of fish that spawn or rear in floodplains will only seek to move into those floodplains when the river is in flood during their reproductive season. In other words, fish that use the floodplain during the so-called mid-season, will generally seek access to the floodplain when flooding occurs during the mid-season. The ripening of the gonads of the fish and the urge to migrate and spawn are stimulated by rising water temperatures (and in some species, probably also by increasing day length). Once the fish are ready to move and spawn, the final trigger is the rising water, which makes it possible for the fish to enter the floodplain. The mid-season spawners are usually ready around 1 April. A few fish may occasionally seek to move into the floodplain at other times, but not the bulk of fish. Therefore, even if the gates were opened to the river at other times of the year (other than mid-season), the mid-season spawners would not move from the river into the New Madrid Floodway to spawn at an inappropriate time.

Sparks Response 8: The comment accurately notes the three main triggers for fish reproduction (flood pulse, temperature, and daylight length). However, there are over 100 species of fish in the Mississippi River and floodplain, each exhibiting different responses to these triggers. For example, backwater or wetland fishes (such as golden topminnow or pirate perch) respond primarily to water temperature to initiate spawning (Hoover and Killgore, 1998). Conversely, facultative floodplain spawners that are mostly riverine during the non-spawning period, such as buffalo, likely respond to all three triggers to initiate spawning (Johnson 1963; Burr and Heidinger 1983). Therefore, the comment "that the majority of fish that spawn or rear in floodplains will only seek to move into those floodplains when the river is in flood during their reproductive season" does not take into account the variation in response to reproductive triggers by different species. This is precisely the reason the interagency mitigation team developed reproductive guilds to identify different types of spawning and rearing behavior in the analysis of impacts and mitigation. Typically temperature is the primary cue that will

influence spawning and will be enhanced by the management of the Permanent Waterbody. See also Sparks Response 6.

Sparks Comment 9:

According to the analysis by Dr. Bohlen of the Corps data set forth in Appendix C to the 2002 RSEIS, there are some years when flooding cannot occur

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all 45 days during the mid-season even with the proposed gates. In these years, fish will only have access during the mid-season as water levels rise and before they exceed the sump area. But once water levels start rising, they approach 284.4 very quickly, so there is relatively little time for fish to enter before the gates must be closed.

There is an inherent trade-off between water level management to hold water in an area and fish access. If levees are built and gates closed to hold water in, then fish cannot gain access. The Corps has provided an extreme proposal in which fish could gain no access at all during the mid-season in the majority of years (which are precisely the years that would otherwise be of alleged greatest value), and only limited access in others.[3]

[3] The RSEIS2 indicates that the Corps may claim fishery habitat credit for Big Oak Tree State Park and/or the shorebird mitigation impoundment if it can determine a way of providing fish access. True fish passage for these sites is even more likely to be limited than for other areas because of the great distance from the Mississippi River of Big Oak Tree State Park and the fact that for the shorebird impoundment to impound water, it must at those times keep water and fish out. All of the problems I have previously raised about passage through culverts apply with particular force to these sites. Of course, a full analysis of the potential fish passage into these areas cannot be made without a detailed explanation of how the Corps would propose to provide such access.

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Sparks Response 9: See Sparks Response 6 and 7 for the discussion of fish passage. See Bohlen Responses 17 and 18 for a discussion on the hydrology.

It is necessary to reiterate that a 2-year frequency flood was used to evaluate hydrology of land use of the floodplain because flooding that occurs every 1-2 years regulates long-term population trends of floodplain fishes. Gates will obviously be closed for floods above the 2-year frequency (elevation 290 feet NGVD). However, these flood events are not necessary for long-term population trends. See RSEIS 2 Section 4.3.1.1.

Although Big Oak Tree State Park is less than one mile from the Mississippi River (RSEIS 2 Figures 1-17) no habitat credit was counted for planning purposes and will not be taken unless monitoring demonstrates fish passage. Additionally, see Section 2.6.1.5

of the RSEIS 2 for a discussion of the likely design of the Big Oak Tree State Park Hydrologic Restoration. Fish passage will be considered in the overall design of the water delivery system that will be necessary to restore the hydrology to Big Oak Tree State Park. Credits to fish mitigation for Big Oak Tree State Park will be calculated only if fish passage is confirmed by monitoring. Additionally, moist soil management areas will be inundated during the spring (and mid-season fish rearing periods) to provide suitable habitat for shorebirds. These areas will be designed to allow for fish access to the extent feasible. Credits to fish mitigation will be calculated if moist soil units provide gains to mid-season fish rearing habitat (See RSEIS 2 Section 2.6.1.2).

Sparks Comment 10:

2. Riley Lake Manipulation Would Create Not only Access But Egress Problems

Under some scenarios, the Corps also proposes to get much of its needed fish habitat by creating, restoring, or enhancing large permanent water bodies. For example, two of the four scenarios in Table 5.7 (p. 117 of RSEIS2) include building a levee or weir along the southern end of Riley Lake, a former floodplain lake that is somewhat silted in and that is now cropped. Once large enough floods have inundated Riley Lake, this levee would keep the water from receding, extending flooding throughout the mid-season according to the Corps.

Unfortunately, for this to work, the levee must also be high enough to block water (and therefore fish) from reaching Riley Lake until it is overtopped since it will not apparently have gates (the RSEIS2 does not mention gates). To provide a net gain of 774 average annual habitat units (AAHU), for example, the weir or levee would have to be high enough to block water from entering the lake until the water level in the river reached 287 feet (Table 5.4, p. 114 RSEIS2). Only if flood levels exceed the height of that weir would water and fish reach the Lake. This means that there are obstacles to fish entry that are not present today.

The same weir is also an obstacle to fish exit. The weir would keep Riley Lake or portions of it flooded while water receded all around the lake – that is its purpose. This means that once water levels in the river recede, Riley Lake becomes isolated, and fish will not be able to leave the lake until the river again rises above a level of 287 feet. That is a problem compared to existing conditions, and becomes an even greater problem because, as I describe below, Riley Lake appears unlikely to be able to support fish year round until the next flood.

The restricted fish entry and exit means that the Corps proposal would decrease the capacity of Riley Lake to produce fish that contribute to Mississippi River populations.

Sparks Response 10: Local interests excavated the outlet channel of Riley Lake in the past to drain the lake and promote agricultural production in the area resulting in a degraded habitat. Restoration of Riley Lake is intended to restore the lake to historical conditions, in particular, historical surface elevations and habitat.

The RSEIS 2 describes the construction of a low level weir across the existing outlet located in the northern (downstream) end, not the southern (upstream) end as stated in the comment. The elevation of the Mississippi River will have to exceed the height of the weir for fish to access the restored Riley Lake. All weir elevations presented in the RSEIS 2 are several feet below the two-year flood frequency, and therefore there will be connection with the Mississippi River in most years. A pulsed hydrograph will provide numerous opportunities for fish access between the lake and the Mississippi River throughout the winter and spring. Please refer to Bohlen Response 12.

Naturally-occurring permanent waterbodies in the lower Mississippi River floodplain typically have varying periods of connectivity due to a pulsed hydrograph. Once the waterbody is disconnected, larval fish and other aquatic organisms benefit from conditions that support higher productivity due to elevated water temperatures compared to the river (*e.g.*, abundance of zooplankton, which is the primary food source for larval fishes), and stable water levels that would normally drop in temporarily flooded areas (as opposed to permanent waterbodies), enhancing survival of young fishes.

The comment provides no evidence to support the assumption that a restored Riley Lake will not support fish. It is highly likely that a restored Riley Lake will support fish throughout the entire year. The greater surface area and water depths will increase productivity and provide significant mid-season fish rearing habitat and thus, contribute to Mississippi River populations. See SCI Response 4 and 5. Additionally see Sparks Response 19.

Sparks Comment 11:

3. The Corps Proposal Would Not Actually Create Continuous Mid-season Inundation

The Corps mitigation assumes that the manipulated areas could be kept continuously wet during the mid-season, i.e., flooded from April 1st to May 15th every year. But the Corps' pumps only pump water out, not in, and to keep water in the sump area, it must first be flooded, and that flooding must first occur from the natural rise of the Mississippi River (sufficient water apparently does not come from within the Floodway itself). The Corps analyzed when this flooding will occur in the 2002 RSEIS, Appendix C. In many years, flooding of the sump area does not occur until well after April 1st, and in many years, flooding of the full sump area never occurs. For example, according to analysis of these data by Dr. Bohlen, flooding will never occur throughout the sump area in 5 of the 32 years analyzed, or roughly 14%, and will hardly occur at all in 3 of the 32 years analyzed, roughly 10%. In only 18 of 32 years could the Corps' proposed closure of the gates keep the sump area flooded for all 45 days (which, as noted above, are also the years without fish access during the mid-season). And in five years, this flooding would already occur under current conditions, so the Corps would only add 13 years.

The Corps fish mitigation analysis is therefore factually wrong and dramatically overstates added mitigation in at least two ways.

First, the Corps has miscalculated the gain in average daily flooded acres from gate manipulation. It assumes flooding for all 45 days every year, when in fact, average flooding would be significantly less.

Second, the Corps' claim that these acres qualify as permanent lake habitat because they are flooded for all 45 days <u>every year</u>, is simply not true.

Third, to the extent the Corps claims that these acres qualify as permanent lake if they are flooded for all 45 days in any single year, the Corps overstates that number of years significantly. Moreover, since these areas would be flooded all

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45 days under current conditions during several of these years, the Corps cannot claim mitigation benefits in those years.

Sparks Response 11: The Corps did not assume that the spawning and rearing pool would be kept continuously wet during the mid-season every year. Compensatory mitigation benefits that a spawning and rearing pool provides are calculated in the same manner that impacts were quantified.

The output of EnviroFish is an average condition and does not assume the target pool is flooded the entire mid-season period every year. Gains in ADFAs that the spawning and rearing pool provide utilizes the same methodology that was used to describe impacts (See RSEIS 2 Table 2.5). This approach considers average conditions based on years of hydrographic data. Average conditions are more appropriate for long-term mitigation planning than single events that skew interpretation of flood requirements. See Bohlen Response 9.

As previously stated in Sparks Responses 6 and 7 above, the gates do not have to remain open during the entire 45-day mid-season rearing period. There are numerous opportunities for fish to access the area prior to and during the mid-season period.

Concerning the first statement, the ADFAs for the spawning and rearing pool were calculated correctly. Please see Sparks Response 4. Additionally, Mississippi River backwater flooding will inundate the sump area up to an elevation of 284.4 feet NGVD and, depending on the river stage and headwater amount, the pool will be maintained throughout the mid-season fish rearing period. This will occur from gate operation, interior drainage, and precipitation. Pumps will be necessary to evacuate interior drainage when the Mississippi River is above an elevation of 284.4 feet NGVD. Pumps will not be necessary to maintain the minimum spawning and rearing pool elevation.

Concerning the second statement, the habitat provided by the creation of a spawning and rearing pool is correctly classified as a Permanent Waterbody. Please see response 5 above for the definition of a permanent waterbody in the context of this project.

Concerning the third statement, the Corps did not overstate any figures and mitigation benefits were calculated properly. Mitigation benefits were calculated by subtracting post-project/pre-mitigation conditions from post-project/mitigated conditions (See RSEIS 2, Section 2.3.4, Section 2.6.2.5, and Section 5.4.3.5). Additionally, see Bohlen Response 14.

Sparks Comment 12:

4. Flooding Throughout the Mid-Season Does Not Transform Seasonally Flooded Lands into Permanent Lakes

The critical premise behind the Corps' new mitigation is that keeping acres of fallow land flooded all 45 days during the mid-season effectively transforms these seasonally flooded lands into a permanent water body from the standpoint of fish. True, permanent water bodies, as the name indicates, hold water year round and can serve many other functions besides providing mid-season spawning and rearing habitat. For example, many species of fishes overwinter in permanent water bodies where they do not have to spend metabolic energy swimming against a current at a time of year when food may be relatively scarce and their rates of digestion low. Permanent water bodies may have entirely different soil chemistry and soil structure from seasonally flooded lands. For example, the sediment deposits in permanent lakes may be soft and easily resuspended by wind-driven waves whereas floodplain soils have a chance to dry out and compact and are therefore less easily resuspended during seasonal flooding. Depending on soil type, and the size and orientation (in relation to direction of prevailing winds) of the lake basin, a permanent lake may be relatively clear and therefore have submersed aquatic vegetation, or it may be a turbid "desert" where wind-driven waves repeatedly stir up bottom sediments and prevent light from penetrating the water. These pronounced physical differences in turn govern water and soil chemistry (dissolved oxygen levels, for example), which influence the plankton and the bottom-dwelling worms, mollusks, and aquatic insects, which in turn provide the food for fishes. Permanent lakes also have permanent aquatic residents, including the fishes themselves and the mollusks and other benthic organisms the fishes may feed upon. The resident fishes may compete for nest sites and food with the transients that enter from the river. In contrast, seasonally flooded lands do not have permanent aquatic residents that may compete with new arrivals. It is clear that flooding for 45 days, from 1 April to 15 May, does not create the soil and water chemistry, the plant community, the plankton and benthic communities, nor the fish communities characteristic of permanent lakes.

Sparks Response 12: The premise for this comment appears to be that the Corps equates what it has defined for fisheries model purposes as a permanent waterbody with a lake, which the comment defines as an area that remains flooded for 365 days in every year. On the contrary, the model was designed only to evaluate spawning and rearing habitat for fishes during the spring, not during other seasons of the year and to make valid comparisons of those values pre- and post-project. Therefore, the term "Permanent" is applicable to a specific time period and is characterized by continuous flooding rather than intermittent or temporary flooding.

Impacts to mid-season rearing habitat were analyzed for each land cover type including fallow, cropland, bottomland hardwood, large permanent waterbody, and small

permanent waterbody. The mitigation analysis for the spawning and rearing pool intended to compare and contrast, for example, potential habitat gains associated with the habitat value of occasionally flooded agricultural land with values associated with areas that tend to be continuously flooded during the defined spawning and rearing period each spring. See Response 5 (comparing the attributes of permanent waterbodies with those of transient flooding). Nothing about the additional habitat values that may (or may not) be provided by various kinds of 365 day "lake" habitat invalidates that comparison.

The Corps does not question that lakes (that exhibit 365 day fish habitat) may provide additional benefits, some of which are listed in the comment. The fact that these additional benefits may be associated with such lakes does not, however, invalidate the quantification of spawning and rearing habitat used to evaluate project impacts and mitigation. Similarly, the proposed amendments to the hydrologic regime at Riley Lake may well provide some or all of the additional benefits mentioned in this comment. No "credit" for those additional benefits was taken because they are considered to be already included in the calculation of benefits for Permanent Waterbodies.

The comment treats the term permanent waterbody as being synonymous with lake. A lake is only one type of permanent waterbody. Please see Sparks Response 5, which provides a definition of a permanent waterbody. There has never been a contention that any permanent waterbody proposed to provide mitigation benefits in the RSEIS 2 is a lake. The Permanent Waterbody provides a spawning and rearing pool during the critical 45-day mid-season period.

Sparks Comment 13:

This is true not only as a matter of biological fact but also as a matter of methodology. The Corps fish model relied heavily on the professional opinion of a small team of fish biologists that included Jane Ledwin at the U.S. & Wildlife Service and Mark Boone of the Missouri Department of Natural Resources. Habitat scores were based on a kind of averaging of this professional opinion. Consistent with this methodology, the Corps cannot after the fact assign one kind of habitat a different value than assigned by the Fisheries Technical Group. I have spoken to Jane Ledwin, for example, and she does not agree that flooding for 45

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days during the midseason makes acres equivalent to a permanent water body (telephone conversation 26 January 2006).

Sparks Response 13: As explained in Sparks Response 12, the Corps does not maintain a 45-day flood duration provides all the benefits of a 365-day lake (referred to in Comment 12 as both a "permanent waterbody" and a "permanent lake"). Presuming that this understanding was conveyed to USFWS biologist Jane Ledwin, we would concur with the answer attributed to her. However, as also explained in the previous response,

that fact does not affect the validity of the Corps' conclusions concerning the effectiveness of the mitigation for fish spawning and rearing impacts associated with the project. Please see Section 4.3.2.4 of the RSEIS 2 and response to Sparks Response 5.

Sparks Comment 14:

> One example proves the flaw with the Corps assumption even as a matter of logic. Under current conditions, the same sump areas that the Corps proposes to manipulate in the New Madrid Floodway already floods all 45 days during the mid-season in 5 out of 32 years according to Corps data analyzed by Dr. Bohlen. For the Corps mitigation analysis to be valid, this habitat in these same years would provide six times the habitat value because of extended flooding even though the Corps would not actually extend the flooding one day in those years. These acres of habitat are already provided by nature, not by the Corps, and should not be credited toward mitigation. In addition, under current conditions, there are extensive parts of the floodplain beyond the sump area that are now flooded all 45 days in some years but that would not be flooded under the proposed project. The Corps fish model calculated the loss of this habitat based on their cropland or forest value, not on their value as permanent lakes. If the Corps truly believed that 45-day flooding converts acres to permanent lakes, it would have analyzed these losses in the same way. It is axiomatic that for mitigation to work, mitigation sites and impact sites must be evaluated using the same methodology.

Sparks Response 14: The comment misinterprets the HEP analysis. The comment suggests that the analysis has taken a pre-project condition as a mitigation credit. That is not the case. In fact, the model begins by measuring the impact of the project on existing conditions -- in this case, the loss of flooding in the sump area. It is this calculation that is used to establish the scope of mitigation (See RSEIS 2, Section 4.3.1). As it happens in this instance, the approach is to mitigate by reflooding an area that physically overlaps an area that was flooded in the pre-project condition.

Mitigation credit, however, depends not on this physical overlap, but on the mitigation acres that will be provided and their associated HSI value. In this instance, transient flooding (the pre-project condition) will be replaced by a spawning and rearing pool that differs both quantitatively (ADFAs) and qualitatively (HSI value) from the pre-project condition. (Habitat Gains = AAHUs per tract with mitigation – AAHUs per tract without mitigation, see RSEIS 2, Section 2.3.4) Gate operations will be used to retain more water in the sump, providing more ADFAs. Further, this will prevent periodic dewatering of the area, giving the area the characteristics of a permanent waterbody as described in Sparks Response 5. There is no false credit for mitigation in the post-project condition as the commenter appears to believe (see RSEIS 2 Table 5.5; Response to Bohlen 14).

Sparks Comment 15:

III. REASONS THE PROPOSED MITIGAITON DOES NOT MEET THE REQUIREMENT OF THE FISH MODEL TO OFFSET EARLY AND LATE SEASON HABITAT

A fundamental flaw with the new proposed mitigation that would extend flooding on some areas during the mid-season is that it does nothing to offset habitat loss for early and late-season fish. This means that the mitigation proposed does not meet the requirements of the fish mitigation model.

Fish use the project area from late winter to early summer, with different fish generally using the floodplain at different periods. The project area provides important habitat all these times. The Corps' fish analysis decided to segregate for analytical purposes fish habitat into three seasons, early (March 1st to March 31st), middle (April 1st to May 15th), and late (May 16 through June 30). The project area today provides extensive habitat for fish in all seasons, and in fact, provides almost the same number of acres for fish rearing in the early season (5,433.7) as mid-season (5,613) (2002 RSEIS at G-21, Table 11). Measured by fish habitat units, the project area provides significantly more rearing habitat during the early season than mid-season (4,719 versus 2,999). Ibid. The project would cause more than a 90% loss of habitat measured either way. Ibid.

The Corps has consistently acknowledged its obligation to offset habitat in all seasons. It has focused on replicating mid-season rearing habitat only on the

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Sparks Comment 15 (continued):

theory that the mitigation it would undertake to do so would also offset early and late season habitat. In my 2003 Declaration submitted to the Corps, I explained that this was not necessarily true, depending on the nature and hydrology of mitigation sites, and the Corps needed to analyze specific mitigation to assure that this was in fact true.

The new proposed mitigation greatly exacerbates this problem. None of the four analyzed mitigation scenarios would provide more than minimal early or late season habitat as measured by the model even under the theories now advanced by the Corps.

The obvious, primary reason is that artificially extending flooding during the midseason does nothing to extend flooding or increase habitat in any way during the early and late seasons. It therefore does nothing to provide fish habitat to early and late season fish as measured by the Corps' own model. Since almost all the actual fish mitigation now proposed is supposed to come from this kind of artificial flooding in the mid-season, it follows that there is almost no mitigation for early and late season fish.

It should be acknowledged that the present plan includes a base mitigation that includes roughly 6,000 acres of reforestation. But these reforestation acres cannot provide much early or late season mitigation for the same reason they provide minimal mid-season mitigation: they are only rarely wet.[4]

Even more fundamentally, the fish model uses different fish to evaluate habitat values in the early and late season than in the mid-season. According to this model, simply reforesting flooded cropland or even converting that cropland to lakes provides no additional habitat value for the early season fish used for the New Madrid Floodway. According to the fish model, flooded cropland provides equally good or better habitat for the evaluation fish (white bass) for that purpose. Thus, the proposed reforestation does not address fish mitigation at all for rearing habitat in the New Madrid Floodway. The only way to provide this habitat would be to restore flooding to presently dry areas, which is not proposed.[5]

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[4] The 2005 RSEIS2 at 104 states that typical mitigation tracts identified in the New Madrid Floodway would flood an average of 6% during the mid-season. There is no reason to believe they would be flooded much more extensively during the early or late-season, which under natural conditions, produce roughly the same number of average daily flooded acres per actual acre in the project area during the early season as the mid-season.

[5] According to the pure math of the model, extending flooding during the early season could also provide more habitat units in the early season, putting all other problems with this approach aside, but not as now calculated by the Corps for the mid-season. For example, if the Corps were to extend flooding from one third of the early season to the whole early season, it would increase the number of average daily flooded acres but these acres would not gain any value for additional quality because permanent water

Sparks Comment 15 (continued):

> If the Corps were to propose to artificially prolong flooding in the early and late seasons as well, that approach would be subject to all the same kinds of problems discussed above for the mid-season. Moreover, this approach would have the effect of further constricting fish access because gates would be closed more often. In other words, even if the occasional mid-season fish might be induced to try to access the Floodway during an early season flood, closed gates in the early season would make that impossible.

Sparks Response 15: The Corps agrees that the floodplain can offer habitat for different guilds of fishes from late winter to early summer. However, the Floodway does not provide habitat continuously during this time. Water is critical for fish survival (*i.e.,* fish cannot live out of water). It is an extremely rare event for the Floodway to remain inundated for the entire late winter to early summer period. For example, in some years the Mississippi River experiences an early (*e.g.,* February – March) rise (such as 1949 and 1971), in other years the Mississippi River experiences a late (*e.g.,* May – June) rise (such as 1958), and in additional years the Mississippi River experiences a rapid rise and fall in the early, mid, and late periods (such as 1957 and 1968) (See 2002 RSEIS Appendix C, Plates 65 to 87). In most years, flooding occurs during the mid-season. On average, over the period of record, the mid-season period (April 1 – May 15) provides the greatest amount of habitat for floodplain fishes.

Envirofish and HEP quantified existing habitat conditions in each time period to determine the most significant impacts of the flood damage reduction project and calculate appropriate mitigation. Different numbers and kinds of evaluation species were used to quantify impacts. Therefore it is not appropriate to compare habitat units from the early season with the mid-season.

The commenter cites information from the RSEIS 2 Appendix G, Table 11. This table presents the existing condition, the authorized condition, and the avoid and minimize condition (3-1.A), not the recommended plan. Table 13 is the appropriate location to view the impacts of the recommended plan (Alternative 3-1.B). However, impacts described in Table 13 were only quantified for the mid-season period. Therefore, the Corps cannot determine how the commenter made the statement, "[t]he project would cause 90% loss of habitat measured either way." The commenter either used Table 11 that does not reflect the recommended plan, or conducted independent analysis that was not included in the comment.

The Corps has never acknowledged an obligation to offset fish habitat in all seasons. This statement may have been misinterpreted in the past. However, this RSEIS 2, specifically this comment, clarifies there is no obligation to offset fish habitat in all seasons. The RSEIS 2 focused on the mid-season fish rearing period because of the following reasons:

- Mitigation is not based for one particular species or one particular time period, but for the community as a whole. The mid-season period on average represents the period when most species found in the study area spawn. Thus, on average the mid-season is the period when most species are impacted by the flood damage reduction project (See 2002 RSEIS Appendix L, Section 8.2). The Corps originally maintained that spawning is the appropriate resource to mitigate because logic suggests that fish have to spawn successfully prior to rearing. However, the Corps intends to mitigate for rearing impacts because this results in more acres of mitigation (See RSEIS 2 Section 4.3.1.1).

- As agreed by the interagency team, a single reference species (white bass) was used to develop the HSI model to quantify the early season impacts to rearing habitat in the New Madrid Floodway (See 2002 RSEIS Appendix G, Table 3). White bass is an ubiquitous species found throughout the project area and the Lower Mississippi River watershed. Hamilton and Nelson (1984) and Pfleiger (1975) reported that white bass prefer to spawn in running water but will also spawn in lakes and reservoirs. Additionally, they reported that white bass will spawn over silt and mud, but rock, gravel, firm sand substrate, or vegetation is preferred. Silt and mud were assumed to be less than optimum spawning substrates. The Delphi group assigned HSI values for the white bass as follows, agriculture = 1, fallow = 0.75, bottomland hardwoods = 0.5, large permanent waterbodies = 1.0, and small permanent waterbodies = 0.5 (See 2002 RSEIS Appendix G, Table 6). Although agricultural lands received an optimum HSI score due to the observed presence of white bass in the study area, cleared lands in slackwater conditions are not the preferred spawning habitat of white bass

  Therefore, by looking only at one season and utilizing the HEP model that was used to quantify impacts, one could construe that the reforestation of thousands of acres of cropland, as recommended in the current mitigation, would result in additional impacts to early season rearing habitat. Likewise, one could construe that clearing vast acres of bottomland hardwoods and planting soybeans could count as mitigation benefits. The USFWS recognized this issue in their 2000 Coordination Act Report (page 38-39). This report states the following:

  > In addition, according to the HEP model, agricultural fields, rather than forested wetlands, appear to have a higher suitability index for larval white bass, which would derive minimal benefit from reforestation as a compensation measure. Therefore, we believe mid-season habitat losses better reflect habitat changes to a large number of both floodplain and riverine species, and compensation based on those losses would benefit the majority of the fish fauna.

- Mitigation techniques that compensate for mid-season fish rearing impacts will also provide, in part, habitat for fish that spawn and rear during the early and late

periods. Potential mitigation areas that compensate impacts to fish will be located within the two-year floodplain, provide appropriate levels of inundation (rearing habitat requires at least one day duration at any depth - See RSEIS 2, Section 4.3.1.1), and provide fish ingress and egress during portions of the year (this may be accomplished through operation of the gate). Therefore, depending on the timing of river stages, compensation measures will provide habitat during other periods of the year.

Through adaptive management and based on monitoring results, adjustments may be made to some mitigation features. As previously stated in Responses 6 and 7, BMP will be developed that maximize fish access, usage, and project economic benefits during the entire reproductive period of fishes. BMP will be developed during the formulation of detailed mitigation plans and coordinated with the interagency mitigation team. For example, depending on flood forecasts, a BMP may include closing the gates and maintaining stable elevations during an earlier period of the year if the Mississippi River is experiencing an earlier flood. Likewise, a spawning and rearing pool may be maintained during the late season if the Mississippi River does not reach flood stages during the early and mid season. Therefore, on average, creation of a spawning and rearing pool will benefit all seasons of fish reproduction.

Sparks Comment 16:

IV. MATHEMATICAL FLAWS WITH ANALYSIS OF ST. JOHNS BASIN BORROW PITS

In the St. Johns Basin, the Corps proposes to provide five sixths of the needed mid-season habitat (1,571 out of a total of 1,884 habitat units) by constructing 387 acres of borrow pits (2005 RSEIS2 p. 32, 37, 110). These are to be areas excavated to provide material for a levee that the Corps now claims it will grade and otherwise design to provide the equivalent of permanent fish habitat. This proposal has at least the advantage that it will in fact provide permanent water.

Apart from any biological flaws with this approach, the Corps has mathematically miscalculated the benefits to be derived by assuming that these borrow pits will provide habitat every day of the mid-season regardless of whether they are in fact subject to backwater flooding in those days. This assumption contradicts the way habitat impacts were analyzed in the project area. The flaw is explained in the Report of Dr. Bohlen (2006).

Sparks Response 16: With respect to the reference to Dr. Bohlen's report, see Bohlen's comments and responses in their entirety.

Borrow pits provide high quality rearing habitat for a variety of species. Adult fish are attracted to borrow pits because of deep, slack water and abundant forage fishes that often concentrate in these areas (See RSEIS 2 Section 5.4.2.7). Many of these adult fish will spawn in shallow, structurally complex littoral areas of borrow pits. Like most natural lakes, plankton densities are usually high, so once eggs hatch, larval fish have an abundant food source. High densities of fish are characteristic of borrow pits, and many of these individuals will eventually be transported or move into the Mississippi River during subsequent floods (Aggus and Ploskey, 1986). Borrow pits meet all of the criteria of a Permanent Waterbody as defined at Sparks Response 5 above. Additionally, borrow pits will be designed to function as lakes as described in Sparks Comment 12. Borrow pits, like all Permanent Waterbody habitat, do not have to be continuously connected. They only have to be periodically connected to the river to provide suitable spawning and rearing habitat.

Borrow pits were always a part of the flood damage reduction project. However, the Corps did not consider this type of mitigation feature earlier for reasons discussed in Section 2.6.1.7 of the RSEIS 2. In the RSEIS 2, the Corps expanded the analysis to include multiple types of mitigation features that will have a greater holistic benefit than just one type of mitigation. Therefore, this RSEIS 2 quantifies the appropriate habitat borrow pit construction provides.

The mitigation benefits that borrow pits provide were calculated properly and are consistent with the methods that were used to quantify impacts to mid-season fish rearing habitat. There is no contradiction as the comment incorrectly states. See Bohlen Responses 20 - 22.

Sparks Comment 17:

V. DEEPER ECOLOGICAL FLAWS WITH THE CORPS PROPOSED MITIGATION

In my earlier Declaration, I described deeper ecological flaws with the Corps' mitigation and its reliance on the fish model. There are a few points worth expanding upon in light of the newly proposed mitigation.

The Corps' fish model is a very simplistic model that essentially is designed to compare habitat according to one variable, the kind of plants on the land. To develop the model, scientists contemplated the different value for different fish of flooded cropland, forest and floodplain lakes assuming all other conditions being equal. The data that went into the model, for example, derived

bodies are not considered more valuable per day flooded than cropland under the Corps model, which uses white bass as the evaluation species for the early season (Table 6 at G-13 in 2002 RSEIS).

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Sparks Comment 17 (continued):

from sampling one floodplain area in the state of Mississippi. Within this area, fish use of habitats with different types of vegetation was assessed during the same flood event. Using this model to compare different kinds of habitats under very different conditions is not legitimate.

That was a problem with the earlier proposed mitigation, which among other things took no account of differences in fish access, but it is an even bigger problem for the new proposals. The Corps is now attempting to use the fish model to compare: (1) habitats flooded under a relatively natural, variable flood regime with habitats where water levels will be maintained as static as possible for at least 45 days during the flood season by operating gates; (2) habitat well removed from the current of the main channel with habitat right next to the main channel in the so-called batture. The model is being extended beyond its applicability.

Sparks Response 17: Models by definition seek to predict results based on particular variables deemed important for evaluating the resource of interest. EnviroFish, is not based on a single variable. The model evaluates hydrology (*e.g.*, 2-year floodplain), hydraulics (depth and duration of flooding), land cover (*i.e.,* type of vegetation), period of the year (*e.g.,* temperature, day length, etc.), and connectivity to the mainstem river to provide a fair basis for delineating functional floodplain habitats (See 2002 RSEIS Appendix C and RSEIS 2 Appendix A). Most scientists would agree that these are the driving variables influencing timing and location of fish spawning and rearing, as selection of those variables by the HEP team confirms.

