Revised Final Independent Peer Review Report for U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems

Prepared by

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Prepared for
U.S. Army Corps of Engineers
Institute for Water Resources

Contract No. W911NF-07-D-0001
Task Control Number: 08200

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REVISED FINAL

INDEPENDENT PEER REVIEW REPORT

for

U.S. Army Corps of Engineers
Vegetation Policy for Local Flood Damage Reduction Systems

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The views, opinions, and/or findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE) Final Draft White Paper, Treatment of Vegetation within Local Flood-Damage-Reduction-Systems, is an internal USACE assessment of current policy and practice with regard to vegetation and flood protection systems. It is USACE's current policy to keep local flood protection systems free of vegetation because empirical experience has demonstrated that vegetation can impact reliability, inhibit inspections and the ability to perform a flood fight, and interfere with maintenance. Incidental vegetative growth and subsequent presence of endangered species may prohibit maintenance necessary to maintain integrity. However, opposing opinions also challenge the "science" behind the policy and guidance.

For these reasons, USACE conducted an independent and unbiased review of its policy for landscaping and vegetative maintenance of Federal Flood Protection Projects. Battelle, as a non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the independent peer review (IPR) of the U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems ("USACE Vegetation Policy"). The IPR was conducted following guidance described in the Department of the Army, USACE, guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008, CECW-CP Memorandum dated March 30, 2007, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

Battelle initially identified approximately 12 potential peer reviewers, confirmed their availability, evaluated their technical expertise, and inquired about potential conflicts of interest. Of those initially contacted, five independent peer review candidates confirmed their interest and availability, and seven candidates declined either due to the schedule and anticipated level of effort, disclosed conflicts of interest, or because they did not possess the technical expertise being sought. The final three peer reviewers selected for the IPR panel were from academe or were independent engineering consultants. Corresponding to the technical content of the USACE Vegetation Policy, the areas of technical expertise of the selected peer reviewers included: civil engineering, interdisciplinary engineering with civil works/vegetation assessment experience, and landscape architecture.

The IPR panel members were provided an electronic version of the documents for the USACE Vegetation Policy on August 10, 2008, along with a charge that solicited their comments on specific sections of the documents that were to be reviewed. Peer reviewers were instructed to submit responses to the charge questions no later than September 2, 2008. More than 500 individual comments were received from the IPR panel in response to the charge questions. There was no communication between the IPR panel and the authors of the Vegetation Policy documents during the peer review process.

Following the individual reviews of the documents for the USACE Vegetation Policy by the IPR panel members, a consensus discussion was conducted to review key technical comments, discuss charge questions in which there were conflicting responses, and reach consensus on the final peer review comments ("final comments") to be provided to the USACE. The final comments were documented according to a five-part format that included: (1) nature of the comment, (2) basis for the comment, (3) significance of the comment (high, medium, and low), (4) comment cross referencing if related to other comments, and (5) recommendations on how to resolve the comment. Overall, 10 final IPR comments were identified and documented. Of the final 10 comments, seven were identified as having high significance (including one, comment 7, that was designated as "High/Medium"), three were identified as having medium significance, and no comments were identified as having a low level of significance. Table ES-1 summarizes the final comments by level of significance. Details on each final comment are contained in Appendix A of this report.

The Final Report for the Independent Peer Review (IPR) of the U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems, which included the 10 final comments, was submitted to the USACE on October 14, 2008. After the report was submitted, a project team discussion conference call was held with the USACE, Battelle, and members of the IPR panel to discuss general questions from the USACE on the peer review process and address USACE requests for clarifying information on the 10 final comments. Following the conference call, the USACE submitted their official written questions and comments on the final comments to Battelle, who provided them to the IPR panel with detailed guidance for preparing and submitting their responses. A Revised Final Report (this document) incorporating a description and summary of the comment and response activities that took place after submission of the first version of the final IPR report, was prepared and submitted to USACE on December 9, 2008. Detailed information on the final IPR comments, USACE responses, and final IPR panel feedback is provided in Appendix A. Appendix C provides Battelle's response to USACE requests for clarification on the peer review process itself. The results of this revised final IPR report will be taken into consideration in preparation of the final USACE Vegetation Policy.

Table ES-1. Overview of 10 Final Comments Identified by the Vegetation Policy IPR Panel.

Significance – High	
1	There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).
2	One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.
3	The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.
4	The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.
5	The policy documents should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.
6	The FDRS inspector must have access to the previous inspection reports and must reference the previous inspections and actions taken between routine inspections. In addition, a national database should be established to share case histories on the performance of levees.
7	Given the estimated timeframe of 1 to 5 years to complete the research outlined in Attachment 6: Effect of Vegetation on Levees, the projected cost of $350K to $2M seems unrealistic.
Significance – Medium	
8	The literature review in Attachment 7 should be more comprehensive and organized by both design and maintenance topics.
9	The method for quantifying risk should be more clearly and specifically defined within the variance permit process.
10	While the definitions for a reliable corridor of access, vegetation-free zone, and vegetation-management zone are clearly stated, the metrics are questionable relative to type of inspection equipment, type of FDRS-pertinent hydrologic/hydraulic data, and overall metrics of adjacent zones.
Significance – Low	
None.	

1. INTRODUCTION

1.1 Background of Report Reviewed

The U.S. Army Corps of Engineers (USACE) Final Draft White Paper, Treatment of Vegetation within Local Flood-Damage-Reduction-Systems, is an internal USACE assessment of current policy and practice with regard to vegetation and flood protection systems. It is USACE's current policy to keep local flood protection systems free of vegetation because empirical experience has demonstrated that vegetation can impact reliability, inhibit inspections and the ability to perform a flood fight, and interfere with maintenance. Incidental vegetative growth and subsequent presence of endangered species may prohibit maintenance necessary to maintain integrity. However, opposing opinions also challenge the "science" behind the policy and guidance.

For these reasons, USACE conducted an independent and unbiased review of its policy for landscaping and vegetative maintenance of Federal Flood Protection Projects. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific analyses. Battelle, as a non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the independent peer review (IPR) of the U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems ("USACE Vegetation Policy").

The IPR focused on USACE policy and technical guidance for landscaping and vegetation management for Flood Protection Projects, as well as proposed research to resolve gaps in the science and engineering supporting the policy and guidance. The review also included input on whether the policy is practicable and based on reasonable assumptions, with a specific emphasis on the application of this policy to local flood protection systems owned and operated by sponsors and non-Federal flood protections systems within the Rehabilitation and Inspection Program. Furthermore, the IPR followed the procedures described in the Department of the Army, USACE, guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008, CECW-CP Memorandum dated March 30, 2007, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* released December 16, 2004.

This revised final IPR report describes the IPR process, summarizes final comments of the IPR panel, and describes the panel members and their selection, which were included in the final report submitted on October 14, plus additional information on activities that took place after submission of the final report. The additional information includes a summary of the process for responding to the USACE clarifying questions and comments regarding the final IPR report, including final comments, and responses to the clarifying questions and comments. Detailed information on the final IPR comments, USACE responses, and final IPR panel feedback is provided in Appendix A. Appendix C provides Battelle's response to USACE requests for clarification on the peer review process itself. The results of this revised final IPR report will be taken into consideration in preparation of the final USACE Vegetation Policy.

1.2 Purpose of Independent Peer Review

The purpose of the IPR, in general, is to strengthen USACE's quality control processes for the development of decision documents in support of its Civil Works program. Independent, objective peer review is regarded as a critical element in ensuring the reliability of scientific and engineering analyses.

To help ensure that USACE documents are supported by the best scientific and technical information, a peer review process has been implemented by USACE that utilizes IPR to complement the Internal Technical Review (ITR), as described in the Department of the Army, U.S. Army Corps of Engineers, guidance *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008; and CECW-CP Memorandum dated March 30, 2007. In this case, the IPR of the USACE Vegetation Policy was conducted and managed using contract support from an independent 501(c)(3) science and technology organization (Battelle Memorial Institute; hereafter Battelle) to ensure independent objectivity, along with a high degree of flexibility and responsiveness, which was essential for USACE to meet deadlines.

2. METHODS

This section describes the methodology followed in selecting independent peer reviewers, and in planning and conducting the IPR. The IPR was conducted following procedures described in USACE's guidance cited above (Section 1.2 of this report) and in accordance with the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. Supplemental guidance on evaluation for conflicts of interest used the National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports*, dated May 12, 2003.[a]

2.1 Planning and Schedule

Table 1 defines the schedule followed in execution of the IPR. Note that the schedule presented below includes significant delays in Tasks 6 through 8 due to the impact of Hurricanes Gustav and Ike on panel members.

[a] USACE comment GQ1 references this section. See Appendix C for detailed response.

Table 1. Schedule.

Task	Action	Due Date (2008)
Task 1	Submit draft Work Plan Submit final Work Plan	11 July 23 July
Task 2	Recruit and collect information on potential peer reviewers; prepare summary information	23 July
Task 3	Submit draft charge Submit final charge USACE approves final charge	16 July 9 August 13 August
Task 4	Submit list of (3) selected peer reviewers and selection criteria Complete subcontracts for peer reviewers	15 July 30 July
Task 5	Review documents and final charge sent to independent peer reviewers USACE briefing to peer reviewers and Contractor kick-off call Independent peer reviewers complete their review	30 July 11 August 15 September
Task 6	Convene consensus teleconference	16 September
Task 7	Independent peer reviewers prepare final comments	2 October
Task 8	Submit final peer review report, including final comments	14 October
Task 9	Project Team Discussion	21 October
Task 10	Submit revised final peer review report, including responses to comments[b]	9 December

2.2 Identification and Selection of Independent Peer Reviewers

Battelle initially identified approximately 12 potential peer reviewers, confirmed their availability, evaluated their technical expertise, and inquired about potential conflicts of interest. Of those initially contacted, five independent peer review candidates confirmed their interest and availability, and seven candidates declined either due to the schedule and anticipated level of effort, disclosed conflicts of interest, or because they did not possess the technical expertise being sought. The reviewers selected were from academe or were independent engineering consultants. Corresponding to the technical content of the Work Plan for the USACE Vegetation Policy, the areas of technical expertise of the selected peer reviewers included: civil engineering, interdisciplinary engineering with civil works/vegetation assessment experience, and landscape architecture.

The credentials of the peer reviewers were evaluated according to the overall scope of the USACE Vegetation Policy, focusing on three key areas:

[b] Task 10 in Table 1 was added to the schedule following submission of the final Work Plan.

1) Civil Engineering – a professional engineer with demonstrated experience in the design, construction, and operations and maintenance of flood control systems with a special emphasis on the earthwork structures such as dams, levees, foundations systems, and sub-drainage systems.
2) Interdisciplinary Engineering – a professional (civil) engineer preferred, experienced in reliability analysis of public works infrastructure with a preference for experience with assessing impacts of vegetation and animals on earthworks, floodwalls, and foundation drainage systems.
3) Landscape Architecture – a professional landscape architect (preferred), experienced in the design and maintenance of landscaping integrated into flood control structures with a special emphasis on understanding of landscaping impacts on infrastructure, OR a Physical or Environmental Scientist or related discipline, with some related certification preferred, experienced understanding the integration and maintenance of landscaping within flood control infrastructure.

The peer reviewers were screened for the following *potential* exclusion criteria or conflicts of interest:

Exclusion Criteria

- Involvement in developing or contributing to the development of USACE guidance and policy related to vegetation on flood control systems
- Current USACE employee
- Currently conducting research for the USACE or a levee sponsor, submitted a proposal to the USACE or a levee sponsor, or anticipating submitting a proposal to the USACE or a levee sponsor to conduct research on the effects of vegetation on levees
- Representing the USACE or other clients in an advocacy position for or against the subject policy (Does not include participating in scientific discourse about subject policy)
- Any publicly documented statement made by the reviewer or the reviewer's firm advocating for or against the subject policy
- A significant portion (i.e., greater than 50 percent) of personal or company revenues within the last three years came from USACE contracts.

Other Potential Conflicts of Interest

- Former USACE employee
- Repeatedly served as USACE technical reviewer
- Currently contracted with Sacramento Area Flood Control Agency or any other state flood control agency with a published policy related to vegetation and flood control

- Other USACE affiliation [Scientist employed by the USACE (except as described in NAS criteria, see EC 1105-2-4 Section 9d)][c].

In selecting final peer reviewers from the list of potential peer review candidates, an effort was made to select experts who best fit the criteria and factors described above. Based on these considerations, three peer reviewers were selected from the potential list (see Section 3 of this report for names and biographical information on the selected peer reviewers). Battelle established subcontracts with the peer reviewers indicating their willingness to participate and confirmed the absence of conflicts of interest (through a signed conflict of interest form).

2.3 Preparation of the Charge and Conduct of the Peer Review

A charge for peer review, which contained specific questions regarding the USACE Vegetation Policy, was developed to assist the IPR panel. The draft charge was prepared by Battelle with input from USACE and guidance provided in USACE's guidance *Peer Review of Decision Documents* (EC 1105-2-410) and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004. A draft charge was submitted to the USACE for consideration and evaluation. The USACE