

**USACE Final Evaluator Responses  
to  
Final Panel Comments  
on the  
Engineering, Economic, and Environmental Review of  
the Limited Reevaluation Report and  
Environmental Assessment on  
Alton to Gale Organized Levee Districts, Illinois and  
Missouri (Continuing Deficiency Corrections)**

<b>Comment 1:</b>
<b>Quantitative technical information on levee soil properties should be provided regarding the lime/fly-ash method to support its use as a sound solution for the immediate and long-term performance of the levees.</b>
<b>Basis for Comment:</b>
<p>The Letter Report cites the use of lime/fly-ash injection for improvements to the levees in the U.S. Army Corps of Engineers (USACE) Memphis District as the precedent for the recommended alternative. While the effectiveness of the solution has been described in qualitative terms in Section 4.5.5, it is important to present quantitative data that have been obtained for the clays in the Memphis District levees before and after soil stabilization, and comparative information for the soils in the Alton to Gale levees and the levees treated in the Memphis District. The report should contain quantitative data on the soil strength increase and change in hydraulic conductivity of the treated soils based either on studies performed by the St. Louis District, studies performed by the Memphis District, or information in the published literature on the effectiveness of the lime/fly-ash injection method. This information is critical to the seepage and slope stability analyses that need to be provided in the report to demonstrate that the USACE criterion of a safety factor equal to or greater than 1.4 will be met by the recommended alternative.</p> <p>Unlike the direct application of lime and fly-ash to high plasticity clays, where the lime and fly-ash are subsequently mixed into the soil, the efficacy of the in situ injection process is not as readily apparent. Since the in situ method depends on the distribution of the reagent throughout the soil mass by means of random shrinkage cracks and fractures that have developed in the levees, a discussion should be provided of the criteria for configuring the proposed lateral spacing of injection holes, as well as limits to be placed on the injection pressure to avoid the possibility of hydraulically fracturing the side slopes during the process. A discussion should also be provided of the sampling and testing procedures that will be implemented to verify that the anticipated strength increase has been achieved at locations away from the injection holes, both in terms of lateral extent and depth. A detailed discussion of the injection process and testing protocols could be provided as an appendix with a brief summary of the salient points in the body of the report.</p>
<b>Significance – High:</b>
It has not been adequately demonstrated that the lime/fly-ash injection process will achieve the desired results in the Alton to Gale levees. Quantitative information on the efficacy of the process needs to be provided in support of the recommended alternative.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. Comparative information on the engineering properties of soils in the Alton to Gale levees and the levee soils successfully treated using the lime/fly-ash injection method in the Memphis District.</li> <li>2. Further details on the injection method construction procedures, including anticipated lateral spacing and injection pressures.</li> </ol>

3. Criteria for determining acceptability after the injection process has been performed, including quantitative data on the anticipated soil strength increase and change in hydraulic conductivity for the soils.
4. Discussion of the quality control sampling and testing program needed after soil treatment to verify the efficacy of the process.
5. Information on the applicability of any environmental, health and safety regulations to lime/fly ash treatment.

**USACE Draft Evaluator Response (#1)**

**Final Panel Comment 1: CONCUR**

1. **ADOPT NOW.** Comparative information of some of the engineering properties of the soils in the Alton to Gale levees and the soils of the Memphis levees will be included in the final version of the Letter Report.
2. **ADOPT NOW.** More details of the injection method, including lateral spacing and injection pressures will be included in the final version of the Letter Report.
3. **ADOPT.** The final version of the Letter Report will include a brief explanation of the overall improvements expected to the levee sections by using the recommended alternative.
4. **ADOPT in FUTURE.** During the Plans and Specifications phase of this project (after project approval and fiscal appropriations) criteria will be developed for determining the acceptability of the process.
5. **ADOPT.** The EA is currently being revised to include this information. An historical review of pertinent existing data, followed by a preliminary assessment of the application, which includes an assessment of risk for human health and the environment, is currently underway.

<b>Comment 2:</b>
<b>Seepage and stability conditions within the levee and levee foundation require further modeling analysis to address the existing slide problems.</b>
<b>Basis for Comment:</b>
<p>While the cause of the levee slides is discussed in Section 2.5.2 and an infinite slope analysis is presented, the Letter Report also needs to present the results of seepage and slope stability analyses that support the development of the four alternatives and also demonstrate that the USACE minimum factor of safety of 1.4 will be met by each of the alternatives. The results of these analyses also provide another basis for comparing alternatives.</p> <p>The report needs to present the engineering properties of the soils in the levee as they currently exist, along with the properties that are expected to be achieved with each of the alternatives. These soil properties form the basis for a series of seepage and slope stability analyses, which are necessary to establish the lateral and vertical extent of the soil treatment required to achieve the USACE minimum safety criterion. The approach is essentially a trial and error process where the thickness of the treated zone is assumed and the section is analyzed to determine the minimum factor of safety, which is then compared to the USACE minimum allowable value of 1.4. If the criterion is not met, the extent of the treated zone is adjusted to achieve the required value.</p> <p>It is stated that for Alternative 1 the depth of soil treatment will extend to a depth of 5 feet into natural ground. Alternatives 2 and 3 indicate that the levee will be treated to a distance 10 feet beyond the toe and 5 feet into natural ground. No similar provision is specified for Alternative 4. The required safety analyses provide the basis of such recommendations. The results of the analyses can be summarized in the body of the report and details of the analyses can be presented in an appendix.</p> <p>Tests performed on samples collected from the levees subsequent to soil treatment will confirm that the anticipated values used in the analyses to develop the alternatives have actually been achieved in the field. The above approach of analysis and post-treatment soil testing provides a means of supporting the conclusion that the recommended alternative will provide a long-term solution to the chronic problem of failures in the side slopes of the levees.</p>
<b>Significance – High:</b>
The report needs to present the results of seepage and slope stability analyses that support the development of the four alternatives and demonstrate that the USACE criteria for safety will be met by the Recommended Plan.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. The engineering properties (long-term soil strength and hydraulic conductivity) of the soils as they currently exist in the levee and the anticipated properties for soils subsequent to soil treatment or replacement for each of the respective alternatives.</li> <li>2. Seepage analyses to develop the pore pressure distribution within the levee and foundation for use in slope stability analyses for each of the proposed alternatives.</li> </ol>

3. Slope stability analyses that support the recommended extent of treatment for each of the alternatives, and which demonstrate that the USACE criterion of a safety factor equal to or greater than 1.4 for long-term conditions will be met by each of the four alternatives.
4. Definition of a post-treatment field and laboratory soil testing program to confirm that the anticipated level of soil improvement has been achieved. .

**USACE Draft Evaluator Response (#2)**

**Final Panel Comment 2: CONCUR**

1. **ADOPT in PART.** The final version of the Letter Report will include a Geotechnical Appendix and in this appendix any data we have for existing conditions will be added. Data from the Memphis District that can be located will also be included.
2. **ADOPT in PART.** For the slope stability analysis we are using typical pore pressure values that represent the soil types present in the slide reaches. The values were selected using the experience of our in-house slope stability experts. The values selected for the slope stability analysis will be outlined in the Geotechnical Appendix including the anticipated improvements for post-injection that will achieve a FS of 1.4.
3. **ADOPT in PART.** Slope stability analysis will be developed using data we have available for existing soil conditions.
4. **ADOPT in FUTURE.** A plan for post-treatment testing of soil to confirm the anticipated results will be developed and carried out during the Plans and Specifications phase of the project.

<b>Comment 3:</b>
<b>The Letter Report should include relevant terminology definitions and backup data to support the estimated real estate, construction, and contingency costs.</b>
<b>Basis for Comment:</b>
<p>There is information within and between the report and the appendices that could be clarified and correlated to provide a more comprehensive document. The Panel offers the following observations:</p> <ul style="list-style-type: none"> <li>• In paragraph 5.1 of the Letter Report there is not a clear basis given for the unit pricing of the preferred alternative that is commensurate with the basis given for the preliminary estimates.</li> <li>• The overall contingencies in the less detailed preliminary estimates are lower than the overall contingency for the more detailed preferred alternative estimate. It is counterintuitive that a more detailed estimate has a higher contingency applied.</li> <li>• There is no basis given for the 25% contingency used for the Real Estate Costs section in Appendix 5.</li> <li>• The effective price level stated in paragraph 5.1 (January 2010) of the Letter Report is inconsistent with the effective price levels of the Appendix 5 tables (p. 5-36 to 5-47) (November 22, 2009) and the effective price date of the Micro-Computer Aided Cost Estimating System (MCACES) estimate (November 2, 2009).</li> <li>• The MCACES estimate notes that the project will be under construction from April to October of each year, avoiding cold weather construction. Contrarily, the Project Schedule section in Appendix 5 shows construction activity from November to March for construction tasks on 5-108, and 5-110 through 5-113.</li> <li>• The MCACES estimate also states that the schedule assumes that two contracts will be awarded each fiscal year. The contracts will have six months for Planning, Engineering, and Design (P, E, and D) and contract acquisition starting in October and construction will begin in April. The Project Schedule section in Appendix 5 (p. 5-108 to 5-113) does not include tasks for P, E, and D or contract acquisition during this period.</li> <li>• The Risk Analysis Report, Section 5 (p. 8) in Appendix 5, states a construction duration of 84 months that does not correlate with the Project Schedule duration.</li> <li>• Total project costs of Alternative 4 in the Letter Report (Table 2 - \$78,216,000) do not agree with the Appendix 5 totals of \$78,454,000 (Summary Tables on p. 5-2 and p. 5-36).</li> <li>• The costs in the Real Estate Costs section on p. 5-97 of Appendix 5 do not agree with the same costs on p. 62 in Appendix 7.</li> </ul>
<b>Significance – High:</b>
Figures and information provided in the Letter Report, its appendices, and the MCACES estimates contain inconsistencies that may impact cost and schedule, thereby affecting project funding.
<b>Recommendation(s) for Resolution:</b>

To resolve these concerns, the report would need to be expanded as follows:

1. Describe/define “detailed estimate” in Section 5.1 more clearly (e.g., labor, material, equipment, and productivity rates and contrast it with bid results and historical costs). Also, providing a detailed MCACES report in Appendix 5 would be helpful.
2. Provide a discussion explaining why there is a contingency difference between the preliminary estimates and the preferred alternative estimate given the difference in the level of detail between the two types of estimates.
3. Provide a discussion on the origin of the 25% contingency for Lands and Damages in the proposed alternative estimate.
4. Either provide discussion to clarify differences, or correlate the effective price dates of the Main Report, Appendix 5, and the MCACES estimate.
5. Provide discussion on why there are construction tasks active from November to March in the Project Schedule section or modify schedule to be consistent with MCACES notes.
6. Include P, E, and D as a task in the Project Schedule.
7. Clarify with discussion in the Risk Analysis Report how 84 months translates to 1,638 days from the Project Schedule.
8. Edit Table 2 in the Letter Report, the Summary Table on p. 5-2 in Appendix 5, and the Summary Table on p. 5-36 so they are consistent.
9. Edit Appendices 5 and 7 so the real estate costs are in agreement.

**USACE Draft Evaluator Response (#3)**

### Final Panel Comment 3: CONCUR

1. **NOT ADOPT.** A detailed MCACES report and a more detailed Section 5.1 cannot be added to the report. The information is considered proprietary information and cannot be released in accordance with Engineering Regulations. A sentence will be added to the report to distinguish between a preliminary and detailed estimate.
2. **ADOPT.** A discussion explaining that further contingency study on the preferred alternative resulted in a contingency difference between the preliminary and detailed estimates will be added to paragraph 5.3 of the main report.
3. **ADOPT.** A discussion explaining the Lands and Damages contingency will be provided by the Real Estate office and added to paragraph 5.3 of the main report.
4. **ADOPT.** The effective price dates will be correlated between the Main Report, Appendix 5, and the MCACES estimate.
5. **NOT ADOPT.** There are no construction activities active from November to March as shown in the Construction Schedule. These months have been edited as non work times, and are grayed out accordingly in the schedule print out. As such, the schedule is consistent with the MCACES notes. A sentence will be added at the beginning of the Project Schedule section of Appendix 5 stating "There are no active construction activities from November to March. During these months, Planning, Engineering and Design will be completed for the appropriate levee district."
6. **NOT ADOPT.** In order to show the non work times for the construction schedule, the PED task cannot be added to the schedule. Since the work on PED will occur from October to April, adding PED as a task will make the schedule difficult to read and may result in confusion on when tasks are occurring. A sentence will be added at the beginning of the Project Schedule section of Appendix 5 stating "There are no active construction activities from November to March. During these months, Planning, Engineering and Design will be completed for the appropriate levee district."
7. **ADOPT.** The statement of 84 months in the Risk Analysis Report is an error. The time will be changed to 98 months, which matches the risk analysis model.
8. **ADOPT.** The summary tables will be edited for consistency.
9. **ADOPT.** The Real Estate information will be removed from the cost appendix to eliminate duplicate information in the report. The Real Estate costs only need to be shown in the Real Estate Appendix.

<b>Comment 4:</b>
<b>More data from prior projects regarding similar levee repair issues should be included to support the Recommended Plan.</b>
<b>Basis for Comment:</b>
<p>The Letter Report revises the recommendations made in the 1986 Letter Report, changing the recommended plan from lime stabilization to lime/fly-ash slurry injection. Because of this, the Panel views data from prior USACE Memphis District projects such as the West Memphis Lime and Fly Ash Injection Slope Stabilization Project as critical evidence in support of the recommended alternative. Moreover, the Panel considers data showing the geographical locations of prior projects that have corrected previous slides in the Alton to Gale Levee Districts as equally important information. Prior slides repaired with lime stabilization methods are stable and unlikely to fail in the future. New slides will require lime stabilization before lime/fly ash injection repair. It is important to the overall project funding, cost, and schedule if currently stable (pre-slide) slopes are given scheduled priority to the lime/fly-ash injection method.</p> <p>The Panel believes the following information is missing from the Letter Report:</p> <ul style="list-style-type: none"> <li>• The report should provide data illustrating that the USACE Memphis District projects correct similar levee deficiencies.</li> <li>• The report should provide data indicating that the corrective measures taken in the Memphis District resulted in a more cost effective and technically sound solution over that previously used by the USACE St. Louis District.</li> <li>• A map illustrating levee sections repaired as opposed to levee sections that have not yet failed would be beneficial in supporting the plan formulation of the project.</li> </ul>
<b>Significance – Medium:</b>
Information from relevant prior projects supporting the recommended alternative would benefit the completeness of the Letter Report.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. Data from USACE Memphis District slope slides that illustrate or identify similarities in the deficiencies of Alton to Gale levee slides.</li> <li>2. Quantitative soil strength data from USACE Memphis District lime/fly-ash corrected levee sections.</li> <li>3. Map delineating previously repaired areas.</li> </ol>
<b>USACE Draft Evaluator Response (#4)</b>
<b>Final Panel Comment 4: CONCUR</b>
<ol style="list-style-type: none"> <li>1. <b>ADOPT.</b> Data that is readily available, including soil characteristics will be included in the final version of the Letter Report.</li> <li>2. <b>NOT ADOPT.</b> Unfortunately we have no soil strength data specifically tied to these areas that is readily available for inclusion in the Report at this time.</li> </ol>

3. **ADOPT in FUTURE.** Maps of all the historical slides which have occurred would ultimately be confusing. These slides have recurred frequently on top of one another or directly adjacent to one another. It would be almost impossible to differentiate between the slides in some reaches. There will be maps included in project contracts to provide information to Contractors that would show previous repairs which may impact their work.

**Comment 5:**

**The cumulative effects analysis in the Environmental Assessment (EA) should consider the socio-economic issues associated with implementing the Recommended Plan.**

**Basis for Comment:**

Cumulative effects are defined by 40 CFR 1508.7 as “The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions.” Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.<sup>1</sup>

The primary purpose of the cumulative effects analysis in the National Environmental Policy Act (NEPA) process is to ensure that federal decisions consider the full range of consequences. There is increasing evidence that ecosystem degradation and unexpected effects on humans are resulting from combinations of individually minor effects of multiple actions over time. The full range of actions that must be considered includes not only the project proposal, but also all connected and similar actions that could contribute to cumulative effects.

A potential cumulative effect of restoring and continuing the level of protection provided by the levees has been described as enhanced social and economic growth and development. This has been described on page EA-33 of the EA as a positive potential effect of the project. Continued or enhanced development in the Alton to Gale study area will also have adverse environmental effects simply as a result of future development itself (i.e., habitat loss, reduction of air quality, increased noise, etc.). Restoring the levees does not eliminate flood risk, and estimated potential damages from a 100-year flood could increase over time with an increase in economic development. Perceived protection from flood risk could also result in re-development and gentrification of low-income areas.

1. The terms “impacts” and “effects” are used interchangeably in NEPA practice.

**Significance – Medium:**

The discussion of cumulative effects in the EA lacks elements necessary to meet NEPA requirements.

**Recommendation(s) for Resolution:**

To resolve these concerns, the report would need to be expanded to include the following:

1. A more detailed description of the types of enhanced economic development that could reasonably be expected to occur or continue if the project is constructed.
2. A discussion of ordinances enforced by local municipalities that guide development in the project area, and a review of local economic development planning documents, so that future development possibilities are more fully understood.
3. A discussion of the potential adverse social impact of reducing flood risk and a possible incorrect public perception that repairing the levee slides eliminates flood risk. This discussion would need to include a description of flood risk considering the “with project” condition. In a post-Katrina world, it is the Panel’s opinion that the public observes certain risks of structural failures leading to catastrophic flooding as unacceptable. The discussion needs to be detailed enough to assist the public in fully

understanding the actual risk, the level of protection being provided, and the full consequences of catastrophic levee failure.

4. A discussion explaining that increased or continued development is an expected consequence of the project and that development has environmental effects associated with each and every project. Such effects include but are not limited to habitat loss, changes in air quality, changes in local aesthetics, changes in noise, and changes in the socio-economic environment that may be positive for some people, but adverse to others.

#### **USACE Draft Evaluator Response (#5)**

#### **Final Panel Comment 5: CONCUR**

1. **Adopt.** A description of the economic development that could reasonably be expected to occur if the project is constructed will be added to the report where appropriate.
2. **Adopt.** A discussion and list of ordinances currently enforced or proposed for future enforcement by local municipalities that guide development within the floodplain will be added to the report where appropriate.
3. **Adopt.** A discussion about remaining flood risk even with the project in place, and a list of nonstructural measures that can be taken by local municipalities and individuals to help reduce damages in the event of a flood, regardless of the percent of occurrence, will be added to the report where appropriate.
4. **Adopt.** A discussion explaining that increased or continued development could have negative impacts on the social, structural, natural, and economic environment and the steps or measures that are being implemented by local municipalities to help mitigate such negative impacts will be added to the report.

<b>Comment 6:</b>
<b>The difference in the number and size of slides across individual levee reaches is not sufficiently explained and may impact the allocation of resources.</b>
<b>Basis for Comment:</b>
<p>The Letter Report provides only a brief discussion of the slide history and likely failure mechanisms. As indicated by the USACE in the kick-off teleconference meeting on June 29, 2010, the Panel believes that the information on the levee reaches is available for incorporation into the report.</p> <p>The Panel agrees that the development of deep shrinkage cracks, enabling water to penetrate to the soil deeper within the levee, is a major factor in strength reduction; however, weathering should also be considered a factor in the strength reduction of high plasticity clays. Furthermore, nature does not provide for perfectly uniform materials; therefore, subtle variations in plasticity, as well as in-place densities, etc., are unknown, but are also factors that bear on the performance of the levees. The Panel recommends further discussion of these factors, which would provide further support for selection of appropriate remedial alternatives.</p> <p>Based upon Figure 10 in the Letter Report (listing the number of levee failures over a 48-year period), it is possible to calculate the length-normalized levee slide probability per reach. These values are quite different in the various levee reaches. This information should be combined with the risk-adjusted potential damages of each reach to create a ranking table for each reach that could provide a mechanism to allocate limited repair dollars over time. In addition, this ranking table should also be tied to the construction schedule in order to develop optimum construction sequencing. By allocating the resources to those reaches with the highest risk of catastrophic failure and concomitant damages first, the overall project benefits will accrue more quickly.</p>
<b>Significance – Medium:</b>
The Letter Report requires further information on the levee reaches to determine if resources have been appropriately allocated.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded as follows:</p> <ol style="list-style-type: none"> <li>1. Expand the discussion of slide failure history and geotechnical factors that influence slide failure propensity.</li> <li>2. Determine the optimum allocation of repair dollars/resources by using the failure history data in combination with the damage assessment. Including a table ranking each levee reach in this manner would be useful.</li> </ol>
<b>USACE Draft Evaluator Response (#6)</b>
<b>Final Panel Comment 6: CONCUR</b>
<ol style="list-style-type: none"> <li>1. <b>ADOPT in PART.</b> A section that encompasses geotechnical factors that may influence the slide failure propensity will be added to the final Letter Report for clarification purposes.</li> <li>2. <b>ADOPT in FUTURE.</b> The Letter Report outlines a Decision Matrix to be</li> </ol>

developed at such time that the project is approved and a recommendation is chosen. A “length normalized” slide probability is a good suggestion. The Decision Matrix will be developed during the Plans and Specs phase of this project.

**Comment 7:**

**More detail is needed to describe the causal relationship between levee embankment slope failure (slides) and risk of economic and environmental damage.**

**Basis for Comment:**

The discussions of inundation risk, slides, potential levee breach, and damage are not linked to show exactly how risk of one leads to risk of the others. Just how slides increase the risk of failure, how failure results in flooding, and how flooding results in damages has not been described. The report should walk through these relationships so that damage reduction benefit estimates may be confirmed. Assuming models were used, the inputs, outputs, and assumptions of the models should be included. Also, the damage levels associated with different probabilistic events should be presented.

The potential impacts of “levee failure and breach” (p. 17) are described as “catastrophic” (p. 17) and itemized by stating that this would be catastrophic to “health, safety, environmental, and economic viability of the protected cities, towns, villages, industry, transportation, and commercial enterprises.” These descriptions are very general and more specifics are needed. A thorough description of the numbers of cities, towns, and villages would be helpful. The value of the buildings and properties – even if provided in terms of ballpark estimates – should be included for each reach and/or Drainage and Levee District (D&LD) in a uniform fashion, or else an explanation provided for why each D&LD is described differently. The population, economic output, and number of jobs in each D&LD should also be estimated or provided. Economic and environmental resources in each D&LD should further be delineated by reach, and by the risk of levee embankment failure and flood event.

The lack of uniformity in providing these descriptions is demonstrated on p. 18 of the Letter Report, where the Wood River Levee district is described in terms of the types of industrial sectors that are protected, and the number of municipalities. There is no mention of the acres protected, the population, number of residences, or the property value. In the subsequent paragraphs describing the other levee reaches, most descriptions include the number of acres protected, one describes the number of residences, one estimate of property value is mentioned for one reach, and one mentions the employment in one two manufacturing facilities. The inconsistency in describing these reaches detracts from the importance of the resources placed at risk.

More supporting evidence is needed to show how slides could become “catastrophic to health, safety, environmental, and economic viability for the protected cities, towns, villages, industry, economies and commercial enterprises” and how “Rural and agricultural economies would be devastated.” It is plausible that inundation will cause damage to the communities located within the floodplain, but the specific risk of inundation, and the risk of additional damages and even catastrophe should be explained. The disruption of roadways is a source of potential damage that is mentioned (p. 19). If this is the primary source of the concern, then it should be more fully explained. In addition, inundation damage to specific cultural and historic resources is mentioned but not quantified. Although nearly one half of the text in the Economic Considerations section of the Letter Report is devoted to describing in detail the cultural resources at risk, there is little to no explanation of how they might be harmed, or of the specific probabilities of any potential damage.

Aside from concerns about how slides could result in damage, the assumptions for the benefit analysis are not clear in that they assume catastrophic failures will occur, yet the actual probability of full-blow failure appears low given none have occurred in 48 years. An explanation for this apparent inconsistency is needed.

**Significance – Medium:**

Without a detailed discussion of the causal relationship between levee embankment failures (slides) and flood damage, project justification is called into question.

**Recommendation(s) for Resolution:**

To resolve these concerns, the report would need to be expanded to include the following:

1. A statement about how the slides specifically relate to potential levee breaches and failures during flood events.
2. Descriptions of the probabilities (or range of probabilities) of anticipated failure or breach.
3. A description of the potential extent of inundation that would occur in the various reaches under different failure or breach scenarios.
4. A table that includes the protected acres, population, regional economic output, the number of firms and employment by sector, the value of property, and the cultural resources in each levee reach at risk.
5. An explanation of the reasons that failure or breaches might occur in the future, though none have occurred over the past 48 years.

**USACE Draft Evaluator Response (#7)**

**Final Panel Comment 7: CONCUR**

1. **Adopt.** Relation of slides to breaches and failures will be included in report.
2. **Adopt.** Probabilities of failure will be presented in tabular form in report.
3. **Adopt.** Extent of inundation will be discussed in report.
4. **Adopt.** Table will be included in report depicting protected areas, population, value of property as well as business firms and employment totals.
5. **Adopt.** Probability of future failure or breaches will be discussed in report.

**Comment 8:**

**The benefit cost analysis contains inconsistent and potentially conflicting information about damages, potential for damage reduction, and benefit estimation.**

**Basis for Comment:**

The Letter Report states that benefit computations were based on extensive data collected for PIRs [presumably, Project Implementation Reports] representing all Drainage and Levee Districts (D&LDs) that make up the Alton to Gale project area during the 2008 floods (p. 28). Real estate surveys and engineering analysis of future with and without project conditions combined with economic analysis from Computerized Agricultural Crop Flood Damage Assessment System (CACFDAS) model generated the damages. However, this information is not well supported, and at times conflicts with information presented in the Environmental Assessment (EA). Detailed information on expected flood damages without the project, and with the project, presented by D&LD or by reach is the appropriate way to describe benefits of flood reduction.

In the Letter Report, the average annual benefit is approximately \$61.7 million, for a total discounted present value of over \$3 billion covering over the lifetime of the project. The EA economic analysis states, “the loss of the Wood River Levee System would not only have notable economic impacts but in the traditional measurement of losses (current estimate \$1.5 billion)...”. There is no citation for the \$1.5 billion total, and this number does not match the benefits for the Wood River system identified in the Letter Report (which reports \$15.15 million annually, or \$757 million discounted, or \$2.76 billion undiscounted). An explanation for this apparent discrepancy is needed.

Similarly, the property damage for the Metro East Sanitary District is reported in the EA to exceed \$1 billion without explanation. This figure does not match up with the benefit values presented in the Letter Report. Further, the environmental damage is reported, but only in terms of clean up costs and just for the one levee district. Values should state the derivation of the dollar figure, and be reported consistently across all levee districts, if possible.

In the EA, the magnitude of loss is stated as “in excess of \$1 Billion” for the Wood River Levee, yet there is no explanation of the source of this estimate. Overall, there is an emphasis on describing the potentially affected acreage and cultural resources, but the economic resources are not described in sufficient detail to justify this \$1 billion cost estimate. If the reason for the lack of detail in explaining the source of potential flood damages is that this project is to repair a deficiency in construction (and is essentially a least-cost analysis, as was used in the original 1986 Letter Report) then the reasoning should be given. However, if the results of an economic benefit analysis are to be used to explain the selection of the alternative, a more detailed explanation is needed.

**Significance: Medium**

Due to the lack of detail in the benefit analysis, project justification is called into question.

**Recommendation(s) for Resolution:**

To resolve these concerns, the report would need to be expanded as follows:

1. At a minimum, the amount of expected damages reduced should be presented by type, such as
  - a) crop damages,
  - b) residential property damages,
  - c) roadways, transportation, and other public facility damage,
  - d) commercial and industrial damage, and
  - e) environmental or natural resource damages.
  
2. Each type of damage (see recommendation #1 above) could also be reported by
  - a) the inundation reduction benefit
  - b) the intensification benefit, and
  - c) the location benefitwhere any of these were estimated. Section 6.4, 6.5, and 6.6 suggest that these were estimated but no reference or explanation is provided.
  
3. Typically the CACFDAS provides estimates for potential damages to crops as a result of flooding. Inclusion of both input details of this modeling and output details would be appropriate.
  
4. Additional damage estimates from the PIRs should be either described or at a minimum referenced specifically.
  
5. If a probabilistic approach to flood protection has been conducted, then risks of exceedance should be reported consistent with USACE planning regulations such as ER 1105-2-101.

**USACE Draft Evaluator Response (#8)****Final Panel Comment 8: CONCUR**

1. **Adopt.** Expected damage breakouts will be provided in report.
2. **Adopt in part.** Relevant benefit categories will be estimated and discussed.
3. **Adopt.** Crop damage data (input and output) will be presented in report.
4. **Adopt.** Damage estimates from MVS PIRs will be both described and referenced. Relevant PIRs will be added in an Appendix.
5. **Adopt.** Risks of exceedance and consistency with ER 1105-2-101 will be explained in report.

<b>Comment 9:</b>
<b>The reason for eliminating the 1986 least-cost analysis economic approach is not clear.</b>
<b>Basis for Comment:</b>
In the Letter Report, USACE used an established flood damage reduction economic evaluation methodology (including calculation of both benefits and costs) to support each of the four project alternatives, while in the 1986 Letter Report, a least-cost methodology was utilized. The Panel believes that the least-cost methodology is appropriate for the Letter Report and recommends that the USACE use it in the report revision. If the USACE determines that a full benefit to cost evaluation is required rather than a least-cost analysis, the Panel believes that the following factors must be considered and included in the final analysis: <ul style="list-style-type: none"> <li>• Benefits must be risk-adjusted to account for the actual probability of catastrophic failure;</li> <li>• Benefits accrued must be consistent with the proposed construction schedule.</li> </ul>
<b>Significance – Medium:</b>
The economic analysis discussion needs a detailed explanation on why a least-cost analysis was not completed as part of the Letter Report.
<b>Recommendation(s) for Resolution:</b>
To resolve these concerns, the report would need to be expanded as follows: <ol style="list-style-type: none"> <li>1. A revised economic analysis that uses a least-cost methodology similar to what was employed for the 1986 Letter Report should be added, or the USACE should revise the economic evaluation to incorporate risk-adjusted benefits.</li> </ol>
<b>USACE Draft Evaluator Response (#9)</b>
<b>Final Panel Comment 9: CONCUR</b>
<ol style="list-style-type: none"> <li>1. <b>Adopt.</b> Inclusion of risk-adjusted benefits will be described in report. Non-use of 1986 least-cost analysis economic approach will be clarified.</li> </ol>

<b>Comment 10:</b>
<b>The justification used to eliminate alternatives from further consideration is not described in sufficient detail to support the selection of the Recommended Plan.</b>
<b>Basis for Comment:</b>
<p>While the Letter Report addresses the factors that need to be considered in the comparison of alternatives, the information is not presented in a manner that is easy for the Panel to follow. The plan formulation discussion is abbreviated and does not address pre-screening of project alternatives in detail. It is not clear how the USACE conducted its pre-screening of alternatives to limit the recommended repair zones to only 24.5 miles out of 200 miles of existing levee. Also, there is very limited discussion on the Recommended Plan from the 1986 Letter Report, which recommended repairing levee reaches as slides occurred. This alternative is dismissed in the initial alternative screening in the Letter Report.</p> <p>Furthermore, though it appears that Alternative 4 presents significant advantages over the other alternatives, it would be most helpful if the Letter Report contained a section that summarized the key factors that were considered in selecting the Recommended Plan. The section should identify the key factors (such as environmental impacts, construction costs, construction schedule, real estate costs, impact on flood protection, factors of safety, etc.). The key factors for each alternative could be presented in a tabular format that either lists actual values (dollars, months, safety factors, etc.) or a relative qualitative term (high, medium, low) for those factors that are difficult to quantify. The table could be arranged in column format from most to least advantageous alternative, which would further facilitate the comparison for the reader.</p>

<b>Significance – Medium:</b>
The comparison of alternatives and the evaluation process would be enhanced by a section in the Letter Report that identifies and compares the key factors that were used in selecting the Recommended Plan (Alternative 4).
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. A brief section that explains the alternative pre-screening process.</li> <li>2. A discussion regarding the selected alternative from the 1986 Letter Report and why that was not an alternative considered for the Letter Report.</li> <li>3. A brief section that identifies and/or describes of the key factors that were used in selecting the Recommended Plan.</li> <li>4. A presentation of the key factors for each alternative that facilitates a comparison, such as a table.</li> </ol>

## USACE Draft Evaluator Response (#10)

### Final Panel Comment 10: CONCUR

1. **ADOPT.** Within the letter report, it states that only alternatives with a factor of safety greater or equal to 1.4 were considered as viable options based on engineering requirements. A brief description of the pre-screening process will be added to the report.
2. **ADOPT.** A discussion will be added explaining why the selected alternative from the 1986 Letter Report was not considered as an alternative for the revised letter report. In the 1986 recommendation, it was recommended that lime stabilization be utilized to repair the existing slides. In the current version of the letter report, we are only addressing long term solutions to address the slope stability issue that exists in portions on the Alton to Gale Levee system. Repairing slides as they occur does not provide a long term solution and leaves the system at risk once new slides occur.
3. **ADOPT IN PART.** Under the recommended plan, it will be noted that this alternative was selected based on the economic analysis and value engineering study.
4. **ADOPT.** All four alternatives presented in the report satisfy the requirement to provide a long term solution to the slope stability issue within the Alton to Gale Levee system. The economic analysis is the key factor for determining the recommended plan. A table will be added to the report with the factors that resulted in option 4 as the selected alternative.

<b>Comment 11:</b>
<b>Further information is required to support the conclusion that the approach of repairing levee slides as they occur is no longer an option.</b>
<b>Basis for Comment:</b>
<p>The Letter Report considers only briefly, in Section 4.4 “Without Project” (Existing) Conditions, the current practice of repairing only the slide areas as slides occur. The Letter Report states that this practice “does not address the vulnerability of continuous and impending levee slide failures prior to and during flood events.” A thorough analysis describing why the current practice of repairing individual slides does not meet this project goal is not included in the report(s).</p> <p>Since the average annual cost of repairing the levees as slides occur is less than the average annual cost to repair them using the recommended plan, the report needs to clearly explain why that approach is no longer a viable option.</p> <p>Appendix 6 (EA), as well as Sections 2.3.1.5 and Section 4.4 in the Letter Report, indicate that individual repairs are sometimes not undertaken for years (p. EA-7), leaving the structures vulnerable when and if catastrophic flooding occurs. A stronger characterization of the negative environmental effects of repeated or almost continuous construction on the levees versus a one-time, larger systemic repair project would be very helpful in supporting the recommended plan.</p> <p>The EA and Letter Report do not describe fully the risk of continuing to repair the levee slides one at a time, and the lengthy process for funding such repairs is not adequately discussed. It is the Panel’s belief that the risk of waiting years to repair slides one at a time in a post-Katrina environment is socially unacceptable. Given the age of the levee system, and the nature of the clays used to construct the levees, failures can occur at anytime, anywhere along the length of the levee, which renders the levee system constantly vulnerable.</p>
<b>Significance – Medium:</b>
The justification for discontinuing levee repairs as they occur lacks sufficient detail.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. Additional language describing environmental effects associated with repetitive and/or continuous construction in various reaches of the river versus the environmental effects of performing one large repair project (i.e., the recommended plan).</li> <li>2. Additional language describing the social environment post-Katrina, the growing public awareness of flood consequences, and the federal government commitment to levee safety (i.e., far less willingness to accept potential loss of life and devastating loss of property due to levee breaches).</li> <li>3. Further justification of the average annual cost of individual levee repairs versus the cost of the recommended plan.</li> </ol>

## USACE Draft Evaluator Response (#11)

### Final Panel Comment 9: CONCUR

1. **Adopt.** Will expand on current language in the EA to explain environmental effects associated with repetitive and/or continuous construction in various reaches of the river versus the environmental effects of performing one large repair project.
2. **Adopt in part.** Awareness of flood consequences will be discussed and included in report (see Comment #5, Recommendation 3).
3. **Adopt.** Further explanation will be included in report comparing economic value of levee repairs versus recommended plan.

**Comment 12:**

**Key assumptions used in the risk analysis need to be clarified.**

**Basis for Comment:**

The Panel agrees that project funding is one of the key assumptions that influence the risk analysis for the project. However, the Panel believes there are inconsistencies between the Letter Report, the Cost Estimate, and the Risk Analysis Report regarding funding in relation to future real estate and levee repair costs. The following issues are categorized by “Risk/Opportunity Events” shown in the detailed Risk Registers of Appendix 5.

- Project & Program Management (PPM) – The Studied Risk Register in Table 2 indicates that Stakeholder Funding Capability has “Significant” impact on project cost and schedule. Commensurate with the Letter Report, the levee districts will have a difficult time cost sharing and/or funding any portion of the project due to sunk Operation and Maintenance (O&M) costs and the lack of tax revenue income. Taken from the information given in the Letter Report and Appendix 5, it is the Panel’s opinion that PPM-2’s risk level is more than “moderate” to the cost and schedule of the project.
- Estimate and Schedule Risks – Paragraph 4.5.5 in the Letter Report states that existing slides will need to be repaired by the lime stabilization method. New Levee Slide Repair is listed in paragraph 6.2 of the Risk Analysis Report as a risk event that influences the project cost. Based on the impact funding has on the project, and the fact that slide repair is not included in the Alternative 4 cost estimate, it is the Panel’s opinion that New Levee Slide Repair should be included in Table 2, Studied Risk Register, and scrutinized as a possible “Significant” risk event that impacts the cost and schedule of the project.
- Lands and Damages (LD) Risks – Section 7 of the Letter Report states that real estate acquisition is not expected for the levee repairs. However, the levee districts would acquire any needed right-of-way (ROW) to complete deficiency corrections. The Detailed Risk Register in Appendix A of the Risk Analysis Report has real estate listed as a risk event. The cost estimate for Alternative 4 includes costs for real estate associated with lay-down areas during construction. Given the information in the Letter Report, appendices, and cost estimate, it is the Panel’s opinion that real estate will be a cost and should be categorized as “likely” in the risk analysis.
- Technical (TL) Risks – Given that New Levee Slide Repair is included in paragraph 6.2 of the Risk Analysis Report as a sensitive item to the cost contingency, the Panel believes the potential is there for lime/fly-ash injected under pressure to destabilize the slopes and cause new slides before chemical reaction is able to take place. The Panel believes this risk event would be a significant impact to the cost and should be included in the Studied Risk Register in Table 2.
- Construction (CON) Risks – Given that CON-3 Material Availability and Delivery is categorized as “critical,” the Panel believes there is a correlation with Estimate and Schedule (EST) risk event EST-2 Material Quantity. EST-2 should take into consideration the uncertainty in the lime/fly-ash percentages in the mix design for the slurry thereby affecting the quantity and reflected in the categorization of the impact in the Risk Analysis.

If the preceding issues are investigated and result in a higher project contingency, thereby increasing the cost and prolonging the schedule, this comment could have higher significance.

**Significance – Medium:**

The Risk Analysis Report lacks detail to tie together information in the Letter Report, Appendices, and Cost Estimate.

**Recommendation(s) for Resolution:**

To resolve these concerns, the report would need to be expanded to include the following:

1. The Risk Analysis Report matrix table provided in the Risk Analysis Excel spreadsheet illustrating how the “Risk Level” is determined. Include more information as to why lack of funding from the districts is deemed “significant” as opposed to “critical” regarding the impact of the project.
2. New Levee Slide Repair in the Risk Register as a risk event, with concerns and discussions that support the impact on the project.
3. A change in the categorization of LD-1 and LD-2 as “likely” in the cost and schedule risk analysis for the project.
4. TL-2 in the risk analysis to address lime/fly-ash injection under pressure and its potential effects to the existing soils.
5. Categorization of EST-2 as “significant” and further evaluation of the soil conditions and mix design to refine the estimated quantities.

**USACE Draft Evaluator Response (#12)**

**Final Panel Comment 12: DO NOT CONCUR**

**The key assumptions in the risk analysis have been discussed in Section 5 of the Risk Analysis Report with further discussion occurring in the cost and schedule risk models.**

1. **NOT ADOPT.** The Risk Analysis Report is a standard USACE Cost DX report with a standard format that does not include the matrix table in the Risk Analysis Excel Spreadsheet. In addition, the Risk Analysis Report is meant to convey the assumptions, contingency findings, and the mitigation measures found as a result of the Cost and Schedule Risk Analysis. The report is not meant to be a guide to how to perform a risk analysis. Information for the categorization of lack of funding is included in the risk model and risk register under the “Concerns” and “PDT Discussions” columns. In addition, lack of funding from the districts risk is deemed significant instead of critical because the PDT feels that the districts with longer repair sections and higher construction costs have increased risk over districts with shorter repair sections and lower construction costs, which reduces the risk to significant.
2. **ADRESSED in PAST.** This risk was added as a result of ATR comments and has

already been included in the risk outcome. Table 2 and Appendix A of the risk report will be updated to show the added risk.

3. **NOT ADOPT.** The real estate accounts for 0.5% of the project cost. As such, it is a low impact level activity and is not studied because of the minimal impact of the activity on the cost or the schedule duration. In addition, the PDT feels that LD-1 and LD-2 have an “unlikely” likelihood of occurrence.
4. **NOT ADOPT.** The potential for the slurry to destabilize the slopes is more of a geotechnical comment, not a cost comment. As such, the issue of slope destabilization will be addressed in the plans and specs phase of the project. Furthermore, the risk of New Levee Slide Repair has already been included in the risk model and cannot be included a second time because it would be a duplicate risk event and would skew the resulting contingency amounts.
5. **NOT ADOPT.** The percentages in the slurry mix design are based on 15 years experience in the Memphis district from injecting the slurry into similar clays. As such, the PDT does not feel that EST-2 is a significant impact to the project cost. The word "greatly" will be removed from the discussion of EST-2.

<b>Comment 13:</b>
<b>A screening process is needed to establish repair priorities for the individual project levee reaches.</b>
<b>Basis for Comment:</b>
<p>If the normalized slide probability is calculated for each levee reach, certain reaches (e.g., Degognia, Fort Chartres, Grand Tower, and Preston) appear to have a much higher chance of slide development. In the 1986 Letter Report, the recommendation was to repair levee reaches with lower chance of slide development on an individual basis, rather than in aggregate or as part of a permanent repair program. The Letter Report identifies the need for such an analysis in Section 8.1.1, which describes the criteria that will be used to determine a sequence of work, and the phased funding expenditures (Section 8.1.2).</p> <p>Some reaches that have a lower probability of failure may have higher potential for damage in the event of a failure. The current funding plan is to provide funding on a straight-line basis at \$10 million/year until 2019. The slide distribution on selected reaches from year to year will affect obligated dollars, and the Panel could not determine if new slides were accounted for in the cost estimate or if these slides were part of the project cost. If a more comprehensive screening were performed on the individual levee reaches, potential damages and funding priorities may be evaluated.</p>
<b>Significance – Low:</b>
Normalized information on the risks of slide, risks of breach, and location of potential damages will allow for prioritization of resource allocation and/or scheduling of project expenditures, and should have been incorporated into the estimation of benefits by reach.
<b>Recommendation(s) for Resolution:</b>
<p>To resolve these concerns, the report would need to be expanded to include the following:</p> <ol style="list-style-type: none"> <li>1. A normalized probability of slide per reach.</li> <li>2. An analysis of how damage per reach, paired with slide/breach probability per reach, could be used to screen and prioritize project scheduling and funding allocation.</li> <li>3. A method for incorporation of new slide information into the screening approach described in recommendation #2 (above).</li> </ol>
<b>USACE Draft Evaluator Response (#13)</b>
<p><b>Final Panel Comment 13: CONCUR</b></p> <ol style="list-style-type: none"> <li>1. <b>ADOPT.</b> The screening process used will be the Decision Matrix developed during the Plans and Specs phase of this project. It will incorporate a normalized slide probability per reach.</li> <li>2. <b>NOT ADOPT.</b> The Decision Matrix will be used to determine the priority and schedule of repairs. There are several other factors that could be considered in the Matrix. (For example, level of protection, what is being protected, amount of budget vs. cost of repairs and input from Levee District.)</li> <li>3. <b>NOT ADOPT.</b> Any slides that occur between now and the time for construction</li> </ol>

would not have any effect on our Decision Matrix. The Decision Matrix will include other factors that take into account the historical slide severity and how the slides affected the level of protection.

<b>Comment 14:</b>
<b>Some environmental consequences are not fully described, such as contradictory impacts to floodplain habitats, impacts resulting from repetitive repairs, and impacts resulting from the no-action alternative.</b>
<b>Basis for Comment:</b>
<p>Portions of Appendix 6 (EA) have conflicting statements or provide contradictory information with respect to environmental consequences. Specifically, the following items were noted:</p> <ul style="list-style-type: none"> <li>• Statements are made in the Letter Report that flooding of existing national forests and wetlands would result in “pristine wetlands and bottomland hardwoods destroyed” (p. 1) and that impacts would be “devastating” (p. 7). Yet, prior to construction of the levee system, these areas were subject to the natural flood cycle of the Mississippi River. A later statement in the EA indicates that rehydration of the same resources would yield positive impacts (p. EA-27).</li> <li>• Adequate information regarding potentially occurring listed species has been included in the EA. However, correspondence in the EA (an email between the USACE and the U.S. Fish and Wildlife Service [USFWS]) does not make clear whether the USFWS is satisfied with how listed species have been addressed. According to the USFWS email, listed species habitat has been discovered near the levees during previous slide repairs.</li> <li>• Impacts to recreation are discussed only with respect to potential environmental consequences (p. EA-34), but recreation resources themselves are not listed or discussed.</li> <li>• Impacts from the no-action alternative are identified and discussed in general terms. However, these effects are not put in the context of a post-Katrina world. There is an opportunity in Section 3.9 of the EA (Socioeconomic Issues) to fully describe the consequences of a complete levee failure during a period of extremely high flow.</li> <li>• Impacts from repeated activities (repairing the levee slides one at a time as has been done in the past, which is part of the no-action alternative) are not discussed. Repetitive activities resulting from temporary or continuous repair operations have adverse effects on water quality, wildlife disturbance, noise and other resources.</li> </ul>
<b>Significance – Low:</b>
Additional language can be added to the EA to clarify or strengthen certain conclusions regarding environmental consequences.

**Recommendation(s) for Resolution:**

To resolve these concerns, the report would need to be expanded to include the following:

1. A statement regarding the consequences of flooding habitats that have been protected by the levees for decades, and how they would therefore be adversely affected by restoration of the natural flood cycle.
2. A brief discussion clarifying or updating agency coordination with respect to protected species.
3. A brief discussion of the types of recreation that may be potentially affected.
4. A discussion of the full effects of a levee breach during a flood, including reference to a new national public awareness of flood consequences in a post-Katrina environment.
5. Expansion of the explanation for discontinuing the practice of repairing individual levee slides one at a time, and a discussion of the adverse effects of repetitive or continuous maintenance on water quality, air quality, aesthetics, wildlife, and other potentially affected resources.

**USACE Draft Evaluator Response (#14)****Final Panel Comment 14: CONCUR**

Will clear up inconsistencies relative to environmental impacts between Letter Report and EA. As noted below, will expand on the no action alternative and non-recommended alternatives regarding general levee maintenance and repair. Although there are parts of the EA that generally address the economic and environmental impacts of levee breaches, the primary focus of this EA is a comparison of the environmental impacts of the alternative methods on “how” to repair the levees. This needs to be better clarified in the EA.

1. **ADOPT.** Language in the EA will be modified/deleted in reference to adverse affects of a levee breach. Analysis of the restoration of the “natural flood cycle” throughout this part of the Mississippi River floodplain is not within the scope of this EA. The scope of this project is focused on evaluating environmental impacts of the construction alternatives to repairing design deficient levee sections, not to quantify the environmental impacts of a major levee breach. Although the indirect effects of unrepaired levees and potential breaches during high water events could be substantial, it is beyond the scope of this EA to quantify those effects. Although there are parts of the EA that generally address the impacts of levee breaches, the primary focus of this EA is a comparison of the environmental impacts of alternative methods on “how” to repair the levees.
2. **ADOPT.** Recent coordination document can be provided.
3. **ADOPT.** Will add additional language to EA regarding recreation.
4. **ADOPT.** Language in the EA will be modified/deleted in reference to adverse

affects of a levee breach. As above, analysis of the “full effects of a levee breach” is beyond the scope of this EA. The scope of this project is focused on evaluating environmental impacts of the construction alternatives to repairing design deficient levee sections, not to quantify the environmental impacts of a levee breach. Although the indirect effects of unrepaired levees and potential breached during high water events could be substantial, it is beyond the scope of this EA to quantify those effects.

5. **ADOPT.** Can expand on the following language if needed. In most levee districts, because of cost, most slides go unrepaired, so there are no adverse effects from repetitive or continuous maintenance. An exception is when levee slides are repaired under the PL84-99 authority. PL 84-99 authorizes repair of flood damage and is 100% federally funded. There is some discussion in the EA under the non-recommended alternatives that covers this - any adverse effects are short-term/temporary. To this point, under PL84-99, the repairs are performed by excavating loose material, placing excavated soils in the easement, mixing hydrated lime with the soils, and replacing - similar to Alternative 2 in the current EA.