The data that were used by the interagency team to determine appropriate HSI values that went into the model utilized fish surveys from the study area (Sheehan et al., 1998), surveys from similar Lower Mississippi River floodplains (Killgore and Baker, 1996 and Hoover and Killgore, 1998), surveys and published life history parameters for evaluation species within the State of Missouri (Pflieger, 1975), and surveys and published life history parameters for evaluation species from adjacent states (Robinson and Buchanan, 1988; Etnier and Starnes, 1993), as well as the expertise of the interagency team that is familiar with fish resources within the Lower Mississippi River. Transferability was an important consideration in the planning process since it was known that potential mitigation lands might be located anywhere within the 2-year floodplain of the lower Mississippi River (see 2002 RSEIS Appendix C and RSEIS 2 Appendix A).

No alternative model has been proposed or produced by this or any other of the many commenters on the Corps' NEPA documents. The Corps is not aware of any other model that specifically calculates functional reproductive habitat in large riverine floodplains, and the comment does not provide any recommendations on alternative approaches to impact and mitigation analysis.

Sparks Comment 18:

> The same is true about the general concept to use "permanent water bodies" to replace flooded forest and cropland. In theory, the fish mitigation model permits trade-offs between these different kinds of habitat because it assigns different scores to each. But in the earlier EIS versions for this project, the Corps agreed that it would pursue the use of "permanent water bodies" for mitigation only to offset impacts on existing permanent water bodies. (And when doing so, it proposed to create truly permanent water bodies through excavation.) I agree with this earlier judgment. The reality is oxbow lakes that are seasonally flooded by the river may be quite different habitat from flooded forests and flooded cropland and will consequently support different assemblages of fish for different periods.

Sparks Response 18: The Corps and the USFWS agreed that construction of borrow pits was an appropriate measure to compensate for impacts of reduced inundation to permanent waterbodies from the construction of the flood damage reduction project. The 2002 RSEIS, Appendix L, Section 8.2 states the following:

> USFWS and the Corps agree that the construction of *borrow pits* that are *accessible to river and floodplain fishes* during the spawning/rearing season is an appropriate compensation measure for losses of *seasonally-connected* large and small permanent waterbodies *on the floodplain*.

This RSEIS 2 supplements the earlier NEPA reports and agreements and concludes that the creation or restoration of Permanent Waterbodies, such as a spawning and rearing pool or restoration of a floodplain lake, adequately compensates for fisheries impacts regardless of impacted habitat type (*i.e.,* agricultural, fallow, bottomland hardwoods, permanent waterbodies). The fish HEP model is explicitly designed to facilitate these trades, and within these sorts of habitats. Additionally, reforesting frequently flooded cropland is still an integral part of the overall compensatory mitigation (see RSEIS 2 Table 2.2 and 2.7). Proposed mitigation compensates for all resource categories identified (*e.g.,* wetlands, terrestrial wildlife, shorebirds, waterfowl, mid-season fish rearing).

Sparks Comment 19:

There are specific, additional problems with the proposal to "enhance" Riley Lake to provide mid-season rearing habitat. The Lake currently has a low point (at an elevation of 280 feet) at the northwestern end that serves as the inlet and outlet to the Mississippi River for both water and fish (SCI Engineering Report 26 January 2006 at p. 3). The proposed impoundment structure (weir) will be located south of the natural low point and at a considerably higher elevation of either 286 feet or 288 feet (Scenarios A and C in Table 5.7 at p. 117 in 2005 RSEIS2). After the weir is constructed, water and fish can only be exchanged between the river and the impoundment at these higher elevations. When the river is at lower elevations, the fish do not have access, nor can they leave the impoundment. Once fish are in the impoundment and the flood recedes, the fish and their young-of-the-year are trapped in the impoundment until the next flood that exceeds 286 or 288 feet. In the interim between floods, the SCI report indicates that the water in the impoundment will seep out through permeable soils when the river levels are low, potentially decreasing the acreage of the impoundment from 538 acres at an elevation of 288 feet to 100 acres or less (SCI Engineering Report 26 January 2006 at p. 2). The impoundment is likely to trap organic debris from the river and if the plankton also are as productive as the 2005

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RSEIS2 claims, their oxygen demand at night, coupled with the oxygen demand of decaying organic debris, could deplete the dissolved oxygen levels in the impoundment, killing the fish. Under these conditions, the "enhancements" to Riley Lake make it likely to be a fish death trap, rather than an area that contributes to fish populations in the river.

Sparks Response 19: Although fish mortality due to drawdown in floodplain lakes is a commonplace part of the natural processes operating in the riverine environment, the Corps disagrees with the conclusion presented in this comment. First, data derived from the period of record strongly suggests that the River will rise above the 288 foot level frequently enough to provide regular opportunities of fish ingress and egress from Riley Lake following installation of the proposed weir. As explained in Sparks Response 10, a pulsed hydrograph will provide numerous opportunities for fish to access the lake and disperse into the Mississippi River throughout the winter and spring. For more details pertaining to fish access, see Sparks Response 10.

Second, soil permeability will be investigated during data collection for the purpose of developing a design. If soil borings suggest permeable soils, alternative sites may be selected. For a better understanding of the Riley Lake restoration technique proposed, see RSEIS 2 Sections 2.6.2.3, 5.4.3.3, and Table 5.4. See SCI Responses 4, 5, and 6 for other factors relating to Riley Lake. There is no reason to believe that the project will increase biological oxygen demand (BOD) due to decomposition of organic debris,

plankton respiration, or otherwise. Restoring historic conditions will instead increase the volume of water in the lake and average depth, tending to reduce the probability that the lake will become hypoxic in the summer and fall due to these common processes.

Sparks Comment 20:

> More broadly, fish need to be able to reproduce in a variety of different years – both small and large flood years, for example. Many fish are highly sensitive to temperature and need relatively warm waters to be available in the spring. The warmest parts of the inundated floodplain are likely to be the shallowest parts that are warmed by the sun and not directly connected to the river current. By allowing floodwaters to spread over a very broad area, the project area greatly increases the likelihood that water temperatures will be appropriate in even very large floods. Moreover, shallow habitats during large floods are at a high premium on the lower Mississippi River now because most of those floodplain habitats have been leveed off and drained. The habitat provided in the project area is of particular value because it is rare. Riley Lake and the great majority of other batture lands are unlikely to be able to reproduce these values because of their proximity to the river and the likelihood that river water will flow continuously through these areas during larger floods.[6]
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> [6] This does not mean that Riley Lake does not now provide valuable fish habitat at these times, but it does mean that it neither now nor under the Corps proposal could provide the exceptionally valuable slack water rearing habitat that is the basis of the Corps's fish analysis at these periods. These periods are a significant quantity of overall flood periods. (For example, by mathematical definition, two thirds of all floods that reach a 2-year level also reach a 3-year level: a 2-year flood occurs 3 times in 6, while a 3-year flood occurs two times in six, which means two out of three 2-year floods are 3-year floods.) For rearing purposes, Riley Lake now probably provides valuable habitat during more modest floods. It is the combination of habitats like Riley Lake that are lower and closer to the main channel of the river with backwater habitats like the project area that is needed to support the Mississippi River fishery.
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Sparks Response 20: It is true that fish will reproduce in both small and large floods. However, large floods do not regulate long-term population trends. Generally, flooding that occurs every 1-2 years regulates long-term trends (see RSEIS 2 Section 4.3.1.1).

Mitigation in areas such as batture that are surrounded by high quality habitat (*i.e.,* bottomland hardwoods, permanent waterbodies) has more benefits to fish than mitigation in the Floodway that has essentially been cleared of most trees. Riley Lake is also closer to the river, whereas much of the flooded portions of the Floodway are far removed. Therefore, the proximity of Riley Lake is also a benefit. In terms of water temperature, there is ample shallow water habitat in the batture, which encompasses millions of acres

in the Lower Mississippi River Valley. The ebb and flow of floods create a variable temperature regime, and fish respond based on habitat preference. A restored Riley Lake will have extensive littoral areas that are subjected to rapid warming. Overall, the Corps considers restoration of Riley Lake, or other floodplain lakes, a significant environmental improvement and anticipates that this project will have direct benefits to the fish community.

The statement was made in the comment that "[t]he habitat provided in the project area is of particular value because it is rare." However, it is important to reiterate that over 85% of the project area is agricultural fields (See RSEIS 2 Tables 3.1 and 3.2 and Figures 1 through 17). Soybean fields are not rare, and are, in fact, a predominant land use throughout the Lower Mississippi River Valley (RSEIS 2 Figures 3 and 4).

Regarding Footnote 6, Riley Lake is inundated by the Mississippi River nearly every year. If the weir is constructed, the lake will still be flooded nearly every year, since the weir elevation is several feet below the 2-year flood stage. The weir will restore historical habitat that was present prior to drainage attempts. See Sparks Response 10 above.

Sparks Comment 21:

> Lastly, the Corps is now proposing to replace a broad and varied area flooded under relatively natural conditions with small, highly managed habitats. In addition to the specific problems addressed by this report, this proposal is inconsistent with the consensus scientific understanding of the importance of natural hydrologic variability. These natural variations have important ecological effects whose nature we can often only generally predict but whose details we often cannot. Our knowledge of the importance of these variations is based on the subtle differences different hydrology has for different species and ecological processes, as well as on a long history of chronicling ecological harm as a result of modified hydrology. Until we can trace these subtle effects, the most prudent policy is to preserve the natural hydrology in the few places it still exists. The Corps' new proposed mitigation contradicts this important ecological understanding.

Sparks Response 21: The Corps agrees that hydrologic variability is important, and that such variability commonly occurs in natural habitats. The project area that will be protected by the flood damage reduction project is almost entirely characterized by topography and hydrological conditions that are already highly modified for agricultural purposes in ways that largely or completely eliminate the "natural hydrologic variability" the commenter references. Approximately 85% of the project area is made up of leveled farmland (see RSEIS 2 Table 3.1, Table 3.2, and Figures 1-17) that have extensive drainage features. Additionally, many of the streams and channels that naturally occurred in the project area have undergone past channelization that has resulted in waterways that

are characteristic of highly degraded habitat types. See RSEIS 2 Figures 1-17. The existing backwater flooding regime is attributed to the construction of the frontline levee system.

Mitigation is proposed to compensate for unavoidable impacts to significant fish and wildlife resources that mostly occur over large tracts of highly uniform leveled soybean fields and mitigate them by restoring thousands of acres of highly variable bottomland hardwoods, restoring hydrologic variability to Big Oak Tree State Park, and creating/restoring Permanent Waterbody habitat that provides significant mid-season fish rearing habitat. Compensatory mitigation is based on sound ecological principles.

The creation and restoration of Permanent Waterbodies proposed for mitigation will provide stable water levels during the mid-season fish rearing period. While the comment may be correct regarding the lack of complete understanding in the current knowledge base of interrelationships of hydrology, species variation, and ecological processes, the Corps provided a model that addresses the lack of understanding by using relevant science-based decisions and assumptions, professional opinions of scientists familiar with the project area, and reasonable goals. No other alternative was proposed or suggested by other scientists and reviewers of the RSEIS 2.

Sparks Comment 22:

VI. PROPOSED NEW MITIGATION IS ON BALANCE ENVIRONMENTALLY HARMFUL IN ITSELF

For the various reasons discussed above, the proposed deliberate extended flooding in either the sump areas or Riley Lake is not only incapable of providing offsetting mitigation for fish impacts, but is environmentally harmful to the existing habitat in those areas in its own right. The areas manipulated are now functioning habitat. (Indeed, the SCI report indicates that Riley Lake has now been planted in trees able to withstand the frequent flooding levels, which increases their habitat value according not only to the Corps model but in reality, a change the Corps has not taken account of.) But the Corps' proposed new manipulation would further block fish access even beyond those already contemplated by the project and is intentionally designed to kill off the trees on the site. The unnaturally extended flooding in the sump area will, according to the 2005 RSEIS2 itself, kill the bottomland trees. The manipulation of Riley Lake will serve to trap fish where they cannot return to the Mississippi River in areas that will generally dry up before reflooding. That is not necessarily a completely adverse effect, in that these fish can be consumed by birds and other animals, but it certainly does not contribute to Mississippi River fish populations. Most generally, the functions of these areas depends on natural hydrologic variability in a variety of ways, and that variability will be removed by these additional manipulations.

Sparks Response 22: This comment is a summary of previous comments and previous responses apply. There are two additional points that require clarification.

The SCI Engineering, Inc. report provided misinformation concerning planted trees in the Riley Lake area. A cottonwood plantation does exist near Riley Lake. However, this plantation is outside of the expanded lake elevation (see site visit report, RSEIS 2 Appendix F, Attachment 1).

The Corps acknowledges that restoring Riley Lake to historical levels will most likely kill the black willows that are currently found within the restored lake's footprint. The existing habitat the black willows provide has been accounted for in the calculation of mitigation benefits (RSEIS 2 Table 2.4 and Table 5.4). However, the restoration is intended to provide historical permanent waterbody habitat, not frequently flooded black willow habitat that is a result of past modifications to the outlet channel.

Black willow makes up the majority of non-agricultural vegetative species found in the sump area. It is not likely that maintaining water levels for 45-days during the fish reproductive season will kill the existing black willow habitat because black willows can tolerate prolonged flooding such as the intended 45-day period. The existing black willow habitat has been accounted for in the calculation of mitigation benefits. However, the existing habitat will be monitored. Mitigation may be adjusted in the event that black willow habitat is being impacted.

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Dr. Curtis Bohlen declares as follows:

1. I am a wetland ecologist with special expertise in wetland identification and mitigation. I testified regarding the 2002 Revised Supplemental Environmental Impact Statement for the St. Johns Bayou/New Madrid Floodway Project before the Missouri Clean Water Commission and described my qualifications as part of that testimony and provided a copy of my curriculum vitae.

2. I have reviewed the December 2005 draft Revised Supplemental Environmental Impact Statement for the project in great detail. In doing so I have reviewed major elements of the 2002 RESEIS. I have performed analyses from files provided by the U.S. Army Corps of Engineers regarding the project as described in the attached report. I have a variety of other materials as described in that report.

3. I have prepared the attached report entitled Assessment of the Newly Proposed Mitigation Options Advanced in the December 9, 2005 Draft Supplemental Environmental Impact Statement for the St. Johns Bayou/New Madrid Floodway Project.

I declare under penalty of perjury that these statements and the views expressed in the attached report are true to the best of my knowledge, information and belief.

Dr. Curtis Bohlen

January 30, 2006

Dr. Curtis Bohlen Comment 1:

ASSESSMENT OF THE NEWLY PROPOSED MITIGATION OPTIONS ADVANCED IN THE DECEMBER 9, 2005 DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ST. JOHNS BAYOU/NEW MADRID FLOODWAY PROJECT

By Dr. Curtis Bohlen
(January 2006)

On December 9, 2005, the U.S. Army Corps of Engineers released a new draft supplemental environmental impact statement for the St. Johns Bayou/New Madrid Floodway project (RSEIS2). The core of the environmental impact statement remains the document released in June 2002, and the new draft neither changes the proposed project nor reevaluates different project alternatives. Instead, the new draft proposed some modified mitigation options, with a primary focus on offsetting impacts to fish during the period from April 1 to May 15, called the mid-season in the draft and in the 2002 RSEIS. The draft offers four mitigation scenarios, and bases its cost/benefit analysis for the project on those scenarios (as calculated by the fisheries model used to evaluate project impacts) without identifying even one conceptual mitigation plan

This report analyzed the new draft. It concludes that the new mitigation findings remain inconsistent with the mathematical structure, requirements and core assumptions of the fish model. It also concludes that the new analyses of wetlands and mitigation to offset wetland impacts continue to ignore vast quantities of wetlands impacted, that the new analysis of farmed wetlands is technically indefensible and contradicted by other analysis already in the accepted record.

Bohlen Response 1: The Corps believes that each of the four mitigation scenarios presented in RSEIS 2 Section 2.6.2 is fairly described as a "conceptual mitigation plan," but as the term is not defined, the Corps cannot respond to the comment in greater detail. The Corps' mitigation approach will be adaptable and be based on the techniques discussed in the RSEIS 2 (See Section 1.4.7).

The Corps disagrees with the conclusions in the second paragraph of the comment and provides responses to each particular issue where the issues are raised in these comments.

Bohlen Comment 2:

I. PROPOSED NEW MITIGATION

The previous mitigation proposed for the project in 2002, among other flaws, mathematically misinterpreted the Corps' own results of the fish model. This model required 8,375 acres of reforested lands be flooded on an average daily basis during the mid-season to offset fish impacts. The 2002 EIS treated this requirement as though it were only 8,375 actual, total acres.

The RSEIS2 still proposes to use more than 4,000 acres of reforestation to help offset fish impacts but acknowledges that these forested sites are rarely flooded. According to the RSEIS2 (page 104), the potential mitigation sites the Corps has identified in the St. Johns Basin are flooded only 20% of the time on average during the midseason period that the Corps has focused on for evaluating fisheries impacts. These lands, therefore produce 20% of an average daily flooded acre per acre of land, and the nominal per acre improvement in fisheries habitat quality due to any restoration activity (as measured by the HSI values) must be discounted by, on average, a factor of 5. The sites in the New Madrid Floodway are, on average, flooded only 6% of the time and nominal increases in habitat quality due to restoration must be discounted even more

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steeply, by a factor of more than 16. Put together, and assuming that other sites could be found that flooded as frequently as sites already found, it would take more than 124,000 acres of reforestation to offset mid-season impacts on fish for the mid-season.[1]

[1] The Corps's calculation of the project's fisheries impacts requires 2,329 AA HUs mitigation in the New Madrid Floodway and 1,884 AAHUs in the St. Johns Bayou (see table 4.4 and 4.5 in the RSEIS 2). If each New Madrid acre were flooded only 6% of the mid-season, that would require over 117,600 acres of reforestation to offset New Madrid mid-season fish impacts. An additional minimum of 6500 acres of reforestation would be required to offset St. John impacts, for more than 124,000 acres overall. The values for acres of reforestation required in table 4.6 are incorrect because they fail to account for the duration of flooding. Acres required should read "average daily flooded acres required from April 1st to May 15th."

Bohlen Response 2: Please refer to Environmental Defense Response 1.

The RSEIS 2 addresses the transposition of units noted in the comment.

As presented in RSEIS 2 Table 2.2, the basic mitigation feature includes but is not limited to reforestation of 6,356 acres. The deliberatively conservative percentages of duration referred to in the comment were used only for planning purposes. Actual flood duration and benefits will be revised during development of site specific mitigation plans (RSEIS 2 Section 5.4.2.1).

Bohlen Comment 3:

> The Corps states that one purpose of the RSEIS2 was to try to figure out a mitigation method that would pass the benefit/cost analysis. The Corps has developed a new proposal that primarily relies on artificially flooding existing wetland areas. The proposal is packaged in four separate "scenarios," but all four scenarios rely for fish mitigation on three major components.

Bohlen Response 3: The Corps agrees this project, like most Civil Works projects, must pass a benefit/cost analysis.

Bohlen Comment 4:

> By far the most significant component of the new mitigation would come from modified management of the gates and pumps in levees at the two basins. In particular, the Corps proposes to keep the small "sump areas" above the proposed levee closure in the New Madrid Floodway flooded somewhat longer during the mid-season, and offers the possibility of doing the same in the St. Johns basin. All of these sump areas are wetlands according to Corps data, so this proposal involves artificially extending the flooding on these wetlands.[2] The Corps acknowledges that doing so would kill the trees now present. The Corps would manipulate these areas by holding water in them after they have already flooded due to the flooding of the Mississippi River. According to the new Corps proposal, when river stage declines after the start of this mid-season, and the Corps previously proposed to open the levee gates so water could flow out of the basins, the Corps would now keep the gates closed to retain water on the sump areas. These gate operations would provide up to 98% of the mid-season fish mitigation for the New Madrid Floodway under the different mitigation "scenarios."
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> [2] The Corps analysis showed the elevation at which flooding occurs at least fifteen consecutive days during the growing season at least every other year, the criterion required to identify a crop field as a farmed wetland, and lesser hydrologic requirements apply to vegetated lands. These elevations were 289 ft in the St Johns basin and variously reported as 288.3 and 290 ft in New Madrid. The sump areas in both basins that would be manipulated by the new proposed mitigation are no higher than 284.4 ft and thus are entirely below these elevations.

Response 4: The Corps agrees that the creation of a 2,000 acre spawning and rearing pool within the sump area is a significant component of the RSEIS 2. Section 5.2.3.5 of the RSEIS 2 states that the existing tree vegetation (Black Willow) may be distressed

although not killed as the comment states (see Appendix F, Attachment 1 and Whitlow and Harris, 1979).

The comment states that "all of these sump areas are wetlands according to Corps data." The Corps agrees the elevation noted is consistent with the 15-day flood duration criterion for farmed wetlands. However, the Corps never attempted to classify these areas as farmed wetlands so it is inappropriate to state that these areas are wetlands based on Corps analysis. Please see RSEIS 2 Sections 4.2.1.2 and 4.2.1.3.

Bohlen Comment 5:

> A second form of new mitigation would claim benefit from the holes ("borrow pits") the Corps needs to dig to generate material to raise levees. The Corps proposes to modify such pits to create 387 acres of "permanent waterbodies" for fish in the St. Johns Basin. These borrow pits would provide (according to the Corps' analysis) 83% of the mid-season fish mitigation needed in the St. Johns Basin.

> The third form of mitigation would take an old, oxbow lake outside the levee system known as Riley Lake and build a small levee across it. Once floodwaters inundated this lake, the levee would retain more water in the lake. The DSEIS does not make claims about how long water would remain in it except to claim that water would remain at least throughout the 45 day mid-season for fish.

Bohlen Response 5: For a description how the Corps intends to enhance borrow pits (referred to as "holes" in the comment) for fish habitat, see RSEIS 2 Section 2.6.1.7. For a description of the Riley Lake restoration, see RSEIS 2 2.6.2.3, 5.4.3.3, and Table 5.4. See Responses to Sparks Comments 5, 10, 16, and 18.

Bohlen Comment 6:

> All this new mitigation is, relatively speaking, cheap. For the "sump areas," for example, the cost is essentially only the cost of acquiring flood easements on the 2,000 to 3,000 acres of frequently flooded land in the sump depending on the scenario. The proposed extended flooding can be achieved entirely through operations of the project gates. According to the Corps, this slight change in project management produces great quantities of mitigation per acre. This deal looks too good to be true and indeed it is. The calculations on which this apparent windfall is based are rife with both mathematical and conceptual (ecological) errors.

Response 6: Some would question characterization of approximately $30 million in mitigation (approximately 30% of total project costs) as "cheap." Moreover, there would seem to be no legitimate reason to criticize mitigation techniques merely because they are not the most expensive available. The identification of mitigation projects that provide

high habitat value at reduced costs is a laudable goal, and we do not take the comment to suggest otherwise.

The project must satisfy both mitigation requirements and the required cost benefit ratio (1:1). RSEIS 2 evaluates whether mitigation efforts are "too good to be true" by means of the HEP mathematical analysis, and the Corps believes that the model disproves the allegation in this instance. The Corps also disagrees that there are either mathematical or conceptual errors, as explained in response to the comments recorded below.

Please refer to the Response to Environmental Defense Comment 2.

Bohlen Comment 7:

> The apparent increase in habitat value generated by this small change in project management rests on two pillars. First, the artificially extended flooding means that acres would be flooded longer during the mid-season, increasing the average daily flooded acres (ADFAs), which according to the pure math of the model implies more habitat. But the various gate scenarios analyzed by the Corps would at most produce a relatively small increase in habitat value solely by changing the duration of flooding, increasing it by 50% under one scenario and 10% under another, and even decreasing it under a third.[3] Most of the claimed increase in habitat value stems from the Corps' curious claim that by flooding these sites for 45 days during the mid-season (after which they will dry out as they do now), the Corps will transform these lands from flooded agricultural and forest lands into a permanent waterbody or lake, i.e., a lake that is flooded all-year round.
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> [3] See RSEIS2, page 116. Tables 5.5 and 5.6. The maximum increase in average daily flooded acres for a New Madrid scenario is from 1036 to 1531 and for St. Johns gate operations is from 428 to 726.

Response 7: This comment and many others express confusion of the Corps' use of the term "Permanent Waterbody." To address this confusion, the Corps has inserted the definition of a Permanent Waterbody in RSEIS 2 Section 4.3.2.4 and Response to Sparks Comment 5. That discussion makes clear that the Corps is not proposing a "lake that is flooded all-year round."

Having established that principle, the Corps agrees that credit is taken for increased quantity (ADFAs) and quality (HSI) in connection with the spawning and rearing pool. For a discussion of the HSI value, see Response to Sparks Comment 5.

Bohlen Comment 8:

According to the fisheries model used by the Corps, large permanent waterbodies provide several times the habitat value per day of flooding of other floodplain lands. According to the Corps fish model, for example, large "permanent" backwater lakes in the New Madrid Floodway offer roughly six times as much habitat value for each day flooded as do flooded agricultural lands and about three times the habitat value of flooded forest.[4] Thus, according to the Corps, this mitigation would increase fish habitat in part by flooding the wetlands in the sump area longer but primarily by making each flooded acre of wetland score dramatically higher in the fisheries model for each day of flooding.

[4] Put another way, counting mitigation in this optimistic way implies that the Corps can gain more than five times as much added value from each mitigation acre manipulated in this way as it would gain through reforestation.

Bohlen Response 8: Permanent waterbodies were identified by the interagency team as optimum habitat for rearing of most larval fish used in the HEP analysis and they assigned the HSI accordingly (2002 RSEIS Appendix G).

Bohlen Comment 9:

II. INCONSISTENT OR INACCURATE MATH WITH THE PROPOSED NEW MITIGATION

There are a number of basic flaws with this proposed new mitigation.

A. The sump areas and Riley Lake would not actually be flooded all 45 days during the mid-season each year as claimed.

A key assumption behind the Corps' proposed mitigation is that flooding an acre for all 45 days during the mid-season turns it into a permanent water body, i.e., a lake flooded year-round. Such a claim is not defensible on ecological grounds, but even if it were, it would only be true if the lands in the sump areas that the Corps counts on to provide this habitat were in fact going to be flooded all 45 days during the mid-season every year. Analysis of the Corp's own hydrologic data shows that this assumption is wrong.

Bohlen Response 9: The Corps agrees that the spawning and rearing pool in the "sump" areas referenced in the comment will not be flooded for all 45 mid-season rearing days every year, and that even if that were the case, that would not justify defining the areas as year-round habitat. Neither admission, however, undermines the mitigation analysis provided in the RSEIS 2.

The model results verify that flooding will be limited in some years, which is why fewer than the maximum number of ADFAs have been claimed as mitigation credit for the

spawning and rearing pool in the New Madrid Floodway. See RSEIS 2 Table 2.5 (Pool elevation of 284.4 feet NGVD produces a 2,000 acre pool. If the area was continuously flooded, this would produce 2,000 ADFAs, but the RSEIS 2 only claims 1,531 ADFAs) (See RSEIS Table 2.5).

Additionally, the characteristics used to define a mid-season "Permanent Waterbody" and qualify it for a higher HSI do not depend on 45 continuous days of inundation every year. See Response to Sparks Comment 5.

Bohlen Comment 10:

> Closing gates when water would otherwise flow out of the floodplain can help keep the sump areas flooded, but it cannot flood them in the first place. Flooding in the project area results from flooding of the Mississippi River.[5] Thus flooding of the sump areas does not occur until and unless the Mississippi River rises high enough to lead to flooding of the sump. But flooding does not occur every year during the mid-season, so in dry years, the sump areas ("permanent water bodies") will not be flooded at all even under the Corps' proposal. In addition, in many years flooding does not occur at the beginning of the mid season, which means flooding cannot occur all 45 days of the midseason in such a year. The Corps' assumption is therefore wrong.
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> [5] The New Madrid Floodway and the St. Johns basin work somewhat differently. In the New Madrid Floodway, Mississippi River water flows directly into the basin. In the St. Johns basin, local runoff fills up the basin but only once the gates are closed during Mississippi River floods to prevent water for moving into the floodplain. Under either scenario, the areas will not flood unless the Mississippi River is flooding.

Response 10: The Corps agrees that RSEIS 2 assumes that the dominant source of flooding for the New Madrid Floodway spawning and rearing pool in most years is backwater from the Mississippi River, and that such flooding in some years will not reach the target pool elevation or that the same flooding occasionally will not occur prior to the beginning of the mid-season spawning and rearing period on April 1 (so that the entire area will not be flooded for all 45 mid-season spawning and rearing days). The mitigation analysis, however, does not make the "assumption" referenced in the final sentence of the comment, for the reasons stated in response to the preceding comment (Bohlen Response 9). For years when flooding is "reduced" in this sense, "credit" – expressed in ADFAs – is reduced accordingly.

Although the Corps did not count credit for habitat provided by capturing interior events during years of low Mississippi River elevations, the potential exists to create a spawning and rearing pool that would benefit fish through retaining interior rainfall in years of low Mississippi River stages.

Please refer to RSEIS 2 Sections 2.6.2.5, 2.6.5.1, and 2.6.2.5.2 for a succinct discussion of advantages of the modified gate operation comparison over existing conditions.

Bohlen Comment 11:

The Corps analysis for this project assumes that a 32 year "period of record" illustrates future flood patterns. The Corps analysis of all economic and environmental effects of the project is based on these data, which present flood conditions in the project area over a 32 year period under current conditions, and how it would occur under various project alternatives. To be consistent, all analyses of fish habitat, mitigation, and other features of the project have to use the same period of record. Analysis of this data shows the following:

In 5 out of 32 years (16%), the New Madrid Flood area would never be fully flooded because flooding sufficient to fill the sump areas to a design elevation of 284.4 ft never occurs in those years during the mid-season. In only 18 out of 32 years (56%), could the sump area be flooded all 45 days, which means that in 44% of the years, the sump area could not be flooded all 45 days.

In 31% of years, conditions are either so wet or so dry that modified gate operations cannot increase the number of days of full flooding of the sump area at all. (In those years, the sump area would either not be fully flooded at all under either existing conditions or the new proposal or the sump area would be flooded all 45 days under either scenario.) In all these years, the Corps claims enormous additional habitat value but there would be no change in flooding duration to the sump areas at all.

On average, the New Madrid sump area is flooded 20.5 days during the mid-season under current conditions. Under the proposed mitigation for the scenario with the largest increase in flooding, flooding would only be extended on average to 32.9 days, and in other scenarios by less.[6]

In short, the mitigation cannot succeed in flooding the New Madrid sump area all 45 days every year, only increases the average annual period of flooding by about 50% to 32.9 days at most, and fails to affect the flooding of the sump areas during the midseason at all in about one third of all years. A similar situation holds in the Saint John Basin.

[6] RSEIS 2, page 116.

Bohlen Response 11: The hydrologic data is accurate for the example described and, as previously noted, the credit taken for the duration of inundation in the Corps' analysis (calculated in ADFAs) is entirely consistent with the facts stated. Again, no credit is taken for the difference in surface area between that provided by the actual pool elevation in any given year, and the target elevation at which the gates would be closed to accomplish the flood damage reduction that is the purpose of the project.

The Corps also agrees that it will apply the HSI value for a permanent waterbody to the spawning and rearing pool in the presence of varying pool elevations year-to-year (what the comment refers to as "enormous additional habitat value"). This is the only point at

which the comment references habitat quality measurements in what is primarily a discussion of habitat quantity. For an explanation of the additional benefits associated with the managed spawning and rearing pool, see Sparks Response 5.

Please refer to Bohlen Response 10. The comparisons made between existing conditions in the New Madrid Floodway and project conditions considering modified operation of the outlet gates to pond water are noted.

Bohlen Comment 12:

The basic factual premise behind the Corp's claim of extraordinary benefits for this proposed mitigation for the New Madrid Floodway – that these intermittently flooded lands function as permanent waterbodies and thus have many times the habitat value of the same lands under the existing flood regime – is untenable as a matter of hydrology and therefore false.[7]

[7] The Corps has not produced similar data for Riley Lake to permit such precise analysis, but there is reason to believe it would be flooded less frequently even than the New Madrid sump area. For example, The Corps has proposed different levee configurations to keep water in Riley Lake up to 286, 287 or 289 feet NGVD (elevation above sea level). The levee would only keep water in if it would also keep water out. Flood levels would therefore have to exceed 286, 287 or 289 feet to flood Riley Lake respectively. By contrast, the New Madrid sump area only needs to be flooded to 284.4 feet. Flood frequency is somewhat different for Riley Lake, however, and cannot be calculated directly using the Corps data contained in Appendix C of the 2002 RSEIS.

Bohlen Response 12: Regarding Footnote 7, since the New Madrid gage is about six miles downstream from the proposed weir location, the two-year Mississippi River flood elevation at the weir is higher than at New Madrid gage. The approximate change in elevation in this reach of the Mississippi River is six inches per mile. Therefore, the two-year flood stage at the weir is estimated to be 293-feet NGVD. The maximum weir elevation of 288 feet NGVD (RSEIS 2 Table 2.7, Scenario C) is well below the 2-year flood elevation at Riley Lake. Therefore, flood waters are expected to inundate Riley Lake frequently. The Corps' assumption regarding Riley Lake is that construction of a weir near the outlet of the lake would maintain a pool during the mid-season period at the elevation of the weir crest and would substantially increase the fisheries habitat value of the lake in comparison to the existing condition.

Bohlen Comment 13:

The critical new assumptions is inconsistent with the fish model.

Another critical assumption behind the proposed new mitigation is that an acre of seasonally inundated floodplain that is flooded for all 45 days during the mid-season should be treated as though it were a permanent lake. I do not accept this idea from an ecological perspective but apart from these concerns, this assumption remains inconsistent with the model and the methodology used to produce the model.

Bohlen Comment 13 (continued):

First, it is fundamental that the same assessment technique must be used to analyze the mitigation sites as are used for project impacts. Under current conditions, the thousands of acres in the project area flood for all 45 days during the mid-season in several years. For example, in a year similar to 1944, the minimum elevation of water in the sump area during the mid season would be just above 285 feet. At that elevation, a total of 2416 acres are flooded for all 45 days during the mid-season. But these acres were not valued as "permanent waterbodies" in those years for purposes of assessing the habitat value of the project area under current conditions. Valuing habitat that way solely for purposes of mitigation is inconsistent and values the same habitat more for mitigation than for assessing project impacts.

The comparison is especially dramatic if a year like 1973 is examined. In a year like 1973, more than 41,000 acres of land would be flooded for all 45 days of the critical midseason. If the Corp's logic were applied consistently, this "permanent water body" in this one year alone would produce more than 91,000 habitat units, requiring mitigation to produce more than 2800 average annual habitat units during the mid-season to make up for project impacts on fish from this one year alone. Nearly all of this putative habitat value would be extinguished by the project, which would dramatically increase the amount of mitigation required if habitat were consistently assessed as the Corps now proposes. Even limiting consideration to lands below the two year floodplain flooded in 1973 would still require mitigation to produce an extra 2400 AAHUs , more than the entire mitigation the Corps now calculates would be required to address mid season fisheries impacts in the New Madrid floodway. This example shows that if all acres in all years flooded for 45 consecutive days each year were assessed as "permanent water bodies" in a consistent manner, the amount of mitigation required for the project would increase substantially.

Bohlen Response 13: Please see Sparks Responses 5 and 15. With the exception of borrow pits and the restoration of floodplain lakes, such as Riley Lake, the Corps does not intend to provide lake habitat by the creation of a spawning and rearing pool. Although lakes that are seasonally connected to the Mississippi River can be classified as Permanent Waterbodies, not all Permanent Waterbodies are lakes. Lakes provide a number of limnological functions that differentiate them from other types of Permanent Waterbodies.

The comment suggests that, using the Corps' analysis, in an average year like 1944 and the flood year of 1973, thousands of acres of the floodplain that were inundated for an extended period of time should also be classified as permanent waterbodies and impacts should be calculated for these acres using that HSI. The comment is incorrect for a number of reasons. First, the floodplain that normally undergoes transient flooding does not meet the definition of a Permanent Waterbody found in Response to Sparks Comment 5. For example:

1. The "waterbody" does form during rising water levels, but does not retain water on the floodplain after floods recede as river stages fall.
2. Although Permanent Waterbodies located within the floodplain do remain sufficiently deep to retain significant volumes of water for a prolonged period, this is not true for the floodplain itself.
3. The floodplain does experience water level fluctuations and stranding of eggs and displacement of larvae is likely.
4. There are warmer water levels at the fringes of the floodplain inundation where the water is shallow, but the main body of the floodwaters is connected to the river and the water temperature is lower than that of a Permanent Waterbody.
5. There is periodic connection to the mainstem river prior to or during the rearing period permitting access by spawning adults.
6. Although material is deposited during the flood, the floodplain does not acquire the characteristics of the bottom of a Permanent Waterbody: a nutrient rich substrate that leads to higher cholorophyll *a* content and rapid biochemical cycling.
7. There is structural diversity of the littoral zone.

So, the floodplain has only 2 of the 7 characteristics of a Permanent Waterbody and would not be classified as such, even in a flood year like 1973.

Second, the comment fails to take into account the calculation of ADFA. By definition, the analysis considered both flood years and drought years to arrive at an average flood condition over the period of analysis. The comment seeks to call out a single flood year and calculate impacts and mitigation solely on the basis of that year. It would be just as logical to select a drought year and calculate impacts and mitigation for that year. By way of illustration, the higher stage and duration of flooding in 1973 was reflected in the impact analysis since Envirofish included the daily stage levels from 1973. Envirofish also included the impacts to the fish resource in years such as 1954, when stage level affects from Mississippi River backwater never exceeded the top bank of floodway ditches.

Third, the interagency team selected the 2-year flood event for analysis because it is this event that is critical for maintaining fish populations over the long term, not the rare extreme flood event (RSEIS 2 Section 4.3.1.1). The comment suggests that the Corps adopt an analysis technique that would be inconsistent with the manner in which impacts and mitigation have been calculated throughout the document.

Bohlen Comment 14:

Another way of viewing this inconsistency is that in some years, the New Madrid sump area is already flooded all 45 days.[8] The Corps therefore cannot extend flooding on these acres at all in these years, but its mitigation plan would claim a dramatic increase in habitat for those years when it did not extend flooding at all. This is especially ironic because under current conditions, not only would the entire sump area be flooded for all 45 days, but fish would have free access to the area from the Mississippi River, while under the Corp's proposed modified gate operation, they would never have access as the gates would be closed throughout the midseason to exclude floodwaters.

[8] Under the Corps proposal, the Corps would be able to maintain flooding for all 45 days in 18 out of 32 years. In two of those years, the entire sump area would also be flooded all 45 days, and in two others, almost the entire sump area would be flooded for all 45 days. In short, in more than 20% of the years that flooding would last all 45 days under Corps management, virtually all the acres are already flooded under existing conditions.

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Bohlen Response 14: The comment seems to misunderstand the difference between the pre-project and post-project conditions. Even assuming the area floods for 45 days in its current state, after the project is constructed, both the area and duration of flooding will be reduced. These are the impacts of the project and they have been quantified through the use of Envirofish and HEP (2002 RSEIS Appendix G). These impacts will be compensated for, at least in part, by increasing the extent and duration of flooding in the "sump" over the post-project pre-mitigation condition by forming the spawning and rearing pool (See RSEIS 2 Table 5.5). This longer, more regular flood regime results in a change in habitat quality, yielding the HSI for Permanent Waterbody. It is this change that provides the AAHUs needed for compensation.

The comment may also object to the use of the HSI for Permanent Waterbody for the spawning and rearing pool, or put another way, may suggest that this HSI should also have been used for those parts of the floodway that sometimes currently experience extended periods of flooding. This has already been addressed in Bohlen Comment 13 above, and in the Response to Sparks Comment 5. Forty-five days of continuous flooding is not one of the characteristics of a Permanent Waterbody identified in that Response (Sparks Response 5).

To further clarify the RSEIS 2's analysis, consider the following example:

Imagine a 100-acre tract of farmland (HSI = 0.37) that is inundated 25% of the time during the mid-season fish rearing period. Therefore, this tract of land has a habitat value of 9.25 HU (100 acres * 0.37 * 0.25). Additionally, assume that conditions are not likely to change under a future without a project scenario. Therefore, this tract provides 9.25 mid-season fish rearing AAHUs under existing conditions.

Next, assume a flood damage reduction project reduces the flooding to the area to 5% during the mid-season fish rearing period. Therefore, this tract of land has a habitat value of 1.85 HU (100 acres *0.37 * 0.05). Likewise, assume that the area will stay in agricultural production for the life of the project. Therefore, this tract of land provides 1.85 mid-season fish rearing AAHUs under post-project conditions.

Impacts are calculated by subtracting post-project conditions from existing conditions (future without project conditions). Therefore, this hypothetical project would impact 7.4 mid-season fish rearing AAHUs (9.25 AAHUs – 1.85 AAHUs). Therefore, we need to mitigate for 7.4 AAHUs.

Assume that mitigation will take place on the same 100-acre tract of farmland. Mitigation includes restoring bottomland hardwood habitat (HSI = 0.7) by reforesting the area, creation of microtopography, removal of farm drains, and plugging a drainage ditch. By implementing these mitigation measures, duration of flooding will be 10% during the mid-season fish rearing period. Additionally, for simplicity reasons only, assume that the habitat gain from planting trees is immediate (Note: The Corps has accounted for transition periods in mitigation calculations). Therefore, the mitigated tract of land provides 7 mid-season fish rearing AAHUs (100 acres * 0.7 * 0.10).

Benefits are calculated by subtracting pre-mitigation conditions from post mitigation conditions. This is where the flaw in logic occurs in the comment. The comment implies that 7 AAHUs are subtracted from 9.25 AAHUs. Therefore, the tract provides 2.25 mid-season fish rearing AAHUs. Thus, 5.15 AAHUs (7.4 AAHU – 2.25 AAHUs) still require compensation. However, this is not correct.

To correctly calculate mitigation, one must subtract 1.85 AAHUs (post-project/pre-mitigation) from 7 AAHUs (post-project/with mitigation). Therefore, the tract correctly provides 5.15 AAHUs. It is not appropriate to utilize pre-project conditions (existing conditions) when calculating mitigation benefits. Thus, 2.25 AAHUS (7.4 AAHU – 5.15 AAHU) still require compensation.

The effect of the mistake in the comment is to include the impacts of the reduced inundation in the mitigation calculation. However, impacts have already been accounted for. Therefore, the impact of reduced inundation would be calculated twice.

The issue of the percentage of time fish have access over the period of record has been addressed. See Response to Sparks Comment 7.

Bohlen Comment 15:

Reassigning habitat categories as the Corps has done in this RSEIS2 is also unjustified based on the methodology used to develop the fisheries model. The methodology used to generate the habitat values that drive the model was a "Dephi" process, in which a few experts met together and assigned these values based on a kind of negotiated judgment. In the best scenario, the Delphi process used in this context has serious scientific limitations, particularly in the absence of any formal model validation or external peer review. But the claim to legitimacy of this process stems from the fact that a group of professionals sat down together and hammered or averaged out differences of opinion. The claim to legitimacy from the product of these negotiations stems from that consensus and from the participation of representatives of resource agencies that are charged with protecting aquatic resources. Consistent with this methodology, neither the Corps as a whole nor any one or limited number of participants in that process can unilaterally change the results of the Delphi process and lay claim even to the limited form of legitimacy derived from that negotiated consensus.. By unilaterally assigning agricultural and forestland flooded for 45 days a habitat value originally agreed to for oxbow lakes, the Corps has done exactly that.[9]

[9] In many of the tables of Appendix G in the 2002 RSEIS, the table header "Oxbows" was used to designate what the Corps now calls "large waterbodies." That raises the question of whether another unnegotiated category reassignment (from "oxbows" to "large waterbodies") may already have occurred.

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Bohlen Response 15: The Delphi technique (Crance, 1987) can be used in the application of HEP models. The Delphi technique as employed in this case combined the knowledge and opinions of subject matter experts familiar with the project area to develop habitat suitability index curves for species where an index curve had not been published. The use of the Delphi approach was agreed upon by the interagency HEP team. The team was composed of biologists from the MDC, USFWS, the Memphis District, and WES (2002 RSEIS Appendix G, page G-1). There is no standard requirement for the sort of peer review this comment recommends. Further, this comment alludes to 'serious scientific limitations' and a need for 'formal model validation.' The interagency team agreed to the use of the Envirofish model because of its inclusion of aspects of hydrology, timing, and land use, as well as spawning and rearing requirements for different guilds of fishes. During the period of project impact and mitigation credit analyses, and even at the present there is no better model available, regardless of formal model validation.

The term "oxbow" was used as an example of a large, permanent waterbody. The HEP Team was fully aware that large floodplain permanent waterbodies represented a variety of habitats including oxbow lakes, large borrow pits, depressional lakes, herbaceous wetlands, swamps, and other geomorphic features that form in the floodplain of

meandering rivers and can be restored or created as part of mitigation. Please refer to Appendix G of the 2002 RSEIS. Tables 10 and 12 in that Appendix clearly use the term "large permanent waterbodies." Tables 5 and 6 refer to "oxbow" for the same habitat types. See also the definition of "floodplain and river bank habitat" in the 2002 RSEIS Appendix G, page G-2.

The comment charges that the Corps unilaterally assigned the HSI for "oxbow lakes" (Permanent Waterbody) to agricultural and forested lands flooded for 45 days. See Response to Sparks Comment 5.

Bohlen Comment 16:

> The proposed mitigation would block mid-season fish access.
>
> Under the Corps original proposed New Madrid gate operations (the "recommended plan" or option 3-1.B of the 2002 RSEIS), the gate would have to be closed whenever water levels would otherwise push beyond the New Madrid sump area, at a design elevation of 284.4 feet. Pumps would then draw the water down to a holding pool elevation of 283 feet until such time as the elevation of the Mississippi River (the river stage) dropped below that, when the gates would again be opened to allow water to drain out of the sump by gravity.
>
> Under the modified gate operations proposed in the RSEIS2 to mitigate fisheries impacts, operation would be similar, except that during the midseason, water levels would not be pumped below the design elevation (284.4 or 283 feet, depending on the mitigation scenario) and the gates would have to remain closed whenever river stage dropped below the design elevation. As a result, the gates would have to be closed both when Mississippi River flooding would exceed the sump area (to reduce flooding) and when the Mississippi stage was below the sump area (to retain water in the sump). In other words, under the Corps' proposed mitigation, the gates to the New Madrid Floodway would have to be closed nearly all the time when the sump area would be flooded.

Bohlen Response 16: The comment accurately describes the proposed modified gate operation. For a response to the question of fish access please see Response to Sparks Comment 7.

Bohlen Comment 17:

As the analysis described above shows, these modified gate operation strategies could keep the New Madrid sump area flooded all 45 days during the mid-season in 18 out of 32 years. However, precisely during these years, the gates would also have to be closed all 45 days during the mid-season, either to reduce flooding or to retain water in the sump. This means fish that spawn in the mid-season will not be able to access the sump area precisely in the years when the Corps claims the sump area would function as an exceptionally valuable habitat, equivalent to a permanent water body.

In five out of the other 32 years, the gates would be open throughout the mid-season, but the floodplain of the sump area could provide little habitat in those years because most of it would not be flooded.

In the remaining 9 out of 32 years, water levels start to rise after the start of the mid-season, so if fish would move through the culverts into the Floodway, they would have a period of access to the floodplain. But in these years, flooding could not occur for all 45 days, so the Corps could not claim permanent water body habitat even under its own theories.

Bohlen Response 17: The Permanent Waterbody (spawning and rearing pool) does not have to be connected to the river during the entire rearing period. Most "natural" floodplain permanent waterbodies do not have a continuous period of connection. See Responses to Sparks Comments 5, 6, and 7. Adult fish move into the waterbody before or during the spawning period and spawn in response to the three "triggers" as appropriate for their species (See Response to Sparks Comment 8). Also, refer to Bohlen Responses 10 and 16 above. Even during years the target spawning and rearing pool elevation could be achieved on April 1, the gates would be opened whenever the Mississippi River was between the target elevation and elevation 284.4 feet NGVD (RSEIS 2 Section 2.6.2.5)[1].

Fish access is not required during the entire 45-day rearing period. Fish will have ample opportunities to access the Floodway prior to and during the reproductive season. See Responses to Sparks Comments 7 and 8.

The comment also suggests that 45 days of continuous flooding is necessary to apply the Permanent Waterbody HSI. This is incorrect for the reasons stated in the Responses to Sparks Comments 4 and 5 and in Response Bohlen Comment 14 above.

[1] The "target elevation" is the elevation at which the spawning and rearing pool would be held during the mid-season rearing period. The RSEIS 2 evaluates more than one target elevation. See RSEIS 2 Section 2.6.2.5.

Bohlen Comment 18:

> In addition, analysis of the water level data shows that once water levels start to rise during the mid-season, they tend to quickly rise to a point where they would induce flooding beyond the sump area, requiring that the gates be closed. Analysis of the data for these 9 years shows that when rising flood waters begin to inundate the sump area in any meaningful amount, they would remain open for only 4.2 days on average before the gates had to be closed, and the area would then remain flooded on average with the gates closed for 27.1 days. In other words, fish would only have access to a flooded sump area at all in slightly more than one quarter of all years, and even in those years, potential access through the culverts would only exist for a few days. Put more simply, in even the minority of flooded years when gates are open at all, access will be dramatically reduced.

Bohlen Response 18: Please refer to Bohlen Response 17 and Sparks Responses 6, 7, 8, and 9.

The statement that only 4.2 days of inundation in any meaningful amount would be available on average improperly implies that fish will only access the area during flood conditions. Depending on the target elevation chosen, on average, up to 17.9 days during the mid-season would be available for fish access before that target elevation is reached in the 9 years to which the comment refers. The comment also does not consider that fish could access the area during the early season period.

Bohlen Comment 19:

> The proposed mitigation would not offset early or late-season fish habitat
>
> The HEP analysis used to examine impacts of the proposed project to fishes was described in some detail in Appendix G of the 2002 RSEIS. The complete HEP analysis examined breeding and rearing habitat requirements of a select group of twelve evaluation species out of the 93 species of fishes that have been collected in the project area. Evaluation species were selected to include species using floodplain habitats in a variety of ways during the early, mid and late seasons. During the course of later analysis, the Corps determined that the most severe impacts to fisheries resources would occur during the midseason. It reasoned that mitigation that addressed the midseason impacts would be expected to simultaneously address the early and late season impacts.

Bohlen Comment 19 (continued):

The logic of focusing on the mid-season was therefore founded on the expectation that mitigation strategies that benefited midseason habitat would also address early and late season requirements. There was never any judgment made that early and late season fish impacts could be ignored – and neither is there any rationale for doing so. When the predominant mitigation technique was expected to be reforestation of agricultural lands, the assumption that compensating for midseason fisheries impacts would simultaneously address early and late season effects , while technically incorrect, was at least more justified. However, this assumption is even more unjustified with respect to the proposed gate manipulations. By definition, the Corps's proposed gate manipulations during the mid-season do nothing to offset project impacts to early or late season fish. This is true not only biologically, but also under the mathematical structure of the HEP fish model.

Manipulating the gates to extend the period of artificial inundation of the sumps into the early and late seasons would be of no real help, because if the Corps were try to retain water in the sumps in the early and late seasons, it would face the same types of problems as I have described above for the mid-season.

Bohlen Response 19: Please refer to Section 8.2 and Appendix L of the 2002 RSEIS. The Corps and the USFWS determined the most appropriate way to mitigate the fishery losses would be to mitigate fishery rearing losses on all habitat types (See 2002 RSEIS Appendix E, pages E-99-100). It was determined that mid-season (April 1 to May 15) habitat losses affect the greatest number of floodplain and riverine species, and that compensation based on these losses would be of the greatest benefit. The Corps did not "[reason] that mitigation that addressed the midseason impacts would be expected to simultaneously address the early and late season impacts." This particular response clarifies this position.

Depending on when elevated Mississippi River stages occur, certain mitigation techniques will benefit early, mid, and late season spawning and rearing habitat. For instance, given appropriate river stages, restoring Riley Lake and the creation of borrow pits will benefit all fish reproductive seasons. The RSEIS 2 takes a holistic approach to compensatory mitigation and believes that compensating for mid-season rearing impacts will result in benefits not just to mid-season fish rearing habitat but to the overall ecosystem as well. The USFWS agreed with this approach (See 2002 RSEIS Appendix E at pp. E-99-100 for the 2000 Coordination Act Report and the Response to Sparks Comment 18).

Regarding gate operations, during the winter waterfowl season, the gates can remain open up to 286.0 NGVD in the St. Johns Basin and to 285.4 in the New Madrid Floodway. In the mid-season fish rearing season, the gates will be open as described in Sections

2.6.2.5.1 and 2.6.2.5.2. Within these parameters, best management practices will be developed during mitigation planning for gate management that allows maximum opportunities for fish access, consistent with recommended flood control measures (See Responses to Bohlen Comments 17 and 18).

Bohlen Comment 20:

The Corps has mathematically miscalculated mid-season benefits from the creation of a borrow pits in the St. Johns basin

Most of the proposed mitigation for the St. Johns basin is now supposed to derive from one or more "borrow pits." These pits are to be constructed to generate material to increase the size of the levee, and the Corps claims that it will shape the pits to work like backwater lake habitat. According to the Corps, this will now provide 83.4% of the mid-season fish mitigation needed for the St. Johns basin at the small additional cost of redesigning the pits.

Regardless of the biological merits of using borrow pits to substitute for seasonally flooded floodplain, the Corps analysis is based on an incorrect application of the HEP fisheries model. The fish analysis focuses on rearing and spawning habitat generated by floodplain flooding. It therefore assigns fish value for lakes only on the days they are flooded by backwater.[10] Thus, if an acre of backwater lake generates 4 habitat units for each day flooded by backwater, and it is flooded by backwater one fourth of the mid-season on average, then it generates only one habitat unit. Based on this model, the science team that assigned habitat values for backwater lakes (oxbow lakes) and flooded forest, found that oxbow lakes produce roughly twice as many habitat units as flooded forest for each day of backwater flooding.[11]

The Corps analysis now claims that the habitat value of the borrow pits it proposes to create should be counted in a manner inconsistent with the way all other habitat values have been calculated. In particular, the way the Corps proposes to determine the habitat value of these borrow pits is inconsistent wit the way the fisheries analysis evaluates the habitat value of other permanent water bodies. The Corps proposes that the habitat value of borrow pits – as distinct from the natural ponds that they are intended to mimic – be counted throughout the mid-season regardless of whether they are covered by backwater. Thus the Corps proposes to count habitat value in artificial ponds in a different manner than the Corpscounts habitat value of the natural ponds that they are intended to mimic. The Corps's interpretation of the HEP model thus substantially and unfairly overestimates the mitigation value of the proposed Borrow pits.[12]

Bohlen Comment 20 (continued):

[10] Page G-10 of Appendix G of the 2002 RSEIs states "Seasonal estimates of average daily flooded acres *for each habitat* and alternative were modeled by MVM using ENVIRO-FISH, and these acres were multiplied by the seasonal HSI values to obtain HU lost." (Emphasis added.)

[11] See RSEIS2 Table 4.3, p. 70, assigning St. Johns "Large Waterbodies" 4.2 habitat units compared to 1.95 for flooded forest. There is a mathematical error in table 4.3. The Cumulative HSI score for agricultural lands is reported as 0.52. It should be 0.42.

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[12] For an acre of borrow pit flooded by backwater one fourth of the season, for example, the Corp's new analysis assigns that acre roughly 8 times the value of an acre of comparably flooded forest although the interagency Delphi team instead assigned permanent water bodies only around twice as much value.

Bohlen Response 20: There is ample scientific evidence to confirm that borrow pits are highly productive habitats and support a diverse array of resident and riverine fishes (Aggus and Ploskey, 1986). Many of the large permanent waterbodies that will be impacted by the flood damage reduction project are borrow pits that were used during the construction of the frontline and setback levee system. Impacts to these pits were appropriately calculated.[2]

First, the impact of the project to currently existing permanent waterbodies is the reduced inundation and therefore a loss of connectivity. The waterbodies will continue to exist and provide whatever habitat value they have, but they will not be connected as often or at all. So, the impact of the project was correctly calculated as reduced period of inundation, *i.e.*, fewer ADFAs.

Second, the proposed mitigation will create permanent waterbody habitat where it does not now exist by building borrow pits in agricultural areas. Just like the existing permanent waterbodies, these waterbodies will also provide value to fish, whether they experience periodic inundation or not. Therefore, these borrow pits should receive the HSI value for permanent waterbodies.

Third, the new pits will experience periodic inundation. Continuous inundation throughout the entire spawning and rearing period is not necessary (See Bohlen Response 17). The commenter would calculate benefits only for the days of inundation, but that ignores the change from agriculture to permanent waterbody habitat.

[2] However, these borrow pits were not constructed according to the design criteria that the Corps will use for the current project. For example, many of the existing borrow pits are rectangular in shape with no variable depth or shoreline. The proposal to construct borrow pits that have variable depths and shorelines will benefit multiple floodplain fish species. Therefore, benefits are appropriately calculated and there is no mathematical miscalculation as the comment states.

Since the habitat value of the agricultural fields was included in the impact calculation, and that value was subtracted from the benefits gained by converting those fields to permanent waterbodies, both impacts and benefits were calculated in the same manner as all other impacts and benefits. There is no inconsistency.

The text and accompanying footnote 10 misrepresent the analysis. The existing permanent waterbodies have value at all times. But, the impact of the project is correctly calculated in terms of the days of lost inundation. By the same token, the new borrow pits will have habitat value for fish at all times. In addition, they will receive periodic inundation.

Footnote #11 erroneously states that the Cumulative HSI for agricultural lands should be 0.42. The correct value is 0.52 as presented in the RSEIS 2.

Regarding Footnote #12, please refer to the earlier portion of this response. The Corps' mitigation increases both the habitat value (HSI) of the lands, but also the flooding duration (ADFAs).

Bohlen Comment 21:

> There are two problems with this. First, the Corps is counting habitat values of the proposed mitigation action in a manner that is inconsistent with the way habitat impacts of the project have been evaluated. It is fundamental to any effort to determine the needed extent of compensation that the same methods be used to estimate environmental impacts and the benefits of mitigation. The Corps analysis fails to do so.

Bohlen Response 21: See Response to Bohlen Comment 20.

Bohlen Comment 22:

> Second, the Corp's new analysis arbitrarily overturns the judgment of relative habitat values produced by the interagency "Delphi" group that drew up the HSI scores at the heart of the fisheries analysis. While it is undoubtedly true that permanent water bodies provide some habitat value for some fish species on a year round basis, the Delphi panel was aware of that and were also aware of how the HSI scores they estimated would be used. The Delphi panel had the opportunity to adjust the species-by-species HSI scores and the selection of indicator species used in the HEP analysis with the full knowledge that permanent waterbodies hold water year round, but would be scored as midseason rearing habitat in proportion to the fraction of the midseason they are flooded by backwater. The Corps cannot rely on Delphi process for the legitimacy of its model and then unilaterally change that analysis.

Bohlen Response 22: The interagency team agreed that borrow pits are properly classified as permanent waterbodies and assigned the HSI for those waterbodies (See 2002 RSEIS, Appendix E, page E-63, the USFWS Coordination Act Report (CAR);

Appendix L, Section 8.2; and Appendix G, page G-2). To the extent that the comment raises questions about the appropriate HSI for permanent waterbodies, see the Response to Sparks Comment 5.

Bohlen Comment 23:

The fish model does not provide a valid basis for St. Johns Bayou habitat to be substituted for New Madrid habitat or visa versa.

The 2005 DSEIS claims that the Corps may choose to locate and calculate mitigation in the St. Johns Bayou basin to substitute for New Madrid losses. Apart from biological flaws, this cannot be done mathematically. Not only different fish but different numbers of evaluation fish are used to calculate habitat value in the different basins. This resulted not from a belief that habitat in the St. Johns basin is more valuable, but rather, from an analytic decision to use a different suite of fish species – and in particular a different number of species – to guide the calculations. Five fish species are used to calculate habitat values in the St. Johns basin and 3 fish species are used in the New Madrid basin.[13] The overall habitat score for each habitat category is simply the sum of the scores of all species that were included in the analysis. Thus habitat scores in the New Madrid basin are all lower than scores for equivalent habitat types in the St. Johns Basin. That is an artifact of the model structure, and does not represent any biological judgment.

In effect, different models were used to assess fisheries habitat in the two basins. They both rest on the HEP analytic structure. They rest on similar species-by-species HSI scores for different floodplain habitats, but they counted different things, so the results are incommensurable. The HEP model was simply not constructed to make comparisons across the two basins. By the same token, the HEP model was not designed to make comparisons across different seasons.

[13] Appendix G of the 2002 RSEIS suggests that decisions on which species to include in the analysis in each basin were based in part on their presence and relative abundance, however in this context, the selected indicator species are acting as surrogates for an entire fish fauna and absence of a particular indicator species should not be interpreted as implying poor habitat quality.

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Bohlen Response 23: The Corps does not agree that there are unspecified "biological flaws" in its mitigation analysis.

The St. Johns Bayou Basin can be used to provide mitigation for impacts to the New Madrid Floodway. The basins are ecologically similar (intense agricultural production, fragmented tracts of bottomland hardwoods, limited buffer strips, and unnatural hydrological regime due to channelization and levees). The basins were part of the historic Mississippi River floodplain and were separated only when the Setback Levee

was constructed. However, the basins have different species assemblages for fish. Therefore, these different assemblages resulted in different HSI values. The Corps treats the basins separately in terms of impacts and mitigation requirements.

If the St. Johns Basin is used to compensate for New Madrid Floodway impacts, New Madrid Floodway HSI values will be used in the calculations. Please see Section 2.6.2.5.2 of the RSEIS 2. Table 2.6 of the RSEIS 2 displays AAHU gains that could be generated by modifying the St. Johns Bayou gate operation. A comparison is made utilizing both St. Johns Bayou HSI values and the New Madrid Floodway HSI values. Benefits were appropriately calculated.

Bohlen Comment 24:

> I should add that the information presented in the various drafts of the EIS describes major differences in the two fisheries and characteristics that probably explain those differences. The St. Johns basin extends a long way, retains substantial riparian forest in places, with significant relictual floodplain inundation., and the St. Johns Bayou itself is healthy enough to support numerous mussel species. That is why the impacts of the project on the St. Johns basin are significant despite the fact that it is already partially disconnection from the Mississippi River. The New Madrid Floodway does not share these characteristics, and does not support a significant residential fishery and contains different fish species. The New Madrid's primary fisheries value is as a reproductive site for Mississippi River fish. Thus from an ecological as well as purely analytic basis, there is no appropriate basis for using one basin to offset impacts in the other.

Bohlen Response 24: The comment incorrectly characterizes land use in the St. Johns Basin. There is riparian vegetation in places but it is hardly substantial. Table 3.1 and figures 4 - 17 in the RSEIS 2 demonstrate that the predominant land cover type is agricultural. The RSEIS 2 proposes through mitigation to increase the habitat value of the basin recognized by the comment and by the Corps (See RSEIS 2 Table 2.2). However, the Corps also intends to manage the St. Johns Bayou outlet to increase the connectivity of the St. Johns Basin with the Mississippi River (See Response to Bohlen Comment 23). This action would result in added reproductive value for Mississippi River fishes in the St. Johns Basin. Therefore there is an ecological basis to use the St. Johns Basin to offset fisheries impacts in the New Madrid Floodway. Each will contribute to the overall health and productivity of the Mississippi River.

Bohlen Comment 25:

III. THE CORPS PROPOSES TO USE THE FISH MODEL IN WAYS THAT EXTEND IT OUTSIDE OF THE SCIENTIFIC ASSUMPTIONS ON WHICH IT WAS BASED.

The Corps fisheries HEP analysis model, even used appropriately, rests on limited scientific foundations. The key parameters of the model, the Habitat Suitability Index scores, were developed through a form of group best professional judgment in which a small group of biologists came to consensus on the relative value of floodplain habitats for different fish species based primarily on differences in vegetation. The group assigned numerical scores to express the relative value of each habitat type for different fish species. These habitat values have no statistical underpinning; indeed, they are not based on any measurable quantity at all. While the biologists involved in drawing up the models reviewed some data on relative fish abundances among different cover types, the HSI values were not directly determined by those data and there is no claim that the data were adequate for doing so. The legitimacy of the model is therefore tied to the scientific consensus that attempted to evaluate the relative value of different habitat types under conditions that were otherwise the same for each type.

Bohlen Response 25: The fishery model is based on the best available scientific information on floodplain ecology, land use delineation, and hydrologic/hydraulic variables that influence habitat value and function. There are no other methods available that clearly identify impacts to fish reproduction. Although several commenters have criticized the methodology, no one has offered a substitute. See the Response to Bohlen Comment 15 above.

Bohlen Comment 26:

HEP models are limited tools, and they must be used with care to ensure that their inherently limited predictive value is not further degraded. In particular, the fisheries HEP model and the relative HSI scores on which it depends were developed for

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habitats within a specific ecological context. It is inappropriate to apply the model to situations beyond the scope for which it was originally intended. In a trivial example, it would generally be inappropriate to apply a HEP model developed in one region of the country outside of that region. In a similar way, application of these fisheries models to situations – even within the project area – that are ecologically quite different from the situations on which the original HSI values were based is likely to lead to significant error.

The relative habitat values in the HSI score habitat quality based solely on land cover type. It is a broad ecological principle that the patterns of flooding have profound implications for habitat quality and use. It is widely understood that the habitat value of areas with managed hydrologic regimes differs from those with natural hydrologic variation. It is widely understood that habitat in the higher energy batture lands next to the river differ from areas with similar duration of flooding within the basins. It is widely understood that habitat value depends on landscape context, and in particular on the type, diversity and proximity of other contiguous habitats. It is also widely understood that the habitat value of bottomland hardwoods varies depending on characteristics such as species composition and age structure of the vegetation.

Yet none of these important components of habitat quality were included in the fisheries HEP model. The model was simply not designed to compare such differences in habitat. A scientifically necessary justification for omitting such well understood and important components of habitat value was that project impact sites and mitigation sites would generally be similar in these important characteristics. It follows that the model will, under these circumstances, provide poor estimates of relative habitat value and thus should not be used to justify trading off habitat losses in the project area for mitigation sites that clearly differ not only in land cover, but also to a significant degree with respect to hydrology, connectedness and proximity to other habitat features.

Bohlen Response 26: The HEP is not being applied to a situation beyond its original scope. The interagency team including the Corps, considered the variation in habitat types. The entire process, as illustrated in the RSEIS 2 Appendix A, was based on a habitat classification system that considers hydrology (*e.g.*, 2-year floodplain), hydraulics (depth and duration of flooding), land cover (type of vegetation), and connectedness to the main stem river. Habitat value (HSI scores) was rated in the context of the

Mississippi River floodplain, not just a specific location within that floodplain. In this manner, the HSI scores are transferable to any habitat within the 2-year floodplain. The 2-year floodplain includes both the batture and portions of the backwater. Transferability was an important consideration knowing that mitigation lands could occur anywhere within the 2-year floodplain of the Lower Mississippi River.

The Corps agrees that patterns of flooding have implications for habitat quality and use. Underlying land use also has implications for habitat quality and use.

The Corps disagrees that the New Madrid Basin has a natural hydrologic variation. See Response to Sparks Comment 21. The current backwater flooding regime is a function of the levee system. If the frontline levee was not in place, the entire floodway would only experience Mississippi River headwater flooding. The hydrology of the floodway is not currently intensively managed. The proposed mitigation will increase the level of hydrologic management in the interest of increasing habitat value. To the extent that the current hydrologic regime represents an "unmanaged" condition, that was taken into account in the Envirofish calculation of ADFAs. See also Response to Bohlen Comment 13 above.

The Corps recognizes that there are some differences between habitat in the batture and habitat within the floodway. However, the batture is not a homogenous area. There are areas that experience high energy flows from the Mississippi River. However, there are also slackwater and backwater areas within the batture. For example, tributary mouths are backwater areas within the batture (RSEIS 2 Section 4.3.2.3). The same landcover types are present in both areas and the interagency team assigned the same habitat value to those types in the batture and the basins.

Flooded batture land that is reforested will have physicochemical characteristics similar to forested areas in the New Madrid Floodway: slackwater, structural diversity, direct accessibility. Swales and ridges in the batture create habitat similar to tributaries: deep, warm water that persists after floodwaters recede and a corridor for movement within the floodplain. In addition, increased hydraulic circulation in the batture will reduce hypoxia that can occur in large backwaters, such as the New Madrid Floodway, during prolonged flooding in late spring and early summer. Batture land is also directly accessible to fish and has heterogeneous habitats suitable for fish spawning and rearing. Those fishes that are "not truly stream or large river species" are either habitat generalists or permanent inhabitants of wetlands that prefer isolated waterbodies. High species richness in the St. Johns basin indicates that these groups of fishes will continue to inhabit streams and wetlands of New Madrid Floodway. The New Madrid Floodway is man-made, trees have been cleared from most stream banks, high turbidity prevails for much of the year, and the adjacent floodplain is comprised mostly of agricultural fields. Conversely, batture land is more diverse, floods regularly, and with reforestation of frequently flooded agricultural land, can provide quality habitat for many fishes that are currently found in the New Madrid Floodway. Thus, the Corps considers batture land suitable mitigation sites.

The model did not have a specific variable assigning value to landscape context, particularly the type, diversity and proximity to other contiguous habitats. Nevertheless, it is clear that the only contiguous habitat of any real significance in the floodway is agricultural fields. Over 80% of the landuse is agricultural. Other habitat types are widely dispersed and fragmented (See 2002 RSEIS Appendix A, Figure 6). As a conservative measure, the Corps did not discount the value of this fragmentary habitat when determining impacts, but counted all areas within the existing 2- year floodplain as having fish rearing value regardless of distance from the river or permanent water areas. It is highly unlikely that all these areas, far removed from the river, have any significant value to spawning riverine fish because there are no depth or duration criteria (*i.e.*, it may be a mile from permanent water; flood for one day and to a depth of one inch). In addition, agricultural lands become more common at higher elevations which provide little, if any, value to most spawning and rearing fishes (See 2002 RSEIS Appendix G, page G-10). However, the interagency mitigation team will take the elements of landscape context such as type, diversity, and proximity into account in developing site specific mitigation plans, including increasing the area of contiguous forested tracts (See 2002 RSEIS Appendix L, Section 10.1).

Species composition and age structure of vegetation were accounted for in the HEP model by annualizing the Habitat Suitability Index values as a function of the growth patterns of planted trees. Please refer to Section 2.3.2 of the RSEIS 2. There are two broad categories of bottomland hardwoods in the project area as they relate to the structure they provide for fish spawning and rearing habitat. These two broad categories are fast growing species such black willow and cottonwood and slow growing species such as bald cypress and red oaks. The annualized HEP model accounted for the transition period that is required of these two broad categories in determining mitigation benefits for reforestation.

The comment assumes that the impact and mitigation sites differ. Although this may be so in some cases, the Permanent Waterbody will actually overlay the area of impact and will thus be identical.

Bohlen Comment 27:

> The proposed mitigation in the 2002 RSEIS already extended the fish model to the limits of reasonable use and beyond by, among other things, using it to justify replacement of habitat with floodplain fish access by mitigation sites that lack such access (floodplain access is another important component of fish habitat that was not explicitly evaluated in the HEP model). Application of the model to estimate mitigation requirements was justified at the time by the Corps in part by assertions that the selection of final mitigation sites would ensure that mitigation sites would be generally similar in important respects to the areas of impact. But the proposed new mitigation plan can make no such claim. Instead, the RSEIS2 proposes to replace tens of thousands of acres of seasonally inundated fish habitat that will be lost in the sense that they will no longer experience any or virtually any backwater flooding and replace them with a few hundred acres that have no hydrologic or ecological similarity to the lost habitat.

Bohlen Response 27: Mitigation sites will in fact be similar to the impact sites since, with the potential exceptions of batture lake restoration and use of the St. Johns basin for New Madrid floodway impacts, the mitigation sites will be located in the same area as the impacts. For example, the Permanent Waterbody will be located in the sump of the New Madrid floodway and overlays one of the prime areas of impact.

Of course, after mitigation measures are in place, these sites will differ substantially from their current condition. Bottomland hardwoods that provide significant habitat to multiple species (fish, amphibians, reptiles, mammals, and birds) will make up the vast majority of compensatory mitigation acreage. They will replace thousands of acres of soybean fields that provide limited habitat. Mitigation sites will provide equal or greater fish rearing habitat than what is currently found under existing conditions in the impacted farmland.

On the question of fish access, see Responses to Sparks Comments 6 and 7. The value of the proposed mitigation in the Permanent Waterbody is clearly set out in RSEIS 2 Section 5.4.3.5. It is expected that most mitigation sites will provide access for fish. Monitoring will reveal if fish have access to other sites in which the Corps has not taken mitigation credit (specifically, restoring hydrology to Big Oak Tree State Park, restoring 1,800 acres of cropland surrounding Big Oak Tree State Park, and the moist soil units). These mitigation measures will likely provide fish access and thus, significant gains to mid-season fish rearing habitat.

The comment "the RSEIS 2 proposes to replace tens of thousands of acres of seasonally inundated fish habitat that will be lost in the sense that they will no longer experience any or virtually any backwater flooding and replace them with a few hundred acres that have no hydrologic or ecological similarity to the lost habitat" is incorrect on its face and is stated in a pejorative fashion. The "tens of thousands of acres of seasonally inundated fish habitat" are in fact soybean fields. The "few hundred acres that have no hydrologic or ecological similarity to the lost habitat" will be prime fish habitat, more than several

hundred acres, and both hydrologically and ecologically similar to, yet superior than, the lost habitat. See Response to Sparks Comment 5 and previously in this Response.

Impacts of the flood damage reduction project are attributed to a reduction of flooding. Leveled, extensively drained agricultural areas make up 65% of the impacted areas in the St. Johns Bayou Basin and 69% of the areas in the New Madrid Floodway (2002 RSEIS Appendix G, Tables 10 and 13).

In addition, the proposed mitigation does not consist of a few hundred acres. As the RSEIS 2 clearly states in Table 2.2, the proposed basic mitigation feature entails the following:

- Provide Mississippi River surface water to the approximate 1,000 acres of Big Oak Tree State Park that would mimic natural flooding conditions.
- Reforest 3,619 acres of cropland.
- Construct 765 acres of modified moist soil units on farmland.
- Plant vegetative buffer strips along 64 miles (671 acres) of New Madrid Floodway channels.
- Create a 266-acre wildlife corridor between Big Oak Tree State Park and Ten Mile Pond CA.
- Reforest 1,800 acres of cropland surrounding Big Oak Tree State Park.
- Construct 387 acres of modified borrow pits.

The implementation of various additional techniques such as restoration of Riley Lake or the creation of a spawning and rearing pool will provide additional mitigation that will fully compensate for mid-season fish rearing impacts. This restoration has the potential to provide from 245 to 538 acres of permanent waterbody habitat (RSEIS 2 Table 2.4). The spawning and rearing pool in the New Madrid floodway alone will provide from 853 to 2000 acres of habitat (RSEIS 2 Table 2.5).

Bohlen Comment 28:

Any model must be used with sensitivity and awareness of its limitations. The analysis presented in the RSEIS2, fails to do so and thus is scientifically flawed. Indeed,

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the way the model has been used here appears almost perverse in the lengths to which it goes to reinterpret the model and stretch the limits of its applicability.

Bohlen Response 28: The Corps has provided explicit responses to earlier comments fully explaining and elaborating on the science-based approach to evaluate impacts and mitigation of flood control projects. The Corps does not agree with the claim that the Corps "stretched the limits of [the model's] applicability" when the model was developed specifically for the purpose of comparing and contrasting different floodplain habitats in the Lower Mississippi River.

Bohlen Comment 29:

> I am aware that other concerns with the biological basis of the fish model have been raised by Dr. Sparks, including the restriction of the analysis just to fish habitat available within the two-year floodplain. Obviously, any such weaknesses in the models biological underpinnings carry over to the analysis of the new proposed mitigation and call its results into question. Furthermore, my analysis of Corps data supports previous comments that the two-year floodplain elevation used in the fisheries analysis has been incorrectly estimated. See Attachment. Correction of this error will require corrections to the fisheries and other analyses. The changes in the RSEIS2 do nothing to address these concerns.

Bohlen Response 29: The Corps has responded to Dr. Sparks' concerns (see Responses to Sparks Comments).

The comment and others have previously expressed an opinion on the appropriateness of using the 2-year floodplain as the basis of fisheries impact analysis. Justification of using the 2-year floodplain (2002 RSEIS Page G-8) has been explained. The use of the 2-year floodplain for fishery impact analysis is again explained in Section 4.3.1.1 of this RSEIS 2.

Having determined that the 2-year event was the event that regulates the baseline/long term populations of fish, it was necessary to determine the elevation at which that event occurs. The Corps began its analysis that was included in the 2000 SEIS by determining the elevation of the 2-year event in the floodway with the project in place ("with project" also sometimes called the "authorized elevation") and the elevation of the 2-year event for at least one of the project alternatives (also called the "avoid and minimize condition"). With the project in place, the physical characteristics of the floodway, whether the project structures are open or closed (which depends on Mississippi River stages), and interior rainfall are the controlling factors to determine the stage of the 2-year event.

The Corps also determined the without project (also called the "existing condition") elevation of the 2-year event. This elevation was determined, based on the same assumptions as above, that is, that the stage of the 2-year event was primarily a result of Mississippi River stages and interior rainfall (characteristics of floodway). Using this method, the 2-year without project stage was set at 292.9 feet.

As the draft SEIS was undergoing quality control review, the Corps determined that the method used to set the with-project and avoid and minimize elevations was correct.[3] With the project in place, it is the characteristics of the floodway and interior rainfall that control elevation. However, the QC review revealed that the method used to calculate the without-project flood elevation was not correct. The Corps recognized that, without the project in place, the elevation of the 2-year event in the floodway is determined by the Mississippi River, not by the characteristics of the floodway. The Mississippi River has a drainage area of approximately 920,000 square miles at New Madrid, while the floodway has a drainage area of only 183 square miles. The influence of the Mississippi River simply dominates the effects of local conditions and controls the 2-year flood elevation in the floodway.

The Corps had already separately conducted a comprehensive frequency analysis of the Lower Mississippi River for the Mississippi River and Tributaries Project (MR&T). This analysis was based on annual peak flows at stations along the river that maintain continuous discharge records. Using that analysis, a flow of 1,000,000 cubic feet per second (cfs) was determined to be the 2-year frequency flow in the reach of the Mississippi River that includes New Madrid.

The Corps then determined the elevation at New Madrid represented by this flow. The Corps employed a synthetic rating curve for the period 1993-1997 based on computed flows at Hickman, Kentucky (the closest point at which discharges are measured, and which in fact sets flows for the entire lower river) and corresponding stages at New Madrid. This means that the Corps computed the flows at Hickman and compared them with the measured elevation (stages) at New Madrid and generated a curve to illustrate the relationship between the two. This analysis established the elevation of the 2-year event without project at New Madrid at 290 feet.

The USFWS also raised this as an issue in their comments on the draft 1998 DSEIS, as presented in the 2000 FSEIS in Appendix J in the 13 page section immediately preceding the Water Quality discussion. The Corps responded in a facsimiled memo (referred to following the USGS Letter and on the sixth page of this section) that sets out the information above. That memo has been included in the RSEIS 2 Appendix F, Attachment 2.

The comment suggests that the Corps should have used only the stages at the New Madrid gage to set the elevation of the 2-year without project event. However, stage data varies from year to year, even with the same flow in the river, due to a variety of conditions. For example, for a flow of 1,000,000 cfs, the stage might be influenced by the temperature of the water (higher temperature yields higher stages), or changes in the channel from year to year as the river degrades and aggrades the bed, or there may have been a flood on a tributary downriver from the gage that would result in a backwater

[3] The existing condition for the St. Johns Basin was computed using this method and is correct since that basin was already cut off from the river.

effect and higher observed stages. Changes in vegetation from season to season and year to year can also influence the stage. In short, any number of events can influence local stage observations. This means that stage data, while useful, are very susceptible to influences that may skew the analysis.

The Corps recognizes these effects and prefers to use flow data to compute flood frequency information, since it is the most reliable tool for this application. This judgment is formalized in Engineer Manual 1110-2-1415. Flow is a much more stable variable and is not so easily influenced by local conditions. That is what was done in this case, but the Corps took the local conditions into account by developing the synthetic rating curve. The Corps of Engineers has years of experience with the hydraulics and hydrology of the Mississippi River in general and in the project area in particular. The Corps has been studying the river intensively since the inception of the MR&T Project in 1928. The Corps used this experience and training and its professional judgment in making the decisions described above.

Bohlen Comment 30:

IV. THE VAROIUS ANALYSES OF WETLAND IMPACTS ARE FUNDAMENTALLY FLAWED

A. The new claims that the project only impacts a few hundred acres of wetlands are contradicted by the Corps' own analysis.

Through the different draft and final environmental impact statements produced as part of planning for this project, the Corps has steadily decreased the area of wetlands it states that the project will impact. In the 2000 Final SEIS the Corps stated that the project would impact 36,000 acres of wetlands. In the 2002 RSEIS, it stated that roughly 18,000 acres of wetlands would be impacted. In places, the RSEIS2 now claims, implausibly, that only 622 acres will be affected by the project, of which 102 acres are vegetated wetlands, and 520 acres are farmed wetlands.

Bohlen Response 30: See Response to Bohlen Comment 58 below. Estimates of wetland acre impacts have been revised to correct and clarify previous information as a result of public comments and also as a result of an updated analysis of potential farmed wetlands and prior converted cropland. In spite of the reductions in project impacts to which you refer, wetland mitigation has not changed from the 2002 RSEIS to this RSEIS 2 (See Response to Bohlen Comment 40 below). Construction of flood damage reduction features in the St. Johns Bayou Basin and closure of the New Madrid Floodway would directly impact a total of 102 acres of jurisdictional wetlands. Additionally, closure of the New Madrid Floodway would impact jurisdictional status to a maximum of 520 acres of farmed wetlands. Therefore, the comment concerning 622 acres is partially correct. Construction of the project will impact jurisdictional status on 622 acres of wetlands.

However, the project will also decrease backwater flooding to additional jurisdictional wetlands. (5,781 acres; see 2002 RSEIS Appendix D, page D-9) However, the decreases in flooding will not impact jurisdictional status to these areas. Jurisdictional wetlands will remain jurisdictional wetlands due to factors other than backwater flooding such as high groundwater table, headwater flooding, and precipitation. Impacts due to the reduction of backwater flooding were assessed by the fish HEP model and the waterfowl WAM model. Impacts from a reduction of flooding were calculated on jurisdictional wetlands as well as prior converted cropland.

Bohlen Comment 31:

What is truly astonishing about these successive statements about the extent of wetland impacts due to the project is that the hydrologic analysis of the pre-project and post-project duration and extent of flooding has not changed at all. Neither has the map of land use within the project area. These steadily shrinking claims about the extent of wetland impacts are based solely on arbitrary changes in what lands the Corps chooses to enumerate. These changes, however, rest on factually and legally incorrect premises.

First, the claim that the project now impacts only 102 acres of vegetated wetlands, such as forested wetlands is based on the premise that the Corps need only consider vegetated wetlands directly filled during project construction. Even in the 2002 RSEIS, the Corps acknowledged that there were thousands of acres of forested and other vegetated wetlands on which flooding would be either eliminated or greatly reduced. The elimination or great reduction in backwater flooding is a major wetland impact and should be treated as such. In my testimony before the Missouri Clean Water Commission, I also explained how the 2002 RSEIS left out many more thousands of acres of wetlands that will also not experience backwater flooding – a significant

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hydrologic alteration – as a result of project construction. These are wetland impacts that must be accounted for under the § 404(b)(1) guidelines even if, as the Corps implausibly claims, these wetlands will remain just wet enough from local rainfall sources not to lose their jurisdictional status as wetlands.[14]

[14] The Corps has provided no substantial justification for its claim that none of these wetlands will lose their jurisdictional status. Indeed, that claim appears implausible, especially with respect to those forested areas now flooded most regularly by the Mississippi River whose backwater flooding will be eliminated.

Bohlen Response 31: See Response to Bohlen Comment 30 above.

The Corps does not claim that the project will impact "only 102 acres of vegetated wetlands" (See 2002 RSEIS Table 4-1 and 4-2 and Appendix D). The Corps has said that 102 acres of vegetated wetlands will be "directly impacted" by the project, that is, they

will be replaced by project structures (See 2002 RSEIS Table 4-1 and 4-2 and Appendix D). The Corps has consistently called "direct" impacts the loss of wetland status because of fill and channel enlargement. Indirect impacts are the reduction in hydrology (inundation from backwater). The Corps analyzed impact to wetlands (See Response to Bohlen Comment 39 below).

The statement in Footnote 14 that "[t]he Corps has provided no substantial justification for its claim that none of these wetlands will lose their jurisdictional status" is incorrect. Pages D-8 and D-9 of the 1999 DSEIS; pages D-5, D-6, and D-7 of the 2000 FSEIS; and pages D-6, D-8, and D-9 of the 2002 RSEIS succinctly provide a clear rationale for the conclusion that the non-cropland jurisdictional wetlands that will receive reduced inundation from backwater flooding will retain their jurisdictional status after project implementation. The thorough review to substantiate this conclusion was done by individuals very familiar with the project area. The ground-truthing procedures utilized to verify the existing wetland status of forested wetlands at elevation 290 feet NGVD were performed at a time in which the Mississippi River was not near an elevation that would inundate these lands. This provides further evidence that forested wetlands that experience reduced inundation from backwater flooding after implementation of the project will retain their jurisdictional status. The Water Quality Certification from the State of Missouri requires monitoring of jurisdictional wetlands below an elevation of 295 feet NGVD to verify this assertion and requires additional mitigation if additional jurisdictional wetlands are impacted.

Bohlen Comment 32:

> Second, the Corps has now abandoned its prior estimate that approximately 9700 acres affected by the project qualify as farmed wetlands. All of these acres will be at least partially drained by the project, and the Corps acknowledged in the 2002 RSEIS that 6713 of these acres may no longer be flooded long enough post-project to qualify as farmed wetlands. In fact, the analysis performed by the Corps showed that all of these 6,713 acres would no longer have backwater flooding sufficient to meet farmed wetland criteria, which require fifteen days of inundation during the growing season at least once every two years on average. The Corps has not altered its own analysis, but now inappropriately relies on an earlier NRCS estimate that 0.4% of the cropland in the project area is farmed wetland. The Corps rejected this same estimate in the 2002 RSEIS.

Bohlen Response 32: For an explanation of the 9,700 acres, 6,713 acres, and NRCS' 0.4%, see the Response to Bohlen Comment 37 below. In general, in earlier documents, the Corps relied on conservative estimates that overstate the number of potential farmed wetlands in the project area. These estimates were based solely on the inundation period. The Corps did not and has not done a jurisdictional wetland determination on any of these acres. NRCS has made its own estimate of the farmed wetlands in the area based on their current mapping conventions and the HGM provided by the Corps. Although the Corps accepts NRCS' analysis for purposes of the Food Security Act, mitigation for the

project has been based on the Corps' numbers, not NRCS' numbers. The commenter's concerns in this regard are misplaced.

Regarding the New Madrid Floodway flood control features, there are no acres that are 'drained' by this project. Draining in the sense of agricultural drainage means to install measures to remove water faster or more efficiently to allow for agricultural production or to intensify production. Several mitigation approaches proposed in this RSEIS 2 would actually serve to reduce drainage from wetland mitigation tracts (Sections 2.6.2.2., 2.6.2.4, 5.2.2.1, 5.2.2.2, 5.2.3.2, for example). Rather than 'drain' the area, the project will reduce backwater flooding.

Bohlen Comment 33:

In response to a Corps request, NRCS last fall "evaluated the St. Johns Bayou/New Madrid Floodway project for its effect upon wetland conservation provisions of the Food Security Act."[15] The agency did not develop a new estimate of the area of farmed wetland within the project area, but stated only, "Our sampling shows the original wetland inventory to be adequate for delineating farmed wetlands (FW) for planning purposes in the project area." The Corps justifies their return to the previously rejected estimate of the area of farmed wetland on that basis.

The letter from NRCS notwithstanding, there are significant problems with NRCS's original estimate of farmed wetlands within the project area, as acknowledged in the 2002 RSEIS. It is worth quoting from the 2002 RSEIS.

> The Bootheel region of southeast Missouri was one of the first areas to be mapped in accordance with the 1985 Food Security Act (Farm Bill). The 1989 mapping conventions were developed with a multi-agency team of U.S. Fish and Wildlife Service, Missouri Department of Conservation, and the NRCS. All determinations in the Bootheel were made off-site using four years of slides (1984-1989). Two sets (spring and summer) of slides were available, and NRCS chose to use the summer set of slides. These years also represent drought years, but that was not considered in making the determinations (pers. Comm., Pat Graham/NRCS).[16]

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[14] The Corps has provided no substantial justification for its claim that none of these wetlands will lose their jurisdictional status. Indeed, that claim appears implausible, especially with respect to those forested areas now flooded most regularly by the Mississippi River whose backwater flooding will be eliminated.

[15] Letter from Roger Hansen, State Conservationist, to Larry Sharpe, October 5 2005. and attached NRCS report.

[16] 2002 RSEIS Appendix D, Page D-4 and D-5

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Bohlen Response 33: The Corps did not "reject" NRCS' estimate of farmed wetlands in the project area. To ensure that the project was fully mitigated, the Corps chose to rely on its own conservative estimate of potential farmed wetlands. The Corps is relying on NRCS' analysis for purposes of the Food Security Act. However, compensatory mitigation is based on compensating for unavoidable significant impacts to fish and wildlife resources. This includes impacts attributed to reduced backwater flooding whether the area is a jurisdictional wetland, permanent waterbody, farmed wetland, or prior converted cropland. Please see Response to Bohlen Comment 37 below.

Bohlen Comment 34:

The RSEIS also points out that NRCS Food Security Act wetland determination rules have changed significantly since this estimate was first produced. In rejecting this estimate of Farmed Wetlands, the 2002 RSEIS states "The Corps did not want to underestimate wetland impacts by analyzing only impacts to a small portion of the land (0.4 percent) that was currently classified as farmed wetlands (FW)."

Thus the Corps, in abandoning its previous analysis has abandoned it in favor of a wetland determination

(1) that it previously rejected as an underestimate of farmed wetlands in the project area
(2) that was based on outdated mapping convention; and
(3) that was based on summer aerial photographs (after the period of spring flooding) taken in drought years.

For obvious reasons, such an estimate is likely to significantly underestimate the extent of farmed wetlands.

Bohlen Response 34: The Corps has not abandoned its previous analysis concerning wetland impact analyses. Wetland information with regard to farmed wetlands has been revised to reflect current information provided by NRCS (RSEIS 2 Section 4.4.3.1). As previously stated and in addition to direct impacts from project construction, mitigation is based on impacts from the reduction of backwater flooding (See Response to Bohlen Comment 37). Impacts were quantified on all areas regardless of jurisdictional status of the area and mitigation has been proposed accordingly.

Bohlen Comment 35:

> Reliance on this estimate for purposes of mitigation planning, which is the main context here, is inappropriate for several reasons. First, the Corp's method for estimating the extent of farmed wetland was based on hydrologic data, which is far more reliable than the indirect evidence derived from aerial photography used in generating the NRCS estimate for reasons discussed below. Second, the Corps cannot simply defer to the NRCS because the Corps and NRCS last October dissolved their Memorandum of Agreement whereby the Corps accepted NRCS wetland delineations. For determination of jurisdictional wetlands, the Corps' own wetland analysis must control. Thus the NRCS estimate, even if it were acceptable for NRCS purposes, cannot be accepted by the Corps over the Corps' own analysis for Corps purposes, including compliance with NEPA, the Water Resources Development Acts, , Section 404 of the Clean Water Act and Executive Order 11990.
>
> By regulatory definition, a farmed wetland is an area in agricultural use that has hydric soils and has a 50% probability of being inundated for at least fifteen consecutive days during the growing season. The determination of whether specific lands constitute farmed wetland is thus a matter of fact, and can in principal be determined unambiguously by site-specific determination of (1) whether the area is in agricultural production, (2) soil characteristics and (3) whether or not the area is inundated for the requisite days in most years. As a matter of practice, however, indirect methods must generally be utilized to estimate whether specific lands qualify. This is because in most contexts, evidence of the duration and frequency of flooding is lacking. Almost always, long-term hydrologic records that permit estimation of the long term probability of flooding are unavailable. A variety of indirect methods have been developed to substitute for this lack of information.

Bohlen Response 35: The Corps appreciates the commenter's confidence in the Corps' method for estimating the extent of farmed wetlands in the project area. The Corps continues to rely on this estimate to determine compensatory mitigation. However, NRCS makes certified farmed wetland determinations. In the 2002 RSEIS, NRCS expressed some concern about the potential effects that new mapping conventions might have on their estimate. NRCS has taken a fresh look at the area, employing their new mapping conventions and they have clearly stated that they estimate that only 0.4% or about 520 acres are potentially farmed wetlands within the project area (See Response to Bohlen Comment 37 below). The jurisdictional status is relevant for determining whether the proposed mitigation is adequate for purposes of the Food Security Act, as confirmed by NRCS. Based on the Corps' HGM and its own reanalysis, NRCS has determined that the Corps' mitigation is adequate for that purpose and the Corps relies on that determination. See the Response to Bohlen Comment 43 below.

Bohlen Comment 36:

In the present situation, however, excellent information on the frequency and duration of flooding exists. 32 years of data on Mississippi River stage can be used with great reliability to determine the duration and extent of flooding in the project area. Extensive hydrologic modeling has been carried out based on this 32 year period of record to support project design. The economic and environmental analyses for the project rely on this data. Thus the Corps has data that can be used to directly and simply determine what lands will be inundated for a period of 15 days during the growing season in most years.[17] It was precisely such an analysis that was used to produce the estimate in the 2002 RSEIS that 9700 acres of farmed wetlands occur within the project area. The original Corps analysis is significantly more robust in terms of determining the extent of areas meeting the hydrologic criteria of farmed wetlands than is the method used by NRCS. (The inherent limitations and particular weaknesses of the NRCS analysis as applied to this project are discussed further below.)

[17] This form of analysis may leave out wetlands in higher elevations flooded solely by local rainfall. It may therefore underestimate farmed wetlands, but it will not overestimate farmed wetlands.

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Bohlen Response 36: The Corps agrees that the 2002 RSEIS, in particular Tables 4-1 and 4-2, indicates 9,700 acres of cropland within 'wetland' tables. Since the comment apparently reflects confusion regarding the data presented of the tables, perhaps these cropped areas could have been presented more clearly as a mixture of farmed wetlands and prior converted cropland. However, Response to Bohlen Comment 37 below and Section 4.2.1.2 of the RSEIS 2 explain the goal of the hydrologic analysis with respect to farmed wetlands. The 2002 RSEIS stated that this was to avoid underestimating the actual farmed wetland acres affected by the project (2002 RSEIS Appendix D, page D-5, second paragraph). However, mitigation in the RSEIS 2 is still based on the Corps' hydrologic analysis.

Regarding wetlands that are flooded only by local rainfall, these potential wetlands will not be impacted by the project, which only reduces backwater flooding. Therefore, whether these wetlands are included or not does not affect the analysis.

Bohlen Comment 37:

> Not only is the approach taken by the original Corps analysis to determining hydrologic characteristics the "gold standard" for determining wetland hydrology but it is also established as the first method for doing so in the 1987 Corps Wetland Delineation manual, which is still in effect. Under that manual, areas that meet hydrologic criteria according to this kind of analysis are deemed to have wetland hydrology. In this case, there is also no dispute that all the areas identified in this way also have hydric (i.e., wetland) soils – and that is confirmed by the NRCS analysis. The Corps admission that 9700 acres are flooded long enough to meet the farmed wetland criterion is therefore conclusive.

Bohlen Response 37: The characterization of the Corps' inundation analysis is appreciated, and the Corps agrees and has consistently stated that the forested areas in question have sufficient hydrology from backwater flooding to meet the Corps' 1987 Wetland Delineation Manual hydrologic criteria. However, the Corps neither performed any ground-truthing of cropland to verify hydrology, nor determined whether any areas also meet the hydric soils criteria to be classified as wetlands, farmed or otherwise. Rather, the Corps assumed that areas estimated to have the necessary hydrology were wetlands and calculated impacts and maximized mitigation accordingly. Based on the hydrology, the Corps estimated that up to 9,700 acres of potential farmed wetlands existed in the project area. This estimate is "conclusive" of nothing more than that, and certainly is not a basis for saying that 9,700 acres of farmed wetlands are located in the project area.

The hydrological inundation analysis was based on Mississippi River stages, contours of the land, and other source of hydrology (2002 RSEIS Appendix C). The comment that there is "no dispute" that all the areas have hydric soils overstates the situation. The Corps did not evaluate whether these acres had hydric soils and the NRCS relied on its mapping conventions. In the absence of empirical data, the absence of dispute on the matter cannot be assumed. However, whether these lands have hydric soils or not is not an issue because the Corps assumed for the purpose of analysis that if the hydrology was there, the other wetland criteria were present as well (2002 RSEIS, Page D-2, Assumption 3). Therefore, the Corps' analysis was conservative.

NRCS is the agency charged with responsibility for jurisdictional determination of farmed wetlands.

The "admission" that 9,700 acres have the hydrology to be classified as farmed wetlands, and to complete that thought, that 6,713 of those acres would lose that hydrology due to reduced backwater inundation, was a conservative approach to develop an estimate of maximum potential farmed wetland impacts (See 2002 RSEIS Tables 4-1 and 4-2). It was not a jurisdictional wetland determination of farmed wetlands. Therefore the Corps' "admission" cannot be "conclusive" on this point. Based on the NRCS' estimate of project area farmed wetlands using current mapping conventions, a substantial portion of

those 6,713 acres are likely prior converted cropland and not farmed wetland (See NRCS letter of October 5, 2005, RSEIS 2 Appendix G).

Additionally, the NRCS has completed one certified determination within the project area (RSEIS 2 Appendix F, Attachment 4). This particular area would have been classified as potential farmed wetlands by the Corps' inundation analysis. However, the results of the certified determination concluded that the area is prior converted cropland (See Bohlen Response 44 below).

The Corps has consistently favored the environmental resources in all of its analyses for this project. The Corps continues to base mitigation for wetlands on its inundation analysis, so the jurisdictional characterization of the acres in question is irrelevant. In other words, the Corps recognizes that it is most likely proposing mitigation for hydrological impacts on a substantial number of prior converted croplands.

Bohlen Comment 38:

B. The HGM analysis is similarly flawed.

Although the 2005 DSEIS truly justifies the proposed mitigation by the use of models focused on individual aquatic functions, the RSEIS2 now includes a separate kind of analysis to evaluate impacts on wetlands per se. This analysis is a modified form of the Hydrogeomorphic Method or HGM. Like any HGM-based functional assessment, it is based on a "Regional Guidebook", in this case, Klimas at al. 2004, A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Forested Wetlands in the Delta Region of Arkansas, Lower Mississippi River Alluvial Valley.

I applaud the decision by the Corps to use this well documented method for determining wetland functions to evaluate project impacts and consider mitigation alternatives. Although the project area lies outside the reference domain of the Regional Guidebook, and thus it cannot be demonstrated based on reference wetlands that the method is valid, I must defer to local experts with respect to whether application of the regional guidebook to the project area is reasonable. There is much to be commended in this effort to use an HGM analysis to evaluate wetland mitigation requirements. Unfortunately, its use here to argue that wetland impacts of the project would be fully mitigated is flawed for four reasons.

Bohlen Response 38: The Corps' wetland analysis is set out in the RSEIS 2 Section 4.2.1. As explained in detail there, the Corps made an estimate of the agricultural lands which would experience reduced inundation and, for planning purposes, assumed that this entire area consisted of wetlands. The NRCS said that the Corps' estimate of 6,713 acres of impacts to farm land was good for planning purposes (2002 RSEIS Tables 4-1

and 4-2). The NRCS' own estimate of the farmed wetlands in the project area using their own mapping conventions was 0.4% (or 520 acres based on the Corps GIS data).

When the Corps withdrew the ROD and reconsidered project impacts, the NRCS was asked to provide additional information on wetland impacts and the sufficiency of the Corps' proposed mitigation. In order to make a statement regarding the sufficiency of mitigation, the NRCS asked that the Corps conduct an HGM analysis to determine the impacts of the project on the various wetland functions provided by farmed wetlands. This is the method of analysis preferred by NRCS. The Corps complied and in addition, used HGM on the area of direct impacts (under the footprint of the project). The results of the HGM analysis and NRCS' reevaluation using current mapping conventions confirmed the NRCS' previous estimates of the farmed wetlands in the project area, the functions they perform, and the adequacy of the Corps' mitigation. This request is explained in Section 4.4.3.1 (4th paragraph), and also related text in Sections 4.2.1.2 and 4.2.1.3 of this RSEIS 2. The HGM Guidebook to the Delta Region of Arkansas is applicable for use in the St. Johns Basin and New Madrid Floodway project area (See RSEIS 2 Appendix D, Assumption 1).

This and other comments suggest that the Corps is relying on the NRCS' estimate to calculate mitigation. This is not the case. The Corps has used NRCS' estimate of area wetlands to determine a baseline for required wetland mitigation. However, the Corps is actually proposing a higher number of acres of mitigation than would be suggested using only NRCS' estimate (RSEIS 2 Section 5.2).

Bohlen Comment 39:

The biggest problem by far is not a flaw with the HGM analysis per se but lies in the limited acreage of wetlands to which it was applied. The HGM analysis was applied to only a tiny subset of the wetlands that will be altered by the proposed project, and thus dramatically understates the cumulative wetland impacts. The Corp's HGM analysis assumes that the only wetland impacts are on 622 acres of wetlands (102 acres of direct impacts and 520 acres of indirect effects to farmed wetlands (following the NRCS estimate of farmed wetland area in the project area). However, it has been well documented that hydrology of many times as many acres of wetland will be significantly altered.[18] In previous testimony, I have argued that the actual area of wetlands that will experience reductions in flooding and other alterations of hydrology is likely to be substantially higher. The Corps has chosen not to evaluate the functional losses associated with these hydrologic changes, although (1) basic principals of wetland ecology hold that they will be substantial, and (2) the very HGM model used in the RSEIS2 indicates that reduction in flooding has a major impact on wetland functions.

The Arkansas Regional Guidebook for the HGM used by the Corps in the RSEIS2 includes assessment models for 7 wetlands function categories. Hydrologic variables are an explicit component of six of the seven and frequency of flooding – explicitly "overbank or backwater flooding from a stream"[19] – is a component of four: Detain Floodwater, Export Organic Carbon, Remove Elements and Compounds, and Provide Habitat for Fish and Wildlife.[20] For three of these four functions (fish and wildlife habitat is the exception), the FCI score (the estimate of relative wetland function in HGM) is essentially proportional to the frequency of flooding[21], Sites that are flooded only once every five years are estimated to provide only one quarter of these functions compared to sites flooded on at least every two years. The HGM model makes it quite plain: significantly reduced backwater flooding from the Mississippi on forested wetlands throughout the project area will significantly reduce wetland function.

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18 The 2002 RSEIS identified 13,205 acres of jurisdictional wetlands within the project area that would experience "reduced inundation" under project alternative 3-1.A. 2002 RSEIS, Appendix D, page D-9. (No estimate was stated for project alternative 3-1.B., which would be mostly reduced). This estimate was based not merely on an improperly limited estimate of wetland acres, but also on an improper definition of "reduced inundation." It referred only to areas that would not be flooded long enough to meet jurisdictional wetland criteria. Other wetland acres would still have reduced inundation but would not cross that particular threshold.

19 Regional Guidebook, page 121.

20 Changes in frequency of flooding can also be anticipated to lead to gradual changes in remnant forested wetlands throughout the project area, as has been observed in and around Big Oak Tree State Park.

21 Strictly speaking, the FCI score is proportional to the frequency of flooding subindex, V_{FREQ}.

Bohlen Comment 39 (continued):

The Corps chooses not to evaluate these wetland impacts at all on forested wetlands, apparently on the basis of their claim that none of the forested wetlands in the project area will be converted from jurisdictional to non-jurisdictional status. While I disagree with that premise, even if it turned out to be true, significant wetland functions will be lost even on wetlands that retain their jurisdictional status. Under Section 404 of the Clean Water Act and the Section 404(b)(1) guidelines, impacts to wetlands may occur not merely from their direct filling or complete elimination but also from other consequences of project construction and such impacts are generally considered in determining compensation requirements. The partial HGM analysis presented in the RSEIS2 ignores these impacts on vegetated wetlands, and relies on a flawed estimate of the extent of farmed wetlands. The analysis is therefore wrong and seriously understates the extent of wetland functional losses associated with the project.

If the HGM analysis were applied to the true extent of wetland impacts on thousands of acres of wetlands, it would almost certainly show that proposed mitigation fails to compensate for wetland impacts. The HGM analysis shows that more than one acre of reforestation is required to make up for each acre of wetland impact on both farmed and vegetated wetlands. A realistic accounting of wetland impacts will therefore show that tens of thousands of acres of reforestation are required to compensate for the projects full wetland impacts.

Bohlen Response 39: Although the 404(b)(1) guidelines do not require an HGM analysis, the Corps did perform an analysis of impacts of the project on wetlands (2002 RSEIS Appendix F). The comment is correct in that the HGM analysis was not applied to the entire project area. The Corps chose to utilize a different methodology in analyzing functional losses of the wetlands. In conducting its 404(b)(1) analysis, the Corps began by quantifying potential wetland areas that would be impacted. The 300-foot NGVD contour was chosen as the maximum practical extent of flooding due to backwater events (which correlates to in excess of a 70-year flood in the St. Johns Basin and excess of a 30-year flood in the New Madrid basin). The number of acres within the 300-foot contour was calculated by using GIS topographic data coupled with an inundation analysis (WETSORT). WETSORT provided the elevation at which water was expected to be present for 12 consecutive days in 50% of the years (for non-agricultural lands)[4] or 15 consecutive days in 50% of the years (for agricultural lands).[5] See 2002 RSEIS Appendix C, page C-5 for a description of the WETSORT process. These elevations were applied to the GIS data resulting in the number of acres in various land cover types meeting the hydrologic inundation criteria (forest, scrub/shrub marsh, herbaceous vegetation, cropland, pasture, sandbars, urban, and open water) (See 2002 RSEIS Section 4.3.1).

[4] This meets the inundation criterion for jurisdictional wetlands under the 1987 Corps of Engineers Wetland Delineation Manual.

[5] This meets the inundation criterion for farmed wetlands under the Swampbuster provisions of the Food Security Act. However, this does not take into account that most of these acres are designated as prior converted croplands.

The Corps, USFW, and MDC ("HEP team") agreed upon the techniques to analyze the functional characteristics of the impacted lands. This team selected aquatic and terrestrial HEP and WAM to evaluate impacts to forested wetlands. Scrub/Shrub/ Marsh habitats were evaluated using the terrestrial and aquatic HEP models. Cropland, pasture, and herbaceous habitats were evaluated using the shorebird and aquatic HEP and WAM. Open water was evaluated using the aquatic HEP. All habitat models were developed by the USFWS. The HEP team jointly selected and agreed on sample sites and the impacts of each alternative (2002 RSEIS Appendix D, page D-13).

Furthermore, in response to the concern that there were other wetland functions that were not fully evaluated (particularly with respect to water quality issues), the Corps commissioned WES to study nutrient cycling, groundwater recharge, floodwater storage, sediment retention/export and nutrient and sediment input of the project on Big Oak Tree State Park (2002 RSEIS Appendix D, page D-14). The results of this study can be found in the 2002 RSEIS at Appendix I.

The Corps' analysis was completely adequate for the Corps' purposes. However, the Corps asked NRCS to confirm its prior estimate of the farmed wetlands in the project area and to advise whether the project's impacts to those wetlands were adequately mitigated. To perform the requested analysis, the NRCS in 2005 requested an HGM assessment be conducted on farmed wetlands to determine if compensatory mitigation was adequate. The Corps performed the HGM and furnished the results to NRCS. NRCS confirmed its previous estimate of the number of acres of farmed wetlands and stated that the Corps' mitigation was "more than adequate." (NRCS letter, dated October 5, 2005, see RSEIS 2 Appendix G).

Neither the Clean Water Act nor the Swampbuster provisions of the Food Security Act regulate prior converted cropland. However, the Corps' mitigation proposal is based upon project impacts to resources and not the jurisdictional status of those resources.

Bohlen Comment 40:

The second major problem with the HGM analysis is that a proper HGM analysis cannot be made until the Corps identifies specific mitigation sites. HGM analyses generally, and HGM analysis under the Arkansas Delta Regional Guidebook in particular ordinarily rest on detailed site-specific analysis incorporating substantial field work. This can be seen clearly when one examines HGM Regional Guidebooks and is clearly evident when one participates in field training on HGM methods. The Arkansas Regional Guidebook includes twenty separate assessment variables, many of which cannot be determined based on map data or remotely sensed information alone. But no field work was carried out in this case. Furthermore, the express intent of the HGM protocols is that they be applied on a site-specific basis.[22] And application of the method on a site specific basis – at least with regard to mitigation sites – is not possible until such time as mitigation sites have been specified. It would be more appropriate to say, therefore, not that an HGM analysis was carried out, but that an analysis was carried out to estimate what the results of an HGM analysis might look like if one were actually carried out. This distinction is far from trivial. It is a fundamental premise of the HGM method that wetland functions vary site to site based on site characteristics, a position consistent with both principals of wetland ecology and the findings of the National Academy of Sciences report on wetland mitigation. On the whole the HGM approach to wetland functional assessment thus reinforces the comments I have consistently made

[22] The first sentence of the introduction of the Arkansas Regional guidebook is the following: "The Hydrogeomorphic (HGM) Approach is a method for developing functional indices and the protocols used to apply these indices to the assessment of wetland functions at a site-specific scale."

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that a proper mitigation analysis requires a detailed mitigation plan with site-specific information.

Bohlen Response 40: See Response to Bohlen Comment 39 above. The Corps did not perform an HGM analysis of the entire project area, is not required to do so, and does not propose to do so. The Commenter is suggesting that the Corps is required to provide a detailed mitigation plan for this RSEIS 2. This is not required (RSEIS 2 Sections 4.5.2, 4.5.3, 4.5.4, and 6.3). See also 2002 RSEIS Appendix M, pages M-11 – 12 and Responses to Bohlen Comments 49, 50, 51, 54, and 55.

Bohlen Comment 41:

> The third problem is that, in the absence of site-specific information on mitigation sites, the HGM analysis was forced to rely in analysis of "generic" impact and mitigation sites. While the analysis makes a assumptions that are for the most part well crafted, ther is one critical exception. The appendix nowhere describes what hydrologic conditions – and in particular what frequency of flooding –were assumed to apply to sites of wetland impact and to mitigation sites. It appears to assume that mitigation sites will be regularly flooded to provide maximum wetland functions.Yet we know (1) that frequency of flooding has a significant effect on wetland functions, and (2) that the potential mitigation sites that have been identified in the New Madrid basin include areas that are infrequently or never flooded by backwater. The key assumption therefore appears to be counterfactual.

Bohlen Response 41: The HGM report the Corps provided to NRCS specifies that both the impact site and the mitigation site are assumed to be frequently-flooded, riverine backwater settings; it does not describe the specific flood frequency used in the assessment (RSEIS 2 Appendix D, page 207, assumption (b)). In fact, however, a 2-year flood zone was assigned to both impact and mitigation sites. As indicated in the 2002 RSEIS, potential wetland mitigation land will be pursued within the post-project 2-year flood zone (See RSEIS 2 Section 2.2 and 2002 RSEIS Section 5.3.2, 11th paragraph). The 2-year frequency designation produces the maximum functional effectiveness for the frequency variable in all models in which frequency is a component. Refer to Response to Bohlen Comment 39 above regarding the higher functionality within the 2-year floodplain as cited in the Arkansas Regional Guidebook.

Bohlen Comment 42:

> Finally, the HGM model (at least as applied in this, "generic" form) assigned no habitat value to farmed wetlands. Yet, in this case, there is no dispute that farmed wetlands have substantial habitat value, as reflected in the Corps HEP analyses For this reason, the HGM cannot address impacts on lost fish and other habitat functions of the wetlands. Loss of habitat values are indisputably a form of impact to wetland, and must be compensated. In the present case we know that the HGM analysis is structurally unable to represent these functional losses, and thus we cannot rely on the HGM analysis alone to be certain that all significant wetland functions are effectively mitigated. The HGM analysis cannot stand alone as a complete assessment of wetland impacts. The , merits of the Corps' overall wetlands impact analysis thus continues to depend on the merits of the fish and other HEP models and the adequacy of the mitigation proposed based on those models

Bohlen Response 42: Concur. The Corps' analysis recognizes the habitat value of farmed wetlands without qualifying it as "substantial."

Bohlen Comment 43:

C. The NRCS wetland analysis for Swampbuster purposes is also flawed.

I have reviewed the NRCS report and underlying maps used to reassess wetlands in the project area in October of 2005. It confirms that the NRCS analysis of wetlands is flawed for Swampbuster purposes as well.

The definition of a "farmed wetland" is identical for Swampbuster and Clean Water Act purposes. The definition, as stated above, requires that wetlands have hydric soils and be flooded for a period of at least 15 days during the growing season. Since there is no question that potential farmed wetlands in the project area have hydric, i.e., wetland, soils, the only question is whether particular parcels are inundated for 15 consecutive days at least every other year on average during the growing season. That is known as the test of wetland hydrology.

Bohlen Response 43: Please see the preceding Responses to Bohlen Comments 37 (as to the commenter's "no question" the soils are hydric), 41, 42, 44 and Environmental Defense Response 11. Additionally, refer to RSEIS 2 Section 5.2.

The NRCS and the Corps have not made certified farmed wetland determinations for this project. The NRCS performed a review using current mapping conventions to verify the previous estimate of farmed wetlands in the project area was still reasonable (NRCS May 29, 1998). This was conducted to ensure that the flood damage reduction project and the proposed compensatory mitigation would not result in Swampbuster violations.

Bohlen Comment 44:

Note that this standard is a numerical one that hinges on hydrologic conditions. In the current situation, the Corp's hydrologic modeling for project planning has

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examined hydrologic conditions – at least with respect to backwater flooding – with unusual precision based on the most reliable form of evidence of site hydrology that is virtually ever available. We thus know, to a degree unusual in wetlands-related work, exactly what lands meet the hydrologic criteria for being designated farmed wetland. The indirect methods employed by the NRCS in their recent partial re-evaluation of the extent of farmed wetland in the basin is far less reliable for determining hydrologic condition than is direct hydrologic modeling.

Disregarding the Corps' direct evidence of wetland hydrology, the NRCS applied an indirect form of evidence for wetland hydrology or the lack of it. On a sampling of sites, it has used aerial photographs taken of crops in years that reflect dry and wet years based on local rainfall. Based on those aerial photographs, it looked for signs of crop stress, delayed planting, and other indications of excessive wetness. While this may comply with NRCS's standard approach to wetland determination, the method is a much less reliable way to determine site hydrology than the evidence gathered by the Corps. The NRCS hydrologic indicators are indirect and the analysis is based on data from only a handful of years, while the Corp's original method was based on direct estimates of flooding based on a 32 year record. No wetland scientist could credibly prefer the NRCS analysis in this case to the direct data provided by the Corps.

Bohlen Response 44: The Corps' hydrologic model estimated that construction of the flood damage reduction project would decrease inundation on a total of 1,296 acres and 5,417 acres of agricultural lands that could meet the 15-day hydrologic criterion for farmed wetlands within the St. Johns Bayou Basin and the New Madrid Floodway, respectively. This model was utilized for planning purposes and was not intended to make certified wetland determinations. This model does not equate to on-site verification. Additionally, the model did not account for other wetland features such as the presence or absence of hydrophytic vegetation, or hydric soil indicators (*i.e.,* histosol, histic epipedon, sulfic odor, aquic moisture regime, reducing conditions, gleyed or low chroma colors, concretions, high organic content in surface layer in sandy soils, organic streaking in sandy soils, listed on local hydric soils list, listed on National hydric soils list, and other soil factors). Put simply, on the basis of elevation alone, the Corps' model set the outer boundaries of the acreage that could be considered to meet the jurisdictional definition of "wetlands" based on backwater inundation. This included the assumption that 100% of the agricultural areas that meet the 15-day hydrologic criterion had hydric soils.

NRCS confirmed that the Corps identified the maximum area that could experience flooding for 15 days (289.0 and 288.3 NGVD in the St. Johns Basin and the New Madrid Floodway, respectively) and could therefore potentially be farmed wetlands from backwater effects only. NRCS then used aerial photographs, Farm Service Agency compliance slides and other tools to determine whether particular areas within the Corps' maximum area actually would be farmed wetlands (i.e., actually were flooded and had hydric soil). Farm Service Agency compliance slides were selected that represented wet, normal, and dry precipitation years. Farmed wetland signatures (*e.g.,* drowned crop, standing water) were interpreted from the compliance slides. NRCS has identified areas within the Corps' backwater flooding zone that are not farmed wetlands, because — 1) they contain non-hydric soils, 2) they have been previously manipulated, or 3) they lack other characteristics of farmed wetlands, such as stressed vegetation, that were not observed during an on-site determination. The NRCS estimated that 0.4% of the entire project area actually would be considered to be farmed wetlands.

The NRCS has stated that the most reliable method to make farmed wetland determinations is to conduct an acre by acre analysis with current mapping conventions to obtain exact data (NRCS letter, October 5, 2005). The Corps agrees with this statement and most wetland scientists would agree as well. However, the Corps did not make jurisdictional determinations for the purposes of calculating damages or mitigation, since jurisdictional status was not critical information for these purposes. The Corps has utilized its hydrologic data to estimate the extent of flood damages and determine unavoidable impacts to significant fish and wildlife resources.

Using the Corps 15-day crop season flood area shape files and the hydric interpretation files for the New Madrid and Mississippi County SSURGO soils files, NRCS determined the percentage of the 15-day flood area that is all hydric and the areas that contain non-hydric soils. Of the St. Johns Basin 15-day flood cropland, 4% contains non-hydric soils. The 15-day flooded cropland in the New Madrid Floodway has non-hydric soils in 8% of the area. This reaffirms that the Corps estimate is the maximum area of potential farmed wetlands using only one of the additional NRCS criteria described above.

Pursuant to its statutory responsibilities, the Corps is aware that NRCS has made three certified determinations within the project vicinity. Two determinations were made outside of the project area in the vicinity of Wilson City and north of New Madrid adjacent to Interstate 55. The remaining determination was made adjacent to the Ten Mile Pond Conservation Area (RSEIS 2 Appendix F, Attachment 2). Based on Corps' GIS data, elevations in this area are approximately 285 - 288 feet NGVD. This area was classified as potential farmed wetlands by the Corps' hydrologic model. However, the results of the NRCS certification indicate that the majority of this area adjacent to Ten Mile Pond is prior converted cropland.

Bohlen Comment 45:

The NRCS standard approach to wetland determinations appears largely irrelevant in the present context. The NRCS used photographs from a small number of years, including "wet years" to identify wetlands. Following standard NRCS practice, "wet years" were identified by local climate data. However flooding in the project area is not dominated by precipitation, but by backwater flooding. The dominant cause of river flooding is not local rainfall, but precipitation in the Ohio River and upper Mississippi River valleys. Thus selection of aerial photographs on which to base wetland determinations does not take into consideration the primary source of flooding in the project area and is technically unjustified.

Bohlen Response 45: NRCS' standard approach is not irrelevant to the purposes for which it was used. The Corps asked NRCS to verify their prior estimate of the number of farmed wetlands as determined under Swampbuster in the project area and to state whether the Corps' proposed mitigation was adequate to avoid the possibility of Swampbuster violations. Each of these questions is committed to the NRCS' expertise by statute, and NRCS properly used its standard approach to answer these questions.

The NRCS' estimate took into account precipitation, backwater flooding, hydric soils, aerial photography, and Farm Service compliance slides. The Corps' estimate included hydrologic inundation only and represents the maximum number of acres that could meet the inundation criterion.

Bohlen Comment 46:

The hydrologic characteristics of river floodplain wetlands makes it difficult for the NRCS to distinguish farmed wetlands from uplands using its standard method. The project area, like many large river floodplains, receives an extended, strongly seasonal period of inundation, often followed by rapid drop in water level. This fact means that areas that are inundated for the requisite 15 days can generally be successfully planted with crops (such as soybeans, which mature rapidly) a few days after floodwaters have receded. Under these circumstances, signs of crop stress due to wetness are unlikely to be observed, because the dominant period of wetness occurs before planting in almost all years. Similarly, when planting is delayed, it will be delayed a similar amount throughout extensive areas of floodplain, making visual evidence of such a delay difficult to observe.

The likely flaws with the NRCS method were directly confirmed by the NRCS in its report to the Corps on wetlands identified. This report stated that the NRCS method failed to identify any wetlands created by backwater flooding. The report says on page 2:

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Bohlen Comment 46 (continued):

> None of the slides available for our sample showed any wide spread effects of backwater flooding or river level stages that would initiate gate closure for the St. Johns Bayou (no headwater flooding was observed). Most wetland signatures were due to inundation or moisture due to precipitation & local flooding events. (emphasis supplied)

Since the NRCS analysis was unable to detect areas of backwater flooding in an area where it is known to be significant, it must provide a very poor estimate of areas inundated by backwater flooding. Indeed, the analysis probably provides a better estimate of areas that will retain wetland characteristics after project completion than it does of the total area of lands inundated by floodwater at least 15 days today.

Wetland scientists acknowledge a hierarchy of proof of hydrology. The Corps' evidence, based on 32 years of hydrologic records and extensive modeling is as direct evidence of the duration and frequency of flooding as it is possible to get without years of on-site monitoring. The NRCS method is far less reliable in general, and is especially so in the context of a large river floodplain. There is no scientific basis for disregarding the Corps' hydrologic data.

Bohlen Response 46: Wetland scientists acknowledge that there are three variables in determining wetlands (hydrology, vegetation, and soils). All three variables make up the scientific basis in determining what is and what is not classified a jurisdictional wetland (See 1987 Corps Wetland Delineation Manual).

NRCS' standard analysis utilizes many different variables to estimate farmed wetlands from prior converted cropland or uplands (See Bohlen Response 44).

The Corps requested NRCS to determine if the proposed mitigation was adequate for Swampbuster provisions, not to make certified determinations on the amount of farmed wetlands in the project area.

Bohlen Comment 47:

> The Corps has used the same hydrologic analysis to estimate flood problems, the extent of flood protection benefits, economic and environmental costs and mitigation. In particular, the Corp's hydrologic analysis underlies estimates of the economic benefits of reduced inundation to farmland that may result from delayed planting or crop stress. If the NRCS analysis were correct (that effects of flooding on crops occur on almost no lands in the project area), it would logically follow that the Corps' analysis of project economic benefits must be wrong. And if the NRCS were correct that areas are seldom flooded with the frequency and duration reported by the Corps, then all the environmental analyses, including the mitigation analyses, must be wrong as well. But neither agency has challenged these underlying Corps analyses.. It is therefore not only technically invalid but logically inconsistent to reject the Corps' direct hydrologic evidence and the estimate of the extent of farmed wetlands that stems from it.

Bohlen Response 47: The Corps concurs that its hydrologic analysis was used to estimate flood problems, extent of flood protection benefits, economic and environmental costs and mitigation. Agricultural economic benefits are derived from the reduction in the duration and frequency of flooding. Flooding occurs on project area lands regardless of their jurisdictional status as prior converted cropland, farmed wetlands, or other lands. Reducing that flooding produces economic benefits, also without regard to jurisdictional status. The Corps' hydrologic analysis did not determine the jurisdictional status of farmland tracts. Rather, on-site delineations of wetlands on particular fields are necessary to determine jurisdictional status.

The Corps has consistently utilized its hydrologic model to determine significant unavoidable impacts to fish and wildlife resources from the flood damage reduction project. All unavoidable impacts (direct from channel enlargement and fill and indirect from the reduction of backwater flooding) were quantified based on the hydrologic model and appropriate habitat model, not by the jurisdictional status of a particular tract of land.

The Corps requested NRCS to determine if the proposed mitigation was adequate for Swampbuster provisions. NRCS requested a functional assessment on the proposed farmland. Additionally, NRCS provided estimates on the acres of farmed wetlands that have the potential to be impacted by the project. NRCS' analyses indicated that 0.4% of the project area (520 acres) is farmed wetlands (See RSEIS 2 Section 4.5.1). Based on the functional assessment, impacts to farmed wetlands could be mitigated at a ratio of 1.53 acres of mitigation for every acre of impact (RSEIS 2 Section 5.2). Therefore, impacts to farmed wetland would be fully mitigated by reforesting 796 acres of cropland using the NRCS estimate.

However, the Corps is not utilizing NRCS' estimate on farmed wetlands in the area and the results of the HGM analysis to determine appropriate mitigation. The Corps is proposing to compensate for impacts associated with a reduction of flooding on

farmland regardless of jurisdictional status at a ratio 1 acre of reforestation to every acre of impact. Therefore, impacts to farmland will be compensated by reforesting 6,713 acres of farmland (RSEIS 2 Section 5.2). Additionally, the Corps is proposing to monitor all mitigation sites to ensure that the sites are functioning as designed (RSEIS 2, Section 6.5).

NRCS concluded that the Corps of Engineers' projections of the affected wetlands and resulting mitigation are more than adequate for NRCS wetland conservation provisions of the Food Security Act (see RSEIS 2, Section 4.3.1.1, and Appendix G). The Corps' remains confident of NRCS' conclusion.

Bohlen Comment 48:

V. THE PROPOSED MITIGATION REMAINS INCONSISTENT IN BASIC WAYS WITH MITIGATION REQUIRED BY THE CLEAN WATER ACT

In a variety of ways, the proposed new mitigation continues to be inconsistent with mitigation required of private parties under the Clean Water Act. I covered these issues in my previous testimony, and the basic issues have not changed. In fact, the current RSEIS2 moves farther away from acceptable mitigation practice.

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Failure to identify specific mitigation site with specific mitigation plan: Recent EPA and Corps guidance has reaffirmed the critical requirement that a relatively detailed mitigation plan be available before the granting of a permit under Section 404 of the Clean Water Act for permits that require mitigation.[23] This guidance was issued in part in response to a National Academy of Sciences study,[24] and a mitigation action plan developed by the two agencies.[25] Recent conversations with officials at EPA responsible for developing wetlands mitigation policy confirm that a detailed site-specific information is required as a matter of standard practice for virtually all private mitigation.

Bohlen Comment 48 (continued):

[23] USACE, EPA, NRCS, FWS, and NOAA (1995). Federal guidance for the establishment, use, and operation of mitigation banks. Federal register November 28, 1995 (Volume 60, Number 228), pp 58605-58614.

USACE New England District Regulatory Division. 2002. Checklist for review of mitigation plan, and Introduction: Performance Guidelines and Supplementary Information on the checklist for review of mitigation plan. U.S. Army Corps of Engineers New England District Regulatory Branch. Revised 4/1/2002.

U.S. Army Corps of Engineers. (2001). Guidance for the establishment and maintenance of compensatory mitigation projects under the Corps regulatory program pursuant to Section 404(a) of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Regulatory Guidance Letter 01-1. October 31 2001.

U.S. Army Corps of Engineers. (2002). Guidance on compensatory mitigation projects for aquatic resource impacts under the Corps regulatory program pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Regulatory Guidance Letter 02-2. December 24, 2002. Avalable at http://www.usace.army.mil/civilworks/cecwo/reg/flexible.htm.

[24] National Research Council. 2001. Compensating for Wetland Losses

[25] EPA and USACE. 2002. Mitigation Action Plan. Available at http://www.mitigationactionplan.gov/.

Bohlen Response 48: See Responses to Zedler Comments 4, 15, and 16. See also RSEIS 2 Section 4.4.3.1 and 33 C.F.R 335.2. As stated in RSEIS 2 Section 4.5.2, Federal Civil Works Projects compensate for unavoidable impacts to fish and wildlife resources, but do not follow the requirements applicable to private applicants under the Regulatory 404 Program. The mitigation proposed for the project exceeds what is normally required for 404 applicants. Specifically, the Corps is proposing to mitigate for damages to prior converted cropland. The 404 Program would generally not require any mitigation for impacts to these areas.

The citations in the comment refer to regulatory guidance. This Civil Works project has complied with Federal Laws in the development of mitigation and the referenced guidance has been used during development of compensatory mitigation measures (see Zedler Responses 4, 15, and 16).

Furthermore, the WQ certification requires that the project will not be operated until all mitigation lands have been acquired and all detailed site-specific mitigation plans approved by MDNR demonstrating that all significant unavoidable impacts to fish and wildlife resources have been compensated to the extent justified. This is a more than reasonable safeguard to ensure that all significant impacts are compensated while still meeting the Federal water resource planning objective to contribute to national economic development consistent with protecting the nation's environment pursuant to national environmental statutes, applicable Executive Orders, and other planning requirements and Federal Law concerning compensation of unavoidable impacts to significant fish and wildlife resources.

Bohlen Comment 49:

> There are two reasons for this requirement. First, without evaluation of a specific site and specific plans for carrying out mitigation on that site, there is no way to evaluate the likely functions that the mitigation site will provide or the likelihood of mitigation success. Both are strongly influenced by site-specific factors. I discussed the strong effect that location may have on wetland functions briefly in the context of the HGM analysis. The point, however, is more general. Wetland functions are generated by site-specific processes, and it is impossible to determine what functions will be provided by mitigation without knowing where the mitigation will be carried out or the likelihood of success. That determines no only what kinds of acres are acceptable for mitigation but the mitigation ratios.

Bohlen Response 49: See Response to Bohlen Comment 48 and the references therein. The Corps concurs that site-specific areas are necessary to determine precise gains in wetland functions as well as benefits to fish and wildlife resources. As we have said before, WRDA 86 requires that mitigation sites be purchased from willing sellers. Willing sellers cannot be identified until a ROD is signed that decides to recommend a project for construction and funds are appropriated. NEPA does not require site-specific detailed mitigation plans. However, conservative estimates regarding likely gains in function and habitat have been made throughout the RSEIS 2. Therefore, based upon reasonable scientific assumptions applicable to the study area, there is a high likelihood that mitigation as discussed in the RSEIS 2 will provide more than the necessary habitat value required to compensate for project. The law requires that mitigation be provided concurrently with construction. The Water Quality Certification requires that mitigation lands be acquired and detailed mitigation plans be approved before the project elements are operated. Additionally, mitigation may be adjusted as a result of monitoring efforts and adaptive management to ensure that mitigation sites are functioning as designed and producing the desired habitat outputs. Mitigation will ultimately be accomplished when impacted habitat values are replaced, not when a certain quantity of acres is procured.

Bohlen Comment 50:

> Second, allowing a project to be approved without a clear mitigation plan, complete with identified mitigation sites, increases the risk that adequate mitigation will never be constructed or constructed in a manner that provides less than the required environmental benefits. One of the most striking conclusions of the NAS report on wetlands mitigation was that failure of permittees to construct required mitigation correctly or at all was a major cause of mitigation "failure". The reason for this is clear: most project sponsors facing a mitigation obligation – and in this I would argue, the Corps is no exception – perceive mitigation primarily as something that increases the cost of projects. Strong financial incentives tend to encourage project sponsors to look for ways to reduce their mitigation obligations. While most permittees no longer chose to ignore their mitigation obligations entirely, the incentives to find ways to cut corners on mitigation (both during the permitting process and during mitigation construction) are strong. Again, in this I would argue the Corps is no exception.

Bohlen Response 50: See Responses to Bohlen Comments 48 and 49 above and the references therein. The project cannot be operated until all land is acquired and site-specific mitigation plans approved by MDNR, as required (See Responses to Bohlen Comments 53 and 55 below).

Bohlen Comment 51:

Modern mitigation policy uses a number of tools to help manage the risk of mitigation failure that stems from these economic forces. These include the following:

- Requiring detailed information – often at the level of site-specific design drawings – on proposed mitigation sites
- Clarification of legal responsibilities for project success, clear specification of performance standards on which success will be measured, and explicit planning for corrective action should problems arise
- Long term project monitoring, including requirements for filing of as-built project drawings and regular reports to detect developing problems before they become difficult to correct
- Use of mitigation bonding, escrow accounts and other financial guarantees to provide less problematic avenues for enforcement compared to civil or criminal litigation.
- Reliance on advance mitigation, especially via mitigation banks (which necessarily requires identification of mitigation sites before project construction) or

These strategies help manage the risks that stem from the financial incentives operating on project sponsors in a number of ways. First, they ensure that when permits are issued, private parties know exactly what their mitigation obligations are going to be, so that they can determine whether the project remains cost-effective. They also give regulatory agencies maximum certainty of what mitigation will be constructed. Through clarity of the description of required mitigation actions they produce a legal setting in which failure to meet mitigation obligations can be clearly documented, simplifying enforcement actions. And by establishment of various financial incentives for proper completion of mitigation, they significantly reduce the incentive for private parties to cut corners on mitigation.

Bohlen Response 51: See the Responses to Bohlen Comments 48 - 50, above. This is not a private project and the rules that apply to private projects do not apply in the same fashion to this Federal project (See RSEIS 2 Sections 4.4.3.1 and 4.5.2). The first 2 bullets above address requirements that will be addressed in the detailed mitigation plans (See RSEIS 2 Section 6.3). These detailed plans are also required by the Water Quality Certification (RSEIS 2 Appendix G). Mitigation monitoring is addressed in RSEIS 2 Section 6.5 and is also required by the Water Quality Certification. Long term management is discussed in RSEIS 2 Section 6.6. Project monitoring is discussed in RSEIS 2 Section 7. The full faith and credit of the United States of America provides the financial assurance that the mitigation will be provided. WRDA 86 requires that mitigation be provided concurrently with construction, not in advance. The concerns applicable to private applicants do not apply to federal civil works projects.

Bohlen Comment 52:

The new mitigation proposals in the RSEIS2 not only fail to provide specific, detailed mitigation plans, they move in the opposite direction. While the primary mitigation features are becoming more clearly defined (with the notable exception that the RSEIS2 still does not provide site-specific data on which to assess the proposals) the so-called "additional mitigation" is so vague as to be almost meaningless.

Bohlen Response 52: The RSEIS 2 presents mitigation in sufficient detail to demonstrate that mitigation is achievable and that the project remains economically justified. Site-specific mitigation, including acquisition of sites, planning, implementation, and long term monitoring, will be coordinated with the interagency mitigation team. See Responses to Bohlen Comments 48 - 51 above.

Bohlen Comment 53:

As was true of the mitigation proposed in the 2002 RSEIS, a significant proportion of the proposed mitigation in the primary mitigation features is via

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reforestation. Yet the document offers few specifics with respect to where reforestation will occur except with regards to plantings around Big Oak tree State Park, and even there the document presents only general description of the area and omits any site-specific analysis. Thus a majority of the proposed reforestation continues to be unspecified with respect to location. It thus is still impossible to review it in terms of its adequacy to compensate for the loss of environmental services the project will entail.

Bohlen Response 53: See Responses to Bohlen 48 - 52 above.

Bohlen Comment 54:

With respect to the Additional Mitigation described in the RSEIS2 , the Corps relies on descriptions of potential actions for additional mitigation, but does not commit to initiating any of the proposed options. Among the vague options included under the "additional mitigation" category are the following:

- **Additional Reforestation.** Reforestation is likely to be one of the most successful approaches to mitigation certain project impacts, so consideration of additional reforestation is appropriate. However the RSEIS2 discusses no specific locations, so there is no way to determine what the benefits will be. Significantly, the Corps also offers no commitment with respect to for exactly how much reforestation – if any – will occur.
- **Increase Flood Durations on Reforested Areas.** No specific locations are specified so both environmental benefits and costs (which are likely to be substantial) are unknown. Moreover, creation of artificial impoundments is environmentally problematic and can cause more environmental harm than good.[26] The necessary balance can only be struck with specific projects in mind. Again, the Corps makes no commitments to using this restoration approach, so we do not know if this is a major or minor component of how they propose to fulfill the remainder of their mitigation obligation. Heavy reliance on artificially maintained hydrologic conditions should raise a red flag with respect to the efficacy, sustainability, and long-term costs of mitigation.
- **Creation/Restoration/ Enhancement of Large Waterbodies;** Although this option is discussed in terms of Riley lake, the Corps does not commit to taking action at Riley Lake, but uses it as a case study of potential projects. In addition to conceptual problems with Riley Lake mitigation discussed above, SCI Engineering has raised a host of site-specific issues. These are the kinds of issues that would have to be addressed at any other site, whose availability and suitability for restoration remain highly speculative.
- **Restoration of Small Waterbodies.** No specific projects are discussed, so it is impossible to evaluate the benefits that might be achieved in this way. A concentrated effort to identify small-scale restoration opportunities

[26] Because these areas have manipulated hydrology, they also provide an ideal situation in which to take actions that create numerical increases in scores in habitat models without necessarily providing the environmental benefits the models might lead you to expect.

Bohlen Comment 54 (continued):

> throughout the project area would be an excellent idea. It is surprising that after years of project planning, the Corps was unable to provide even a list of candidate projects.
>
> In short, each of these proposals is little more than an offer to look for additional mitigation options. Their inclusion here underscores the fact that the Corps has been unable or unwilling to identify adequate mitigation even to meet their own assessment of mitigation needs.

Bohlen Response 54: See Responses to Bohlen Comments 3, and 48 - 54 above. One goal of the RSEIS 2 is to demonstrate that a variety of mitigation techniques can be used to compensate for unavoidable impacts to fish and wildlife resources. Precise gains in habitat values will be calculated during the development of site-specific detailed mitigation plans. The formulation of these plans as well as calculation of benefits will be based upon the information in the RSEIS 2. The RSEIS 2 demonstrates the overall mitigation strategy. However, monitoring mitigation sites will ultimately determine when mitigation is complete.

The interagency mitigation team, including the Corps and sponsor, has identified numerous areas for potential mitigation. The Corps has currently acquired 1,657 acres of areas for mitigation purposes. The Corps was in the process of formulating detailed mitigation plans for these sites prior to the withdrawal of the ROD. For instance, an opportunity was identified by MDC staff on one particular tract of land purchased for mitigation that could involve restoration of a small waterbody. Plugging a drainage ditch adjacent to Ten Mile Pond Ditch has the potential to restore a meander scar of the historical channel. This restoration will provide added benefits to all resource categories than simply reforesting the area. Opportunities such as this will be examined throughout mitigation formulation. This is a primary reason why the Corps maintains that mitigation must retain flexibility.

Mitigation planners are analyzing the possibility to retain water for longer durations on mitigation tracts to provide additional habitat for fish and waterfowl. This can be accomplished by the construction of perimeter levees and water control devices (RSEIS 2 Section 5.4.3.2). Through adaptive management, these areas will be monitored to provide maximum gains to all resource categories. In the event that these areas are not functioning as designed, the water control devices and perimeters levees will be removed.

Additionally, coordination with MDNR staff revealed that potential mitigation lands located south of Big Oak Tree State Park were historically canebrakes. The Corps and MDNR staff will pursue this option if the lands are acquired.

Bohlen Comment 55:

Although the Corps presents four mitigation "scenarios," they do not select any one as a preferred alternative. In fact, they do not promise to follow any of them. A huge range of possible mitigation options are described in the RSEIS2. Locations for many of the proposed actions remain unspecified, and the Cops effectively reserves the option to swap mitigation among proposed actions. To a significant extent this document lays out a menu of choices, some of which may not be feasible, others of which may do more environmental harm than good, and leaves selection among these alternatives to the future. Avoiding these kinds of vague promises in private-sector mitigation is a major focus of recent mitigation guidance, and a core recommendation of the NAS report.

Bohlen Response 55: See Responses to Bohlen Comments 48 - 55 above. The RSEIS 2 sets out that the Record of Decision will prescribe the recommended mitigation plan (RSEIS 2 Section 1.4.7). Nevertheless, flexibility will remain a critical concept in the development of compensatory mitigation. Flexibility and adaptive management will allow the Corps to adjust mitigation based upon expected needs of the mitigated resource as well as the needs of the general public. As previously stated in Bohlen Response 48 above, the WQ certification states the following:

"Neither the New Madrid portion of the project nor the St. Johns Bayou portion of the project shall be operated until all mitigation lands for that respective portion of the project are acquired and all detailed mitigation plans approved."

Therefore, the project will not be operated until all unavoidable impacts to significant fish and wildlife resources are compensated to the extent justified. This is a reasonable safeguard to ensure successful mitigation.

Bohlen Comment 56:

While the Corps is not a private party, in this project it faces the same incentives to keep mitigation costs down as do private parties, because the project only barely manages to meets the cost-benefit requirements of the WRDA. The various drafts of the EIS, including the RSEIS2, make clear that a favorable benefit-cost analysis, and in fact, a higher benefit-cost analysis than other alternatives, is central to the Corps' justification for its selection of a project alternative. But even as presented by the Corps, the four mitigation "scenarios" lead to an overall project that passes the benefit-cost test by extraordinarily slim margins of between 1.01 to 1 to 1.04 to 1.[27] The New Madrid levee closures fail to pass economic muster for two of the four mitigation scenarios (Scenarios A and C), and even the remaining two mitigation scenarios achieve only a paltry cost-benefit ration of 1.01 or 1.02 to 1.[28]

[27] RSEIS 2, page 46 and 47 and table 2.9 on page 50. and tables 5.13 through 5.16, pages 125 through 128.
[28] Tables 5.13 through 5.16, pages 125 through 128.

Bohlen Response 56: See Responses to Bohlen Comments 3 and 6 above and Response to Environmental Defense Comments 2 - 3.

Bohlen Comment 57:

> Given the uncertainty in mitigation plans, and the high significance of mitigation costs to the overall economic analysis of what is clearly a project that only marginally meets the cost-benefit requirement, the Corps cannot now be confident that any mitigation scenario will allow the project to pass economic muster. Such a call requires far more detail in mitigation planning.[29]

[29] The RSEIS2 claims that the Corps will monitor project impacts and act to address mitigation shortcomings, but this statement does not remedy the lack of specificity in a detailed mitigation plan. It does nothing to demonstrate that mitigation can offset project impacts or that it can do so at a cost that makes the project economical. Furthermore, requiring additional mitigation after the fact would be even more difficult than requiring a detailed mitigation plan after project impacts have already occurred. But more fundamentally, there is nothing clear to monitor for. The fisheries models, for example, make no

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biological predictions of fish communities to be found through monitoring. The HSI scores reflect relative habitat quality, and while habitat quality is an important heuristic tool for qualitative analysis of environmental impacts, it is not directly measurable. Habitat quality is not the same as the abundance of fish within different habitats, nor is it equal to the relative importance of habitats as sources of food or for quantitative production of larval or young of the year fishes. Habitat quality (and thus HSI models) can combine features of all of these as well as other factors. Significantly, this means that it is impossible, after the fact, to determine whether particular mitigation efforts have provided the "habitat value" they were designed to produce. In the present case, as the fisheries HEP model makes no specific quantitative predictions, no set of measurements can demonstrate that mitigation goals were achieved, except in the trivial sense that mitigation that numerically satisfies the HEP model was or was not constructed.

Bohlen Response 57: While the Benefit to Cost ratios that are presented in RSEIS 2 Section 5.8 are close to unity (slightly higher than 1 to 1.0), the mitigation credits have been conservatively calculated and presented. For example, in RSEIS 2 Table 2.7, wherever a 'TBD' designation was provided in the Draft RSEIS 2, there would be some habitat improvement. However, these particular techniques and corresponding benefits to individual resource categories were considered sufficiently uncertain that no mitigation credit for them was taken. During long term monitoring, the Corps intends to verify habitat units provided by these techniques to the respective resource categories. There are many other areas where the analyses are conservative, such as with the post-project hydrologic inundation durations, the value of the hydrologic restoration project for Big Oak Tree Park to fishes, and the wetland impacts (which includes substantial prior converted cropland acreage). The additive effect of these conservative analyses gives confidence that the implementation of the project would be beneficial to the Nations' economy.

Additionally, the Corps is working with the interagency mitigation team in the development of monitoring protocols. Monitoring will occur on each site-specific

mitigation area and will be developed during the formulation of the detailed site-specific mitigation plan (See RSEIS 2 Section 6.5). A monitoring plan will also be developed to monitor the St. Johns Bayou Basin and the New Madrid Floodway to ensure that predictions made in previous NEPA documents and clarifications made in this RSEIS 2 are accurate (See RSEIS 2 Section 7.0). Monitoring is a critical component of the Corps' plan and is clearly outlined in the water quality certification. The monitoring plan will be developed with the interagency mitigation team and must be approved by MDNR prior to any ecological impacts.

Bohlen Comment 58:

> Under these circumstances, the Corps is undoubtedly facing strong internal and external pressures to reduce mitigation costs in order to keep the cost-benefit numbers of the project as a whole favorable.. In this it is no different than most private entities looking for mitigation. I would argue that the behavior of the Corps to date strongly supports the idea that these pressures are intense, and there is no reason to believe that they will abate. Indeed, I believe that a primary motivation behind the continually shrinking estimates of wetland impacts in successive EIS documents and the promotion in this most recent RSEIS2 of relatively inexpensive but technically unjustified mitigation approaches has been to minimize the costs of mitigation even at the expense of not fully compensating for environmental impacts of the project.

Bohlen Response 58: The Corps has the responsibility to safeguard the public's resources entrusted to it. This duty applies to all aspects of project analysis, design, and construction. See Responses to Bohlen Comments 3 and 6 above and Response to Environmental Defense Comments 2 and 3. The Corps has conducted several reviews of this project. Each such review has involved a closer and more detailed examination of the analyses and assumptions of previous documents. It is this careful review that accounts for both reductions and expansions in previous estimates of aspects of the project.

Bohlen Comment 59:

> Under these circumstances vague mitigation plans, a lack of specificity in what actions will be undertaken, and reliance on loose descriptions of mitigation goals provides a fine recipe for future conflict and inadequate mitigation. If the project is approved and goes ahead prior to specification of a detailed mitigation plan, the Corps will have only a general notion of the eventual costs of mitigation. If mitigation costs exceed estimates for any reason, the Corps would be faced with only two unacceptable options. One would be to minimize mitigation costs and perform inadequate mitigation. The other would be to exceed the mitigation budget and build an uneconomical project that is a net economic loss to the nation.

Bohlen Response 59: The RSEIS 2 demonstrates that mitigation is attainable and that the project is economically justified. The RSEIS 2 is based on conservative estimates

regarding gains to habitat from implementing mitigation measures and detailed cost estimates for the mitigation techniques. The cost estimates allowed for several contingencies. The RSEIS 2 also demonstrates that mitigation measures will be monitored to ensure that all unavoidable impacts to significant fish and wildlife resources are compensated. Please see Responses to Bohlen Comments 49, 56, and 57 above.

Bohlen Comment 60:

> The 2005 DSEIS provides policy rationales for not selecting a detailed mitigation plan with detailed sites, but none of these rationales (whether or not legal) distinguish the Corps from private parties. The Corps points out that it does not have condemnation power and therefore wishes to remain flexible. But private parties also typically lack condemnation power. Yet private parties regularly must identify mitigation sites on private lands and they must do so before a section 404 permit will be issued. The Corps wishes to avoid the expense of selecting a specific mitigation site until after the permit is issued. So, undoubtedly, would private parties.

Bohlen Response 60: Please refer to Sections 4.4.3.1. and 4.5.2 of the RSEIS 2.

Bohlen Comment 61:

> I see only two truly distinguishing features between this project and the normal project requiring environmental mitigation. One is that the project's impacts are exceptionally large. Under established practice, a larger project is subject to more vigorous scrutiny by the Corps and EPA. A second distinction is that the Corps here serves as both regulator and project proponent. But that too calls for more rigor up front because once the project is approved, and especially once it has been constructed, the Corps will face strong incentives to determine that mitigation is acceptable, even if it is substandard.
>
> Since the existing mitigation plan promises very little, the Corps will have considerable leeway in deciding what mitigation is constructed. Since there are few clear tests to be applied to determine whether the mitigation constructed actually addresses resource concerns, interpretations will have a significant effect on what is eventually constructed. And importantly, the Corps faces very limited possibility of legal challenge or other enforcement even if less mitigation is constructed than initially promised, mitigation proves less successful than anticipated, fails to replace lost wetland an habitat functions, is significantly delayed in its construction, or is otherwise substandard.[30]

Bohlen Comment 61 (continued):

[30] The Corps states that they will not operate the project until all mitigation has been deemed adequate and approved by MDNR. But at best this is no different from other situations in which permit regulators could in theory stop projects from operating after the fact. The failures of this approach explain why it is no longer relied upon. Institutional strategies to reduce risk of default such as mitigation bonds, escrow accounts and mitigation banks are increasingly the norm In this case, moreover, MDNR is limited to enforcing the terms of its water quality certification. And in this case, it is obvious there would be even more pressure on MDNR to approve whatever mitigation is on offer quickly rather than allowing farmers' fields be flooded. Given the lack of specificity over what mitigation will be constructed and given the vagueness of the mitigation requirements in the RSEIS2, MDNR will have little leverage once the project is constructed in case of disagreements with the Corps and thus will have a very hard time imposing much quality control.

Bohlen Response 61: See Responses to Bohlen Comments 48, 49, 51, and 55 and RSEIS 2 Sections 4.4.3.1. and 4.5.2. This project has undergone very rigorous scrutiny from various state and Federal regulatory and wildlife agencies; local, state, and Federal government, elected officials; Federally recognized Indian Tribes; non-governmental organizations; academia; and the general public, as well as state and Federal court. This scrutiny has resulted in a project that provides for National Economic Development consistent with the goals for protecting the Nation's environment. All unavoidable impacts to significant fish and wildlife resources will be mitigated to the extent justified. Furthermore, there will be a net benefit to overall habitat for most resource categories (wetlands, terrestrial wildlife, and waterfowl habitat) within the project area.

Bohlen Comment 62:

Failure to Discount for Temporal Losses: Recent Corps and EPA guidance documents have continued to insist temporal losses be offset with greater mitigation. In other words, if mitigation sites are not going to be fully functional at the time of project impacts, more mitigation is required. Offsetting these temporal losses requires some kind of discounting for time. The mitigation proposed in the RSEIS2 continues to violate this principle as there is no effort taken to discount future wetland functions even though much of the mitigation remains dependent on mature trees that will come into effect only over time.

What has been done, both in the fisheries analysis and in the HGM analysis, is to estimate an annual average level of function over the 50 year planning horizon for the project (the writers call this an annualized value or average annual habitat units).[31] This

Bohlen Comment 62 (continued):

acknowledges that mitigation sites will not provide full functions immediately, but it is not discounting. Discounting addresses the fact that benefits received many years from now are not as valuable as benefits received today. A dollar in hand today is worth somewhat more than a dollar that will be delivered next year. The difference in value depends on the discount rate. But in one year's time, I'll still prefer a dollar in hand to a dollar I would not get until two years from now, so I can apply the same logic again (and again).[32] While the logic is most familiar in a financial context, it applies equally to environmental goods and services.[33] A good fishing trip today is worth more than a good fishing trip 20 years from now. Nevertheless the Corps continues to treat fish habitat value and wetland values that come into being 20 or more years from now as having the same value as fish habitat available immediately. But their net present value is lower. The Corps' analysis thus fails to account completely for the loss of wetland and fisheries functions and understates the mitigation required to fully compensate for present-day environmental impacts.

quality control.

[31] Incidentally, the equation depicting the calculation of a Cumulative HU on page 24 is incorrect. First, it includes a summation sign that does not specify an index of summation. Moreover, the expression inside the summation is a complete formula for calculating cumulative habitat units within one habitat type. Presumably, the summation sign refers to summation across all habitat types. If so, that should be made explicit, otherwise it may lead to serious calculation errors. Second, the expression inside the summation sign is strictly correct only for a specific model of the long-term development of habitat values, one in which values develop linearly from the moment of project implementation until *the end of the planning horizon* (50 years in this case). This is inconsistent with the model presented in the text, which postulates that fast-growing species would develop 100% of function in 10 years, while slow-growing ones would

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deliver full function in 20 years. I have not yet been able to confirm whether the calculations resulting in numbers in the text were carried out correctly, but if they were, they did not use this formula.

[32] Mathematically, this relationship can be expressed in its simplest (discrete time) form as follows. Given an asset that has a value of X dollars, and an annual discount rate of r, the present value of that asset if delivered in n years is $\frac{X}{(1+r)^n}$.

[33] This logic was developed in detail in King, D. M., C.C. Bohlen and K. Adler. 1994. Watershed Management and Wetlands Mitigation: A Framework for Determining Compensation Ratios. EPA Office of Policy, Planning and Evaluation, Washington DC. A spreadsheet that allows calculation of time-discounted mitigation requirements is available on the HGM website, at http://el.erdc.usace.army.mil/wetlands/datanal.html.

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Bohlen Response 62: Temporal losses were calculated based on standard methodologies that are commonly used in HEP (USFWS 1980) and HGM analyses (Klimas, *et al.*, 2004). See RSEIS 2 Section 2.3.2 and Appendix C.

The math question in footnote 31 is noted. The math was performed correctly, but there is a typographical error in the document. An appropriate correction will be made in the final RSEIS 2.

Bohlen Comment 63:

> Failure to focus on natural hydrology and landscape position: Finally, the Corps' proposed mitigation relies heavily on artificial manipulation of small areas of wetlands to produce habitat benefits. This approach is fraught with risk. Hydrology is the driving force that shapes wetland ecosystems, and success at generating wetland functions by manipulating water is mixed. All too often, hydrologic manipulation leads to unanticipated changes in wetland structure or function. Even when such manipulations are deemed successful, they may result in increases in one function (say production of waterfowl), but at the expense of others (say access for floodplain fishes). Recent Corps and EPA guidance, reflecting the findings of the NAS report, generally discourage reliance on mitigation that relies primarily on artificially maintained hydrology to provide nominal mitigation benefits.

Bohlen Response 63: See RSEIS 2 Section 4.3.2.4, and Responses to Zedler Comments 10 and 14, Sparks Comment 4, and Environmental Defense Comments 6 and 9. Risk is exactly what the Corps is trying to reduce. By pooling water during the rearing season, the risk of premature dewatering and elevated mortality of fish is reduced. The Corps has documented the high rearing value of permanent waterbodies, and there is every reason to expect that larval fish survival will be enhanced in spawning and rearing pools. See RSEIS 2 Section 4.3.2.4 and Response to Sparks Comment 4.

Most of the project impacts and mitigation features, including the spawning and rearing pool, are located in what are currently leveled soybean fields. These fields do have some habitat value. However, the Corps maintains that bottomland hardwood habitat, restoration of hydrology to Big Oak Tree State Park, moist soil management areas, 64 miles of buffer strips, wildlife corridors, 387 acres of modified borrow pits, spawning and rearing pools, and restored floodplain lakes provide much greater ecological functions than that provided by frequently flooded soybean fields.

Table 1. Lands Flooded in New Madrid Basin at elevations corresponding to different flood return intervals.

		Acres Flooded in Different Land Categories[1,2]						
	Flood Elevation (ft. NVGD)	Cropland	Fallow	BLH	Large Waterbody	Small Waterbody	Total Flooded Acres	Total ADFAs[3]
Two Year Flood (Flood at least 50% of years)	293.00	27,205	2,134	4,863	614	592	35,408	8895
Three year Flood (Flood at least 33% of years)[4]	295.60	41,093	3,087	5,860	646	636	51,322	
Four Year Flood (Flood at least 25% of years)[4]	295.85	42,305	3,174	5,945	647	640	52,711	
Five Year Flood (Flood at least 20% of Years)	296.00	43,032	3,226	5,996	648	643	53,545	10,027

Note 1: Calculations are based on electronic files containing the data set forth in Appendix C of the 2002 RSEIS, provided to Environmental Defense in response to a FOIA request. Calculations used the method for assessing return intervals set forth in the RSEIS2 on page 64.

Note 2: Land use and cover type data has been provided to us only at integer elevations. Hydrologic data and the elevations associated with different flood return intervals are known more precisely. The values presented here use linear interpolation to estimate areas in each land cover flooded at non-integer elevations.

Note 3: ADFAs are calculated solely for land below the designated elevations for April 1st to May 15th. Results are expressed based on land use data at the nearest integer elevation.

Note 4: ADFAs are not reported for the three and four year flood elevations because the nearest integer elevation for the three, four and five year flood elevations is 296 feet, and the results of this calculation would be identical. This is an artifact of the way the calculations are carried out, and does not imply that actual ADFAs for these elevations would be identical.

Bohlen Response 64: See Response to Bohlen Comment 29.

Bohlen Comment 65:

Table 2. Lands Flooded in St. Johns Basin at elevations corresponding to different flood return intervals.

		Acres Flooded in Different Land Categories[1,2]						
	Flood Elevation (ft. NVGD)	Cropland	Fallow	BLH	Large Waterbody	Small Waterbody	Total Flooded Acres	ADFA
Two Year Flood (Flood at least 50% of years)	292.50	9,853	951	2,877	166	546	14,392	4105
Three year Flood (Flood at least 33% of years)[4]	292.70	10,289	967	2,904	167	548	14,875	
Four Year Flood (Flood at least 25% of years)[4]	293.30	11,680	1,037	2,989	179	556	16,440	
Five Year Flood (Flood at least 20% of Years)	293.56	12,319	1,076	3,026	188	560	17,169	4,241

Note 1: Calculations are based on electronic files containing the data set forth in Appendix C of the 2002 RSEIS, provided to Environmental Defense in response to a FOIA request. Calculations used the method for assessing return intervals set forth in the RSEIS2 on page 64.

Note 2: Land use and cover type data has been provided to us only at integer elevations. Hydrologic data and the elevations associated with different flood return intervals are known more precisely. The values presented here use linear interpolation to estimate areas in each land cover flooded at non-integer elevations.

Note 3: ADFAs are calculated solely for land below the designated elevations for April 1st to May 15th. Results are expressed based on land use data at the nearest integer elevation.

Note4: ADFAs are not reported for the three and four year flood elevations because the nearest integer elevation for the two, three and four year flood elevations is 293 feet, so the results of this calculation would be identical. This is an artifact of the way the calculations are carried out, and does not imply that actual ADFAs for these elevations would be identical.

Bohlen Response 65: See Response to Bohlen Comment 29.

Bohlen Comment 66:

National Academy Report

Parameter	# Studies	# States	Range of Values	Mean	Median
1. % Required mitigation actually attempted	8	7	28 to 100	76	70
2. % Regulatory compliance					
a. % area gain (loss)	8	5	(92) to 44	(17)	(32.5)
b. % permits issued	19	6	0 to 100	58	53
3. % Ratio required and ratios met (post construction)	9	4	17 to 90	61	62
4. % Functional equivalency of completed mitigation	9	4	0 to 67	21	18

From Table 6.16 in NRC 2001

Bohlen Response 66: Table noted. However, there is no text explaining the purpose of this table that was copied from the NRC (2001).

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Dr. Christopher Woltemade Comment 1:

REPORT REGARDING THE WATER QUALITY ANALYSIS OF THE REVISED DRAFT ENVIRONMENTAL IMPACT STATEMENT (DECEMBER 2005) FOR THE ST. JOHNS BAYOU/NEW MADRID FLOODWAY PROJECT

Dr. Christopher Woltemade
(January 2006)

I am a hydrologist working as a Professor at Shippensburg University of Pennsylvania at and have previously provided a report and have testified about the water quality assessment for the St. Johns Bayou/New Madrid Floodway project of the U.S. Army Corps of Engineers. I have reviewed the December 9, 2005 Draft Supplemental Environmental Impact Statement for the project. This DSEIS continues to use the same basic spreadsheet "model." Nothing in the new draft has changed my previous views regarding the project, but I offer this additional assessment of some new claims in this draft.

Woltemade Response 1: Comment noted.

Woltemade Comment 2:

I. Basic Summary of Project Impacts

The purpose and effect of the project is to restrict backwater flooding that now occurs regularly in the project area on tens of thousands of acres to a 2,500-acre sump area. When flooding occurs on these acres, it generally does so for a week or more, which is enough time for them to remove large quantities of pollutants, including nitrogen. The primary factors that determine the extent of nutrient removal are the extent and duration of flooding. Because the project so dramatically reduces the extent of flooded acres that will remove this nitrogen, it will unquestionably dramatically reduce the amount of nitrogen-removal.

Woltemade Response 2: The comment suggests that large quantities of nitrogen are removed during periods of backwater flooding. The majority of the land currently available to backwater flooding in the project area has been leveled, drained, and used for agriculture (primarily soybean production) for many years. Agricultural lands have been demonstrated to be sources of nutrients to rivers and lakes (*e.g.*, Beaulac and Reckhow, 1982, from Ashby, *et al.*, 2000) due in large part to fertilizer application. The relationship between agricultural lands acting as a source of nitrogen rather than a sink has been demonstrated by several major studies that concluded that rivers that drain a higher percentage of agricultural lands have higher concentrations of nitrogen than rivers that drain a higher percentage of forested areas (Mitsch, *et al*. 1999.) The Corps disagrees with the suggestion that the project will "unquestionably dramatically reduce

the amount of nitrogen removal" based upon the discussions of the processes and site characteristics in the following paragraphs.

To address potential impacts of various project alternatives on water quality, a model was developed using a mass balance approach in a spreadsheet format (Ashby, *et al.*, 2000). The model is consistent with a basic understanding of nitrogen cycling and how nitrogen is introduced into riverine ecosystems. Generally, nitrogen is introduced into watersheds by a variety of mechanisms (*e.g.*, backwater/headwater flooding, rain carrying atmospheric nitrogen, applications of nitrogen fertilizer to agricultural lands, nitrogen in sewage sludge from municipal wastes, and other processes (collectively called the "nitrogen input")). Furthermore, nitrogen is exported from water sheds through several processes including to following:

- denitrification and volatilization - where bacteria converts nitrate in the soil to gaseous nitrogen which is released to the air,
- runoff - where water carries dissolved and particulate forms of nitrogen compounds to surface water bodies,
- leaching - where nitrates enters groundwater,
- and physical removal during harvesting.

Runoff and leaching pose the biggest concern to water quality as nitrogen is very mobile and easily moves with water in the soil and in runoff. In the Mississippi drainage basin alone, agricultural activities are a major source of the nutrients that enter the Mississippi River (National Science and Technology Council Committee on Environment and Natural Resources 2000). Therefore, any measures that slow or prevent runoff or increase filtering efficiency of lands adjacent to surface water bodies (*e.g.*, runoff ditches, streams, and rivers) should result in less nitrogen entering the river system.

As previously described in Ashby, *et al.* (2000), (See 2002 RSEIS Appendix I for a modified version of this report) the project area is both a source and sink for nitrogen, depending on land use and hydrologic conditions. During periods of rainfall and subsequent runoff in the project area (*i.e.*, the St Johns Bayou and New Madrid Floodway), the combination of sources and sinks (*e.g.*, water quality processes) was considered to result in a net nitrogen export (*e.g.*, more nitrogen from the project ends up in the Mississippi River than is removed by the project area). This was attributed to the fact that most of the land in the project area is cropland which is a considerable source of nitrogen during runoff events, likely from fertilizer applied to agricultural fields. The Mississippi River itself is also a source of nitrogen (from upstream watersheds) that is available to the project area during periods of backwater flooding.

An interagency team comprised of scientists from the Corps, MDNR, USFWS, and EPA was formed to review the water quality analysis methods, as described in Ashby, *et al.,* 2000 and Appendix I of the 2002 RSEIS. This team agreed that wetlands (cypress/tupelo, scrub/shrub marsh, marsh, bottomland hardwood, riparian, sandbars, open water, and rivers) removed nitrogen from floodwaters. The team also agreed that

while upland and agricultural areas may process some nitrogen, the overall effect of flooding such areas was an increase of nitrogen to the floodwaters (Ashby, *et al.*, 2000). Overall, impacts to the water quality of the Mississippi River is not expected to be discernible, due to the large volume of water in the Mississippi River in comparison with the floodwater volume of the project area (2002 RSEIS Appendix I, page I-iv). Impacts to nitrogen loads to Mississippi River water from various scenarios considered were all calculated to be less than 0.1 percent of the total estimated Mississippi River nitrogen load of 1.6 million metric tons in a year (RSEIS 2 Section 4.2.2.2.). It is reasonable to assume that additional mitigation would likely provide a slight improvement in water quality over current conditions (RSEIS 2 Section 5.3.3.)

In summary, the assumptions of the model are:

- Some nitrogen from Mississippi River water is removed during backwater flooding (Ashby, *et al.*, 2000, page 7)
- Nitrogen removal efficiency varies with land cover, with primary removal occurring in various types of wetlands (Ashby, *et al.*, 2000, Tables 4 and 5)
- 10% of particulate materials (including phosphorus, nitrogen, carbon, sediment) are removed due to sedimentation (Ashby, *et al.*, 2000, page 7 and Appendix C)
- Water inundation would occur from November through January and later, which is sufficient time for water quality processes to occur (Ashby, *et al.*, 2000, page 4)
- Water quality processing is calculated using the extent of flooding by acres by land cover type (wetlands, cropland, BLH, pasture, etc – See Ashby, *et al.*, 2000, Tables 4 and 5) by flood frequency event (corresponding to a certain acreage for the various land cover types – See Ashby, *et al*., 2000 Appendix C)

Model assumptions were accepted by an interagency team. The interagency team also agreed on the approach of the analysis which was to use net change (*i.e.*, whether the land cover type resulted in a decrease (net removal) or increase (net export) of nitrogen) to evaluate several project alternatives.

Woltemade Comment 3:

> II. Results of Corps Model
>
> To assess the impacts of the project on nitrogen removal, the Corps developed an extremely simplistic model. I testified before the Clean Water Commission about the fundamental flaws in that model, and there is no indication that the model has been changed or corrected for the 2005 DSEIS. Among other problems, as discussed below, the model leaves out the primary mechanism by which farmed wetlands remove nitrogen and therefore greatly underestimates the likely nitrogen removal on flooded crop fields. Regardless, the Corps's own model shows that absent mitigation, the project would dramatically reduce the amount of nitrogen removed by the project area, which in turn means that all extra nitrogen would remain in the Mississippi River.

Woltemade Response 3: To the extent that the comment suggests the model leaves out the primary mechanism by which farmed wetlands remove nitrogen (*i.e.*, denitrification), Ochs and Milburn (2003) reported denitrification rates of approximately 0.001 and 0.002 kilograms per hectare per 90 days of flooding. These studies were conducted on flooded and non-flooded cotton and soybean fields. These reported denitrification rate values are extremely low. The values do not differ markedly for selected flooding conditions or by crop type (soybean and cotton). With regard to nitrogen removal within the model (Ashby, *et al.*, 2000, Appendix C), the model provides for 10% nitrogen removal from floodwaters on agricultural lands and was accepted by the interagency team. Nitrogen export coefficients rates utilized in Ashby, *et al.*, 2000 of 1.875 kg/ha to 15 kg/ha (Ashby, *et al.*, 2000, pages 8 and 9), when multiplied by a 10% nitrogen removal factor, would result in a removal rate of 0.1875 kg/ha and 1.5 kg/ha (Ashby *et al*., 2000 page 8). The model therefore does not likely under estimate the nitrogen removal on flooded crop fields.

Ochs and Milburn's peer-reviewed 2003 publication occurred after the report prepared by Ashby, *et al*., (2000) but was presented at the water quality certification hearings in January 2004.

With regard to "nitrogen [that] would remain in the Mississippi River," the annual load of nitrogen transported by the Mississippi River to the Gulf of Mexico is estimated at 1.6 million metric tons (National Science and Technology Council Committee on Environment and Natural Resources, 2000). The amount of nitrogen that enters the project area during a 5 day winter flooding event at a discharge of 800 thousand cubic feet per second was estimated to be 11,745 metric tons (Ashby, *et al*., 2000, page 12). This value is less than 0.1% of the estimated annual total Mississippi River nitrogen load of 1.6 million metric tons (RSEIS 2 Section 4.2.2.2.). Even if the project area provided 100% removal, (which is highly unlikely since the majority of the project area is agricultural land) the amount that enters the project area is indiscernible in terms reducing the amount of nitrogen carried to the Gulf of Mexico.

Regarding the absence of mitigation referred to in this comment, evaluations that include mitigation are discussed in Woltemade Responses 5, 6, and 7 below.

Woltemade Comment 4:

> In particular, in an average sized flood today (represented by scenario 5 in the model, which the Corps viewed as approximately a 2-year flood), 21,610 kg N would be removed. By contrast, in an average sized flood under the proposed
>
> 1
>
> project, only 3,977 kilograms would be removed. As a result, the project area would remove 82% less nitrogen.[1]
>
> This is the only valid measure of project impacts as assessed by the model. Any nitrogen not removed by the project area remains in the Mississippi River and therefore remains available to contribute to the very serious hypoxia problem in the Gulf of Mexico.
>
> Prior drafts of the EIS made no effort to evaluate the offsetting effects of mitigation. The reason is straightforward. These effects cannot be properly estimated without knowing their location, flood frequency and their source of water.

Woltemade Response 4: The reported value of nitrogen estimated to be removed during an average flood (3,977 kilograms - Ashby, *et al*., 2000 Table 14 Scenario 3 with both basins) was based on flooding to an elevation of 282 ft. This value should not be interpreted to represent net nitrogen removed by the project area. The scenarios were selected for Ashby's analysis and are based on alternatives set out in the 1999 DSEIS (See Ashby, *et al*., 2000, page 4). Therefore the commenter's comparison between scenario 5 and scenario 3 does not represent with and without project conditions described in the RSEIS 2. Consequently, the statement that the project area would remove 82% less nitrogen is not applicable for evaluating project impacts. A more valid comparison is provided in Response to Woltemade Comment 7.

The Corps concurs with the statement that "any nitrogen not removed by the project area remains in the Mississippi River" with the caveat that additional nitrogen removal likely occurs in other areas as the water travels downstream and additional nitrogen enters the river downstream as well. However, as previously stated, the amount of nitrogen removed by the project area is indiscernible in relation to the hypoxia problem in the Gulf of Mexico.

The effects of mitigation on nitrogen removal are discussed in Responses to Woltemade Comments 5, 6, and 7.

Woltemade Comment 5:

> However, as I have previously testified, even if we assume that mitigation lands will be ideally flooded and located to remove nitrogen, the mitigation proposed in 2002 would almost certainly not offset these impacts. Reforesting 8,375 acres of already flooded cropland, if in ideal locations, could modestly increase nitrogen removal because forested lands will remove modestly more nitrogen than flooded cropland. But the increase cannot possibly be enough to offset the lost nitrogen removal on tens of thousands of acres that are no longer regularly flooded. The mitigation now proposed by the 2005 DSEIS does not affect this judgment. Not only does the total acreage of mitigation sites remain roughly the same, but the new draft makes clear that many of these acres are to be located above the sump areas that will still be allowed to experience backwater flooding. They may experience some local flooding infrequently, as claimed, but they will not help filter Mississippi River water, which is the primary source of water and nitrogen that are not removed by the project.

Woltemade Response 5: Literature cited in Ashby, *et al*., (2000) and results from Ochs and Milburn (2003) do not support the reviewer's contention that forested lands will remove modestly more nitrogen than flooded cropland. In fact, bottomland hardwood restoration (as proposed in the mitigation) will result in greater net nitrogen removal when compared to flooded crop fields (Ashby, *et al*., 2000 Tables 4 and 5). Additionally, nitrogen export would be reduced by taking cropland out of production through reforestation which will directly lead to less fertilizer application. See Woltemade Response 7 for a more detailed explanation of removal efficiencies for each landcover type.

With regard to the "lost" nitrogen removal on "tens of thousands of acres" of agricultural land that are no longer "regularly" flooded, this removal is not a very high amount. For example, using a nitrogen removal rate of 0.002 kg/ha (for a 90 day period of flooding), as reported in Ochs and Milburn 2003 for flooded cropland, would result in 8.1 kg of nitrogen removed per 10,000 acres. However, using values reported in Ashby, *et al.*, (2000), nitrogen currently being contributed to the Mississippi River by the project area ranges between 7,588 to 60,703 kg per 10,000 acres of upland agricultural areas.[6] Based on this comparison, upland agricultural areas likely export more nitrogen to the Mississippi River from runoff than they remove from flood waters.

Removal of cropland from production and reforesting (proposed as mitigation in the RSEIS 2) will reduce nitrogen available to the Gulf of Mexico by: (1) reducing fertilizer applications (no crop, no fertilizer), (2) improving nitrogen removal from runoff in the project area (actually, mitigation will improve/add nutrient and sediment removal from the project area during runoff throughout the year and not just during Mississippi River backwater inundation), and (3) improving removal of nitrogen from Mississippi River during periods of backwater flooding on the mitigation sites when flooded. The Corps' mitigation proposal is also consistent with reports calling for restoration of croplands to

[6] Ashby reports values of nitrogen removed of 1.875 to 15 kg/ha.

wetlands in the Mississippi River Basin in order to reduce nitrogen flow into the Gulf of Mexico (National Science and Technology Council Committee on Environment and Natural Resources, 2000).

Compensatory mitigation acres will be located within the 2-year floodplain and will be subjected to runoff flooding from the project area. Some of these acres which are located in the fish spawning and rearing pool will also be subjected to annual backwater flooding. The mitigation acres within the fish spawning and rearing pool will provide filtering of Mississippi River water during annual backwater flooding and filtering of headwater runoff the rest of the year. The remaining mitigation tracts will provide filtering of runoff throughout the entire year. All mitigation types (*e.g.*, reforestation with BLH, buffer strips along streams and ditches, moist soil management units, Big Oak Tree Park hydrologic restoration) will take cropland out of production and will result in improved nitrogen removal efficiency in the project area. This is in accordance with recommendation by National Science and Technology Council Committee on Environment and Natural Resources (2000).

Woltemade Comment 6:

III. New Corps Analysis

The water quality analysis in the 2002 DSEIS never attempted to estimate the nitrogen benefits of proposed mitigation, and Dr. Ashby, the primary author of that study, acknowledged in a deposition that I have read that such an analysis could not be done until specific mitigation sites were selected. Despite this acknowledgment, the 2005 DSEIS asserts that there has been new analysis of the benefits of mitigation, and claims that it shows that when mitigation is included, the project will result in a reduction in nitrogen loading to the Mississippi River. Subsequently, Environmental Defense requested and received the spreadsheets for these calculations, which I have reviewed.

[1] The pages of the water quality analysis setting forth these estimates are attached. My understanding is the version of the analysis that was printed in the June, 2002 EIS left off the calculations for the St. Johns basin. The calculations in text are for both basins.

2

Unfortunately, the actual Corps analysis shows nothing of the kind because it is not based on a comparison of the area without the project and the area with the project. In effect, the Corps analysis assumes that the project does not really exist.

Woltemade Response 6: The Water Quality Analysis for the 2000 FSEIS (Ashby, *et al*, 2000) included impacts from project flood control operation and did not include expected

benefits from compensatory mitigation. During the referenced deposition on November 14, 2003, Dr. Ashby was asked and answered several questions regarding mitigation. At the time of the deposition, the type and locations of mitigation were not developed and Dr. Ashby acknowledged that he did not know the characteristics of the mitigation sites at that time. This extract from the deposition is provided as an example:

> **Page 59, line 7. Mr. Searchinger: Is it fair to say that you don't know if the mitigation sites will have the same characteristics that would provide optimal wetland retention benefits, is that true?**
> **A: I don't know that at this time.**

Dr. Ashby agreed that water quality benefits were dependent upon specific characteristics of mitigation sites. He also agreed that location of the sites will have an influence on the water quality benefits. The following extracts are provided as examples:

> **Page 36, line 6, Q: Okay, Now the water quality benefits of the mitigation site, of the mitigation of the project, is it fair to say that the amount of benefit will depend on the specific characteristics of the mitigation sites?**
> **A: Yes.**
> **Q: So the location actually chosen will have influence on the water quality benefits?**
> **A: Yes.**

Although the remaining mitigation sites (in excess of the 1,657 acres obtained in 2004 - See RSEIS 2 Section 1.2) have yet to be identified, the characteristics of areas appropriate for consideration as mitigation sites have been identified and quantified, allowing further analysis that is included in section 5.2.3 of the RSEIS 2.

The new analysis includes the effects of compensatory mitigation using a flooding scheme from previous analyses that approximates a hydrologic scenario with the project in place (flooding to the various pool elevations - See RSEIS Section 2.6.2.5). Since mitigation lands will be located in the post-project 2-year floodplain, it is consistent with the impact analysis to consider the benefits of these mitigation areas in calculating the post-project mitigation benefits.

The new analysis presented in the RSEIS 2 Table 5.3 includes compensatory mitigation using a flooding scheme from previous analyses that approximates a hydrologic scenario with the project in place. Estimated nitrogen loads exported from the New Madrid Floodway to the Mississippi River for various flow scenarios and project formulations are reported in the second column of Table 5.3. In Table 5.3, the estimated nitrogen load from the basic mitigation scenario (*i.e.*, with project) was 58.3 metric tons and was comparable to the estimated nitrogen load of 120 metric tons from the moderate high flow load (*i.e.*, 290 feet elevation - 2-year flood) for without project conditions. A more complete assessment is provided in Woltemade Response 7.

Woltemade Comment 7:

> In reality, the major effect of the project is that fewer acres flood in the same flood event. That is the whole purpose of the project. For example, under existing conditions, 17,315 acres flood in the New Madrid Floodway when a flood reaches 290 feet. If the project were in operation, flooding would be blocked beyond 284 feet, so only 1,727 acres would flood – a 90% reduction. Any proper analysis has to compare the different number of acres that flood. But the Corps analysis assumes that the same number of acres flooded. (It does this technically by assuming that nitrogen release and removal would occur on the same acres with the project in effect as under current conditions.) According to the Corps's analysis, the only difference is that now, thousands of these same acres have been reforested, which remove more nitrogen according to the Corps' assumptions. By this hypothetical scenario, nitrogen runoff has obviously decreased, but it is not the scenario of the actual project. The mitigation analysis therefore has no bearing on the actual affects of the project with mitigation.

Woltemade Response 7: See Woltemade Responses 5 and 6. The numbers used in the comment are approximately correct with these exceptions: (1) approximately 2,000 acres will flood at elevation 284.4 feet NGVD, the proposed spawning and rearing pool elevation, during the April 1 - May 15 timeframe, (2) 6,400 acres will be flooded for winter waterfowl, and (3) while 17,315 acres exist in the New Madrid Floodway at elevation 290 feet NGVD, 12,775 acres are agricultural. However, actual post project hydrologic conditions will vary depending on actual gate operations and wet precipitation years so some additional retention of runoff and backwaters may occur.

Regarding the Corps assumptions with respect to more nitrogen removal through reforestation, please refer to Woltemade Responses 2 and 5.

The comment states the mitigation analysis has no direct bearing on the actual effects of the project with mitigation. In fact, the mitigation analysis for water quality includes a comparison of nitrogen removal efficiencies at an elevation of 290 feet NGVD between existing conditions and with mitigation associated with restored acreage. As described below, this has a direct bearing on actual effects of the project with mitigation since amounts of nitrogen removed with and without mitigation are compared. Furthermore, loss of nitrogen removal attributed to reduced flooding is also addressed in the following discussion.

While the project will result in a decrease in nitrogen removed from Mississippi River water since backwater flooding will be reduced but as previous described, this is a very small amount (*i.e.*, 8.1 kg/ha, see Woltemade Response 5, Second paragraph), especially when compared to estimates of nitrogen exported or removed from the project area as illustrated below:

- The New Madrid Floodway currently removes an estimated 10.3 kg of nitrogen from Mississippi River floodwaters on 12,775 agricultural acres

(corresponding to elevation 290 NGVD or the 2 year flood event) using Ochs and Milburn's (2003) 0.002 kg/ha denitrification rate,[2]

- The New Madrid Floodway currently exports an estimated 120,880 kg of nitrogen to the Mississippi River at elevation 290 NGVD (Ashby, *et al*., 2000 Table C1 Scenario 5),
- With basic mitigation in place, it is estimated that the New Madrid Floodway would export 58,322 kg nitrogen to the Mississippi River (RSEIS 2 Table 5.3, last row in table),
- Increased nitrogen removal efficiencies due to mitigation in the project area would remove 62,558 kg (120,880-58,322) of nitrogen,
- Therefore, the removal efficiency per acre is increased to slightly more than 50% and,
- This clearly compensates for the loss of 10.3 kg of nitrogen removal associated with Mississippi River flooding filtration by the agricultural lands.

[7] 12,775 acres * 0.4046873 hectares/acre * .002 kg/hectare = 10.3 kg

Woltemade Comment 8:

IV. Other Flawed Standard of Measurement

At various times, the Corps has also suggested that the project will improve water quality, even without mitigation, using another measure. This measure is so-called nitrogen removal efficiency. But common sense shows that this measure is not environmentally relevant. .

In this context, efficiency means how much nitrogen is removed per acre flooded. The project would improve nitrogen removal efficiency because even though dramatically fewer acres are flooded, the few acres that remain flooded include relatively more forested lands. Efficiency is improved in the same way that closing 9 older sewage treatment plants while preserving one new treatment plant will increase the average efficiency of each operating treatment plant. But it also now means that the sewage that previously entered and was at least somewhat treated by the nine older plants now flows into the river completely untreated. From an environmental standpoint, the question is whether more or less nitrogen is in the Mississippi River with or without the project and, as I discuss above, the project would increase the amount of nitrogen in the river even according to the Corps' own analysis.

3

Woltemade Response 8: See Woltemade Response 7 above. The ability of various land uses to remove nitrogen (or the relative efficiencies of those land uses) is extremely environmentally relevant. If this were not so, there would be no scientific basis for recommending wetland and riparian restoration to achieve water quality improvements. The National Science and Technology Council Committee on Environment and Natural Resources (2000) recommended conversion of cropland to forested wetlands to help ameliorate the Gulf of Mexico hypoxia problem. Even the comment includes a reference to "more effective nitrate removal" from Spieles and Mitch (1998) as cited in Woltemade (2000) indicating that nitrogen removal efficiency is environmentally relevant.

The example provided in the comment fails to accurately describe the current situation. The floodway currently provides very little "treatment" of Mississippi River water, and actually contributes to the nitrogen load of the Mississippi River since it is predominantly agricultural land (Woltemade Responses 2 and 7). The project's mitigation features, since it increases nitrogen removal efficiencies, will reduce the amount of nitrogen entering the Mississippi River from the project area (Woltemade Response 2). With the

implementation of compensatory mitigation features, the contribution of the nitrogen load to the Mississippi River from the project area will be reduced by an estimated 50% (Woltemade Response 7).

Regardless, considering both its value as a filter for the Mississippi River and the floodway and also as a net nitrogen contributor, the project area still has an indiscernible effect on the total nitrogen load carried by the Mississippi River (Woltemade Response 3).

Woltemade Comment 9:

V. Fundamental Flaws with Corps Analysis

Although I have previously described a variety of flaws with the Corps analysis, I wish to further highlight two. One is the improper treatment of flooded agricultural fields, which function as farmed wetlands. Wetlands remove nitrogen in two possible ways. One possible way is through sedimentation. As water moves through the wetland, sediment falls out and some nitrogen is attached to the sediment. This is a modest process. By far the primary source of nitrogen removal is a biochemical process through which the nitrogen in water is converted to harmless nitrogen gas, which is released into the atmosphere (which is already mostly nitrogen gas). At times, Dr. Ashby has claimed that the model incorporates nitrogen removal for farmed wetlands. In fact, he has acknowledged, that it only factors in the removal of nitrogen through sedimentation, which is modest (10%).

This has a major effect on the model because it assumes that flooded agricultural fields remove little nitrogen, while flooded forest lands remove large quantities of nitrogen. But denitrification occurs primarily because of the bacteria in flooded soils, and they will exist in flooded forests as well as flooded agricultural land if flooded for several days. I am aware of no scientific disagreement about this fact. The result is that the Corps model both underestimates nitrogen removal in the project area under existing conditions, and has the potential to greatly overestimate the value of a mitigation plan that is based largely on reforestation.

Woltemade Response 9: As previously pointed out (Woltemade Responses 2 and 5), there is published information that flooded agricultural fields provide much less nitrogen removal by conversion to nitrogen gas (denitrification) than fully functioning wetlands. A possible explanation why follows. Denitrification is accomplished primarily by the activity of bacteria. As the comment notes, there is no disagreement about this fact. However, the denitrifying bacteria require organic matter, which typically accumulates in great concentrations in wetlands (Mitsch and Gosselink, 1986) as cited in Reddy and D'Angelo (1994). It is likely that organic matter in post crop season agricultural fields is much lower than in established wetlands since much of the organic matter is removed in

the harvesting processes. The microbial community structure in bottomland hardwoods can also be quite different from the microbial community in agricultural fields since they are subjected to very different types of hydrology that affect microbial community structure.

Woltemade Comment 10:

> Another flaw with the model is that it is not really a hydrologic model at all. It leaves out nearly all of the factors that need to be considered in even a simple hydrologic model to estimate changes in nitrogen loss. It leaves out length of inundation- how long water remains in the wetlands. It leaves out water routing pathways. It calculates the effects of only single flooding events, not the effects of reduced flooding from multiple flooding events over the course of a year. These are fundamental qualities to any hydrologic model. The model used was not peer-reviewed, and for these reasons, I doubt it could pass even lenient peer review.

Woltemade Response 10: The model is not presented as, or intended to be used as a hydrologic model. The model uses hydrologic information relevant to the project and evaluates changes in multiple water quality constituents, including nitrogen with various project and hydrologic scenarios.

The comment makes three criticisms of the model used.

The first is that the model leaves out length of inundation. This is not correct. The model assumes a 60 day inundation period which is considered to be adequate for material processing (Ashby, *et al*., 2000). In fact this time period exceeds the recommended periods cited in Woltemade (2000) of several days to two weeks. This is discussed in Woltemade Response 2.

The second criticism is that the model leaves out water routing pathways. This is correct since the model is based on mass balances and accounts for change in mass of a material (*e.g.,* nitrogen) by land cover type. The Corps acknowledges that additional processing of materials is occurring and would be accounted for with more rigorous hydrologic models that account for water routing pathways. However the intent of the model was to provide a mechanism for evaluating project alternatives. Using removal efficiencies based on a mass balance approach as a function of land use and different flooding regimes for alternative evaluations was considered acceptable by the interagency team.

The third criticism is that the model calculates the effects of only single flooding events and not the effects of multiple flooding events over the course of the year. Based on accepted runoff coefficients reported in Ashby, *et al*., (2000, pp. 7 - 8), the effects of multiple flooding impacts can be assessed. For example, using model results reported in

Ashby, *et al*., (2000 Table C1 and Table 5.3 RSEIS 2), the net yield of nitrogen was estimated for several flooding events as follows:

- 120,088 kg during flooding to an elevation of 290 feet NGVD in the New Madrid Floodway (Scenario 5),
- 58, 321 kg for the same flooding scenario (*i.e.*, a moderate high flow approximating a 2-year flood event) with mitigation accounted for (Table 5.3),
- 14,246 kg during flooding at an elevation of 285 feet NGVD (Scenario 2).

Thus, it follows that a 2 year flood event (with mitigation) would have to occur approximately 2 times per year to provide a nitrogen export value equal to existing conditions (58,321 * 2 = 116,642). Furthermore, the estimated yield of nitrogen at elevation 285 feet NGVD is the equivalent of approximately 1/4 of the estimated nitrogen exported during a flood event at 290 feet NGVD, suggesting that as many as 8 flood events (of less magnitudes of the 2-year flood) would have to occur to equal the export of nitrogen associated with existing conditions. Using the estimate of nitrogen export with mitigation (58,321 kg), the project area could process approximately 4 flood events associated with the 285 foot elevation.

Finally, the model calculates mass by multiplying concentrations by volume, adjusting for material processing with input values (*e.g.*, removal rates for wetland land covers and export coefficients for upland land covers), and adjusting for acres flooded under various flooding scenarios. This is accomplished with mathematical equations in a commercially available software package. Input values used in the calculations were cited from peer-reviewed literature and were accepted by an interagency team prior to application of the model.

References:

Ashby, S.L., Ruiz, C.E., and Deliman, P. 2000. Supplemental Water Quality Analysis – St. Johns Bayou and New Madrid Floodway, ERDC/EL SR-00-7, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Beaulac, M.N. and Reckhow, K.H. 1982. An examination of land use – Nutrient export relationships, Water Resources Bulletin, 18(6):1013-1024.

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Ochs, C.A. and S.A.Milburn. 2003. Effects of simulated wintertime flooding to control erosion on selected chemical and microbial properties of agricultural soils in the Mississippi delta, J. Mississippi Academy of Sciences, 48:2, 102-114.

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Spieles, D.J. and W.J. Mitsch. 1998. The effects of season and hydrologic and chemical loading on nitrate retention in constructed wetlands: a comparison of low and high nutrient rivierine systems. Pp 105-117. In W.J. Mitsch and V. Bouchard (eds.). Olentangy River Wetland Research Park at The Ohio State University Annual Report 1997.

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ATTACHMENT 1

Riley Lake and Eagle's Nest Area Wetlands Reserve Program (WRP) Site Visit

Riley Lake and Eagle's Nest Area Wetlands Reserve Program (WRP) Site Visit
St. Johns – New Madrid Floodway Project
New Madrid County, Missouri

Introduction

Environmental Defense (ED) has raised concerns about the validity of acreages of bottomland hardwood and farmland numbers used in the DRAFT Revised Supplemental Environmental Impact Statement 2 (DRSEIS 2). Furthermore, ED has made a claim in their comments on the DRSEIS 2 that a potential mitigation feature of flooding the sump area would kill existing trees within the WRP sites.

The purpose of this field survey was to document the vegetation in the vicinity of Riley Lake (Figure 1Figure 1. Riley Lake Area with 288' NGVD and less contour.) and to document the vegetation on the WRP lands (Figure 2). Riley Lake is located in the Donaldson Point area located in the batture to the south of the proposed levee closure location. The WRP lands in the Eagle's Nest area are located in the New Madrid Floodway sump.

Methods

After obtaining verbal permission from area landowner's via the local levee board attorney, Lynn Bock, Kevin Pigott proceeded to the project area on 02 February 2006. Various locations were visited with latitude, longitude, dominant vegetation, and other supplemental information being collected on site.

Results

Riley Lake

The SCI report submitted by ED is misleading. The "significant amounts of the area assumed to be farmland actually exist as densely-planted cottonwood trees" are primarily located outside the proposed footprint for Riley Lake and are indeed at elevations greater than or equal to 290' NGVD. This elevation is greater than the maximum suggested as an option in the DRSEIS 2. As indicated in Figure 1, the cottonwood tree plantations are the majority of the vegetation appearing in the red area to the east of the Riley Lake footprint and immediately south of Missouri Department of Conservation land. The existing vegetation within the Riley Lake footprint is primarily established Black Willow trees (Figures 3 and 4). It is noted that the imagery used in figures 1 and 2 are US Department of Agricultural National Agriculture Imagery Program (NAIP) near infrared imagery and are dated 14 August 2005. Phone calls to SCI for locations of the cottonwood plantations within the Riley Lake project area described in their report were not returned and the field investigator was unable to determine the location of the described cottonwood plantations. No dense stands of cottonwoods were observed within the proposed Riley Lake footprint within the limited field time.

WRP Land

Of the approximate 800 acres of WRP land in the Eagle's Nest area, almost all land is within the 285' NGVD contour (Figure 2) and could potentially be influenced by a proposed mitigation option. However, the WRP tracts are comprised of "cells" delineated by perimeter levees and water control structures. All of the land appeared to be managed for waterfowl with roughly half of the land being used to grow a food source for waterfowl (Figures 5 – 9). Approximately half of the WRP tracts have young Black Willows growing in them. According to US Forest Service data for the Lower Mississippi Valley and Missouri River Divisions, Black Willows are very flood tolerant, able to survive deep, prolonged flooding during the growing season (Whitlow and Harris, 1979 cited in http://na.fs.fed.us/spfo/pubs/n_resource/flood/table.htm). Water is currently being held on these WRP tracts with no apparent damage to the growing trees or other vegetation.

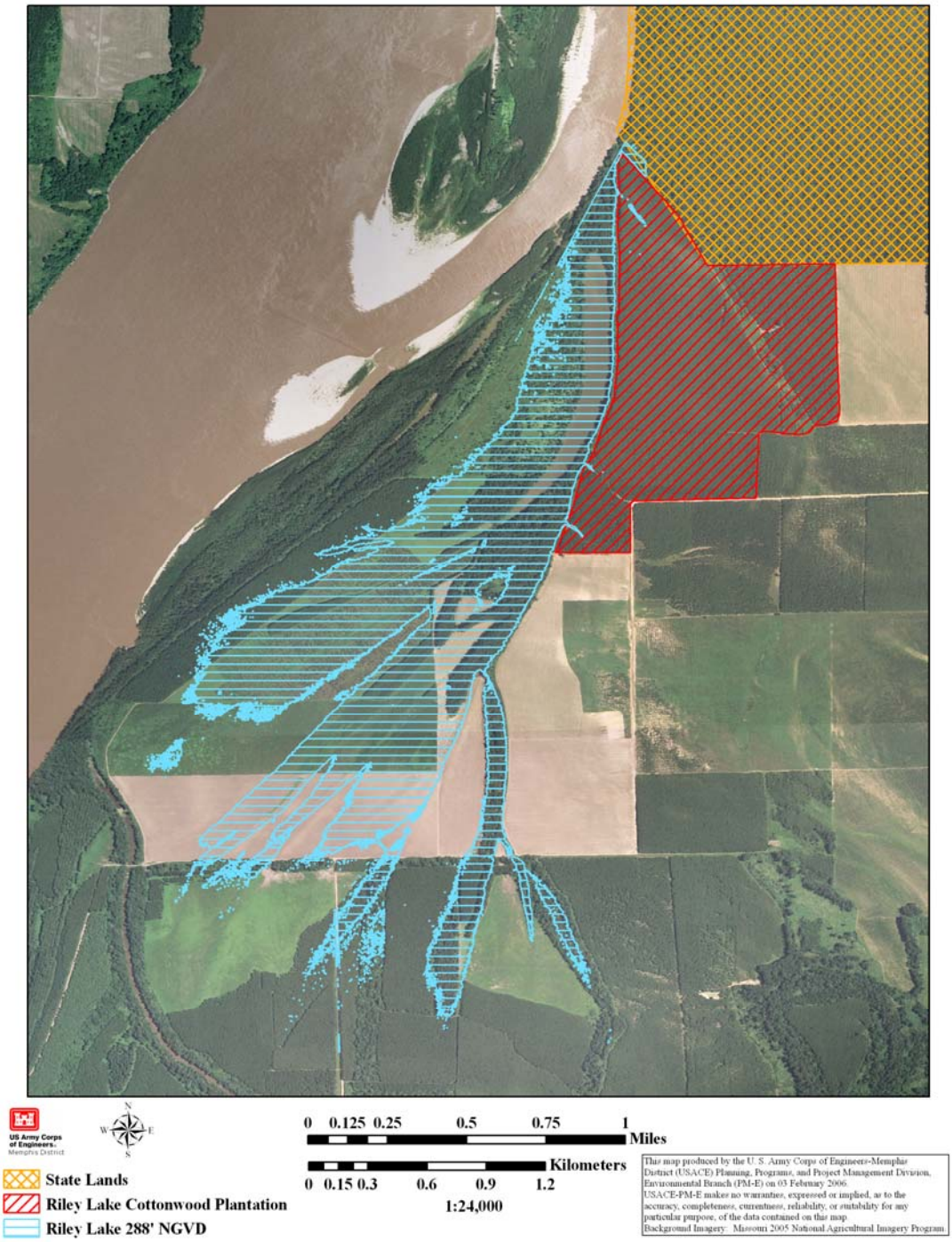


Figure 1. Riley Lake Area with 288' NGVD and less contour.

Figure 2. WRP land and 285' NGVD and less contour.

Figure 3. Existing vegetation adjacent to Riley Lake.

Figure 4. Existing vegetation adjacent to Riley Lake.

Figure 5. Flooded East Bayou WRP land looking South.

Figure 6. Flooded East Bayou WRP land looking Southwest.

Figure 7. East Bayou WRP land looking North.

Figure 8. Typical WRP water control structure (Eagle's Nest Farm WRP).

Figure 9. Waterfowl food source in Eagle's Nest Farm WRP land looking North.

References Cited

Whitlow, T.H. and R. W. Harris. 1979. Flood Tolerance in Plants: A State-of-the-Art Review. National Technical Information Service, U.S. Department of Commerce. August: 1-161.

ATTACHMENT 2

Change in Frequency Elevation in New Madrid Floodway

CHANGE IN FREQUENCY ELEVATION IN NEW MADRID FLOODWAY

A change in the frequency analysis for existing conditions in the New Madrid Floodway necessitates a revision to the 2-year frequency elevation as presented in the draft St. Johns - New Madrid SEIS. The following paragraphs describe the process.

In developing the criteria to quantify the fisheries impacts for each of the conditions, a necessary standard was the limit of valuable habitat. It was subsequently agreed that the 2-year frequency elevation would be the upper limit of potential impacts for the study. Therefore, only acreage below the 2-year frequency elevation was considered in the analysis.

To determine the 2-year elevation, the physical and rainfall-runoff characteristics of the New Madrid Floodway were utilized for the authorized and avoid and minimize conditions. The process entailed using actual rainfall for the period 1943-1974 and simulating the basin response at the outlet by routing daily runoff through the proposed structures. Daily runoff was developed using unit hydrograph procedures and sump storage routings reflecting corresponding Mississippi River stages. The frequency analysis was based on the resulting peak storage calculated in the sump for each year in the period-of-record analysis. Therefore, the physical and rainfall-runoff characteristics for the New Madrid Floodway were utilized to determine the interior frequency elevation. A similar method was applied to determine the existing conditions for the New Madrid Floodway, which assumed that interior storage in the Floodway was the dominant factor in determining the frequency relationship. As a result of using this procedure, a 2-year frequency elevation of 292.9 was determined for existing conditions.

During the review process of the draft SEIS, a quality control internal review was conducted by others in the agency. A result of the review was that the procedure used to develop the 2-year frequency elevation for existing conditions in the New Madrid Floodway was incorrect. It was also determined that the correct procedures were followed in developing the authorized and avoid and minimize frequency elevations, since the physical characteristics of the New Madrid Floodway and the basin response to rainfall-runoff processes are dependent upon the physical characteristics of the New Madrid Floodway. (It is important to understand that the authorized and avoid and minimize alternatives differ from existing conditions in the Floodway in that the basin is isolated from the direct influence of the Mississippi River by closure of the 1500-foot gap at the lower end of the Floodway). However, application of the basin characteristics of the New Madrid Floodway to determine a frequency elevation for existing conditions was not proper. This is true because virtually every annual peak elevation in the New Madrid Floodway under existing conditions is determined solely by flows in the Mississippi River and is independent of the Floodway area. Applying the physical characteristics of the Floodway, which is only a minor tributary (183 square miles) of the Mississippi River, to determine the frequency response is incorrect. It was determined that the frequency value for existing conditions at New Madrid is properly based on an analysis of peak flows and stage-discharge relationships along the Mississippi River system, which has a drainage area of approximately 920,000 square miles at New Madrid.

A comprehensive frequency analysis of the Lower Mississippi River was previously conducted. The analysis was based on an analysis of annual peak flows at all stations along the river that maintain continuous discharge records. A flow of 1,000,000 cfs is reflective of the 2-year frequency flow along the reach of the Mississippi River which includes New Madrid.

To determine the current 2-year elevation of the Mississippi River at New Madrid, a

synthetic rating curve at New Madrid was developed for the period 1993-1997 based on computed flows at Hickman, Kentucky and corresponding stages at New Madrid. The Hickman station is the key station for determining the flows in this reach of the Lower Mississippi River. For the established 2-year frequency flow of 1,000,000 cfs, the corresponding stage at New Madrid has been computed as 290 and is shown on Plate 1. This elevation is the appropriate 2-year frequency elevation for existing conditions in the New Madrid Floodway. The fisheries analysis has been updated to reflect this value. Plate 2 depicts the 2-year frequency elevations for the fisheries analysis for the three conditions evaluated for the New Madrid Floodway.

The revision in the 2-year frequency elevation for the New Madrid Floodway affects only the environmental impacts associated with the existing conditions fisheries analysis in the Floodway. All other analyses and results contained in the Hydraulic Appendix for the draft SEIS remain acceptable, since the analyses are not contingent upon the revised 2-year frequency elevation.

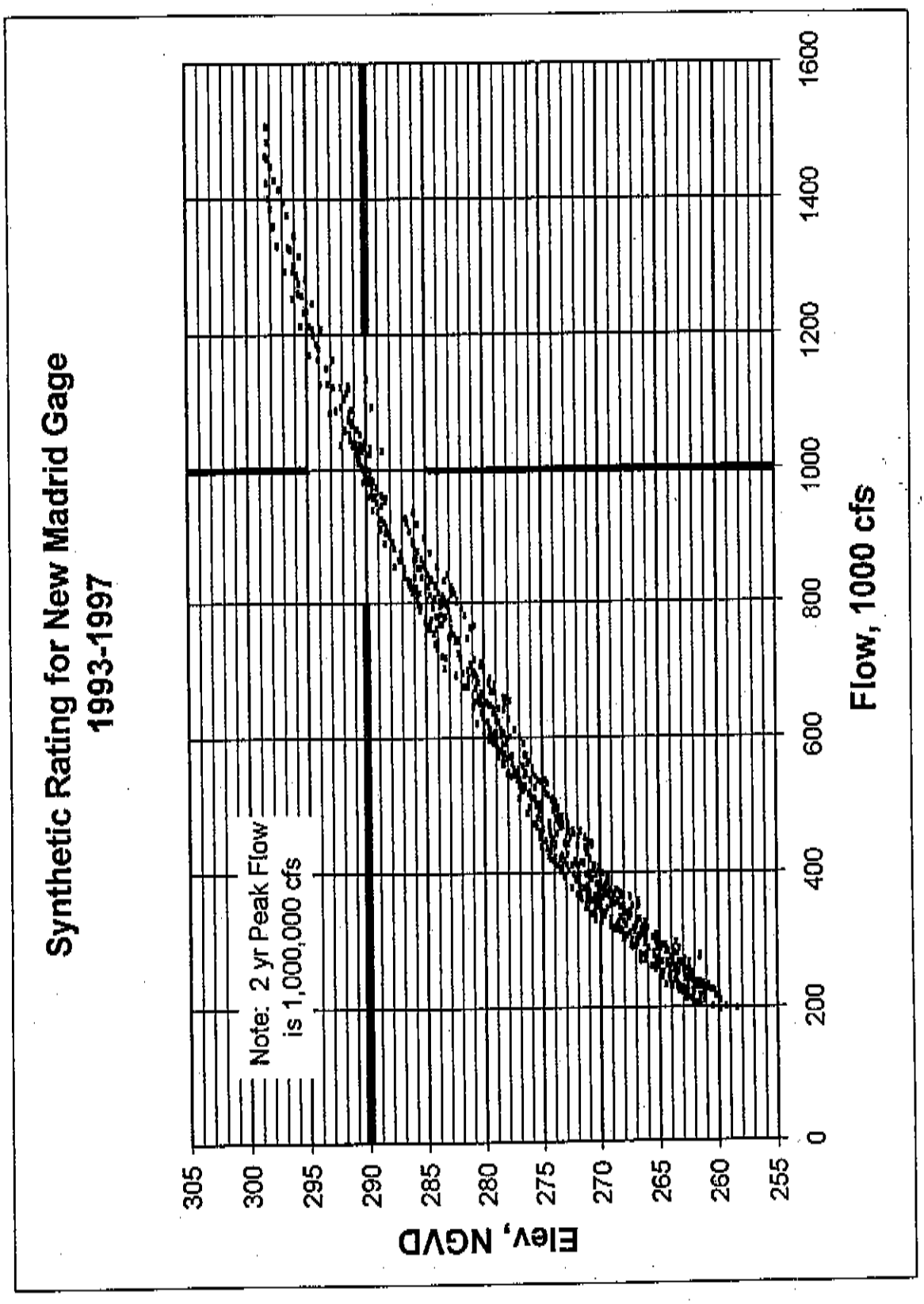
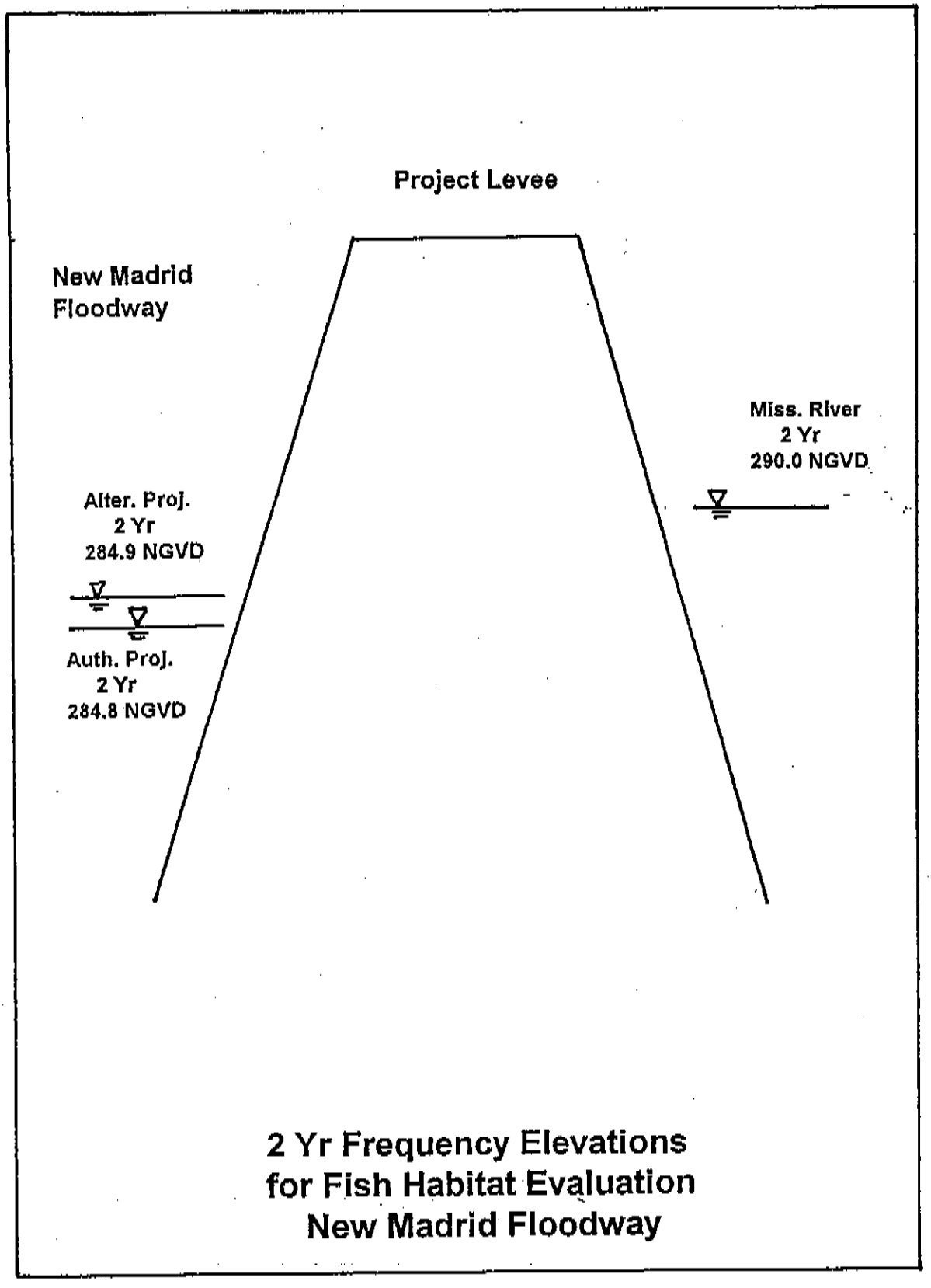

Synthetic Rating for New Madrid Gage
1993-1997
Note: 2 yr Peak Flow
is 1,000,000 cfs
Elev, NGVD
305
300
295
290
285
280
275
270
265
260
255
0
200
400
600
800
1000
1200
1400
1600
Flow, 1000 cfs

Plate 1



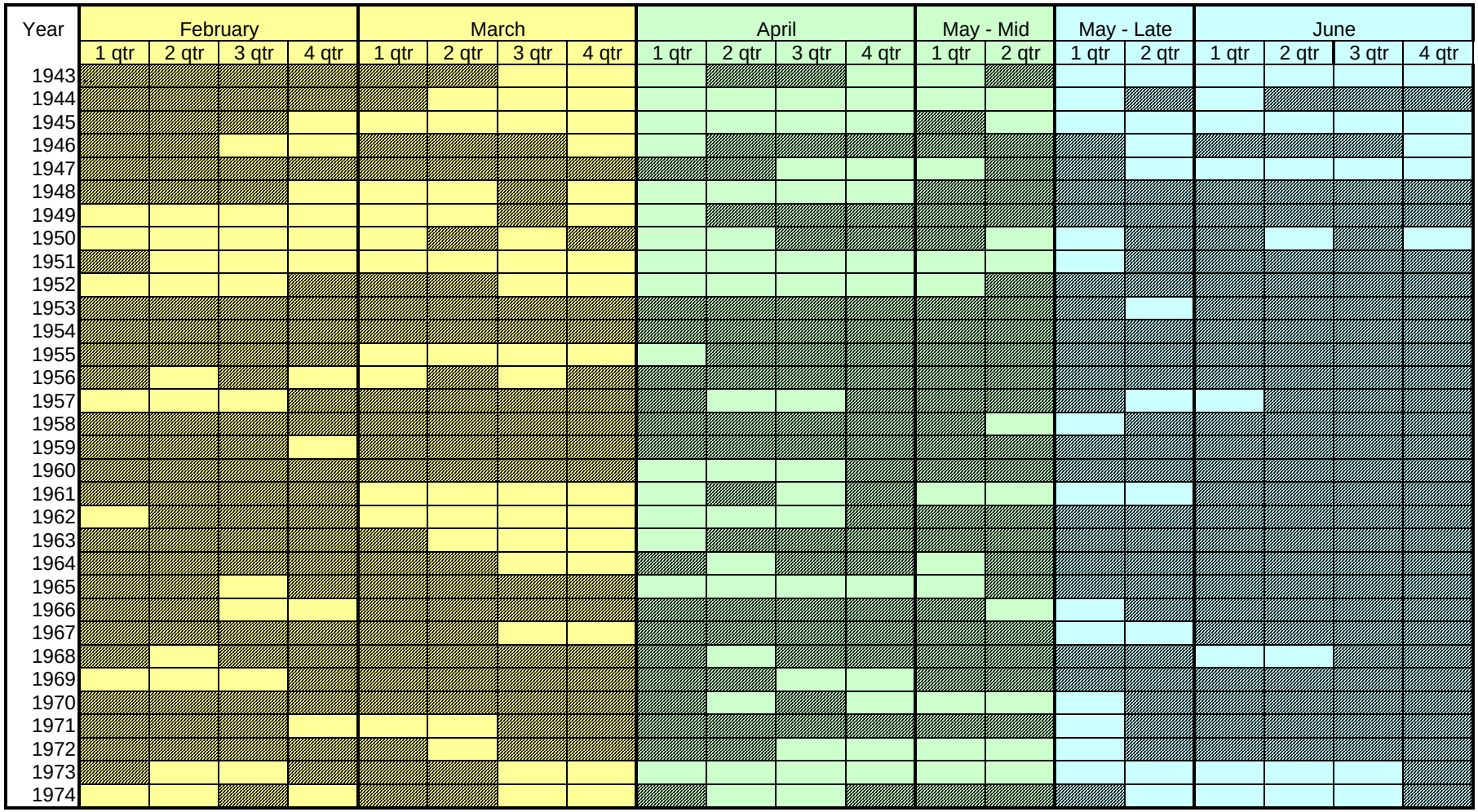
2 Yr Frequency Elevations for Fish Habitat Evaluation New Madrid Floodway

Plate 2

ATTACHMENT 3

Periods When the New Madrid Culverts are Likely to be Open

Periods When New Madrid Culverts Are Likely to be Open*



Early Season Fish Spawning & Rearing
Mid-Season Fish Spawning & Rearing
Late Season Fish Spawning & Rearing

Early Season Open Gates**
Mid Season Open Gates**
Late Season Open Gates**

* Likely to be open means the stage for at least three daysout of each shaded monthly quarter is below the start pump elevation
** This does not exclude the gates being open during the early season prior to crop planting

ATTACHMENT 4

NRCS Certified Wetland Determination

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
480 W Jackson Trail
Jackson, Missouri 63755
Phone 573.243.1467
Fax 573.243.3808

Subject: ECS-Wetland Determination/Delineation

Date: November 21, 2005

To: Robyn Sitzes, Resource Conservationist
NRCS, Charleston

File Code: 190-13-14

Enclosed is the documentation for your county's **Request for Certified Wetland Determination / Delineation** on this tract.

This Certified Wetland Determination is valid for the Food Security Act only. A copy of this Certified Wetland Determination is being sent to the COE for the Clean Water Act. Prior to any manipulations or conversions in this area approval must be obtained from the COE.

Please contact me if you have any questions.

Donnie Holbrook

Donnie Holbrook
Soil Scientist - Wetland Team

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An Equal Opportunity Provider and Employer

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
480 West Jackson Trail
Jackson, Missouri 63755
Phone: 573.243.1467

November 21, 2005

Dick Mochow
US Army Corps of Engineers
Regulatory Functions Branch
167 North Main
B 202
Memphis, TN

Dear Mr. Mochow:

Enclosed is the Certified Wetland Determination for the 2454, 2455, 2456, 2436 & 2437 tracts in Mississippi County, Missouri. The Ten Mile Pond Conservation Area.

If you require additional information or if you have any comments or questions, please call.

Donnie Holbrook
Wetland Team Soil Scientist

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Wetland Delineation Worksheet
MDC-Ten Mile Pond
Tract: 2454, 2455, 2456, 2436, 2437
County: Mississippi

1. Date of field visit: 11/3, 11/10/2005

2. Legal description: sec. 16, 21, T. 24 N., R.16 E.

3. Purpose of Request: MDC wants to build a small levee on crop fields to be able to flood the fields for wildlife use. The levee will be placed entirely on cropland and the fill for construction will be taken from the adjacent crop field.

4. Participants on the Delineation: Dick Mochow COE on 11/10/05, Rob Vinson MDC, Rod Doolen Wetland Biologist, Donnie Holbrook Wetland Soil Scientist on 11/3 and 11/10/05.

5. Pre-field review includes: Checked the local soil survey and FSA aerial photos and slides and U.S. Geological Topography maps and NWI maps (when available).

6. How many plots were taken: 1 (additional plots were taken for confirmation)

7. Method (please circle): ***routine*** ***transects*** ***other***_____

8. Description of the site: Project area was cropland on terraces and includes five tracts.

9. Description of each plot (location is depicted on the attached map) and/or other remarks: Plot 1 was selected to best represent the project area.

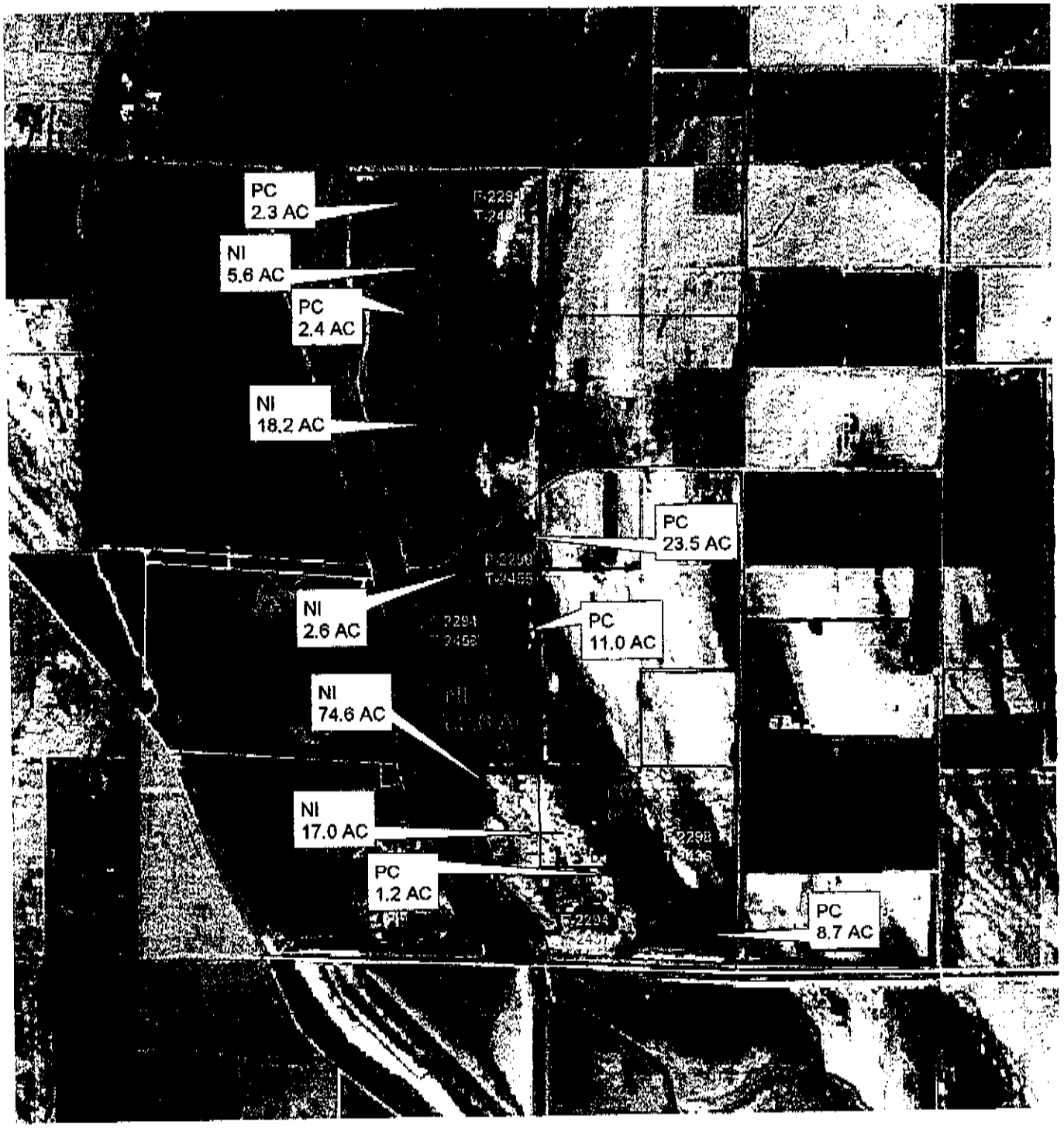
10. **Conclusion of Project Site**: All plots (approx. 274.2 acres) represent the levee construction running from north to south on five adjacent tracts. They **did not** have the required indicators for a wetland and for FSA purposes will be delineated as **Prior Converted Cropland (PC).** The areas below where the levee will be constructed were **Not Inventoried (NI).** All the remaining area was also **Not Inventoried (NI).**

Donnie Holbrook
Wetland Team Soil Scientist

See attached WetForms for additional information.

NOTE: *The acres on this delineation are estimated. The delineation line(s) on the attached photo is the approximate location of the wetland. Only wetlands flagged by NRCS and measured by FSA in the field are the official certified wetland determination. The wetland will only be flagged once by NRCS (as requested by landowner). The landowner is responsible to place permanent markers to mark the official wetland boundary.*

Certified Wetland Determination
MDC-Ten Mile Pond



0.5 0.25 0 0.5 1 Miles

N
W E
S

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: T-2454,2455,2456,2436,2437	**Project No:** Ten Mile	**Date:** 25-Nov-2005
Applicant/Owner: MDC-Ten Mile Pond Conservation Area		**County:** Mississippi
Investigators: Donnie Holbrook		**State:** Missouri
		Plot ID: 1

Do Normal Circumstances exist on the site?	(Yes) No	**Community ID:** cropland on terrace
Is the site significantly disturbed (Atypical Situation:)?	Yes (No)	**Transect ID:**
Is the area a potential Problem Area?	Yes (No)	**Field Location:**
(If needed, explain on the reverse side)		sec. 16,21, T. 24 N., R. 16 E.

VEGETATION (USFWS Region No. 3)

Dominant Plant Species(Latin/Common)	Stratum	Indicator	Plant Species(Latin/Common)	Stratum	Indicator

Percent of Dominant Species that are OBL, FACW or FAC: (excluding FAC-) 0/0 = 0.00%

FAC Neutral: 0/0 = 0.00%
Numeric Index: 0/0 = 0.00

Remarks:
beans and corn stubble

HYDROLOGY

YES Recorded Data(Describe in Remarks):
- NO Stream, Lake or Tide Gauge
- NO Aerial Photographs
- YES Other

NO No Recorded Data

Field Observations

Depth of Surface Water:	N/A *(in.)*
Depth to Free Water in Pit:	N/A *(in.)*
Depth to Saturated Soil:	N/A *(in.)*

Wetland Hydrology Indicators

Primary Indicators
- NO Inundated
- NO Saturated in Upper 12 Inches
- NO Water Marks
- NO Drift Lines
- NO Sediment Deposits
- NO Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- NO Oxidized Root Channels in Upper 12 Inches
- NO Water-Stained Leaves
- YES Local Soil Survey Data
- NO FAC-Neutral Test
- NO Other (Explain in Remarks)

Remarks:
No wetness signatures for farmed wetland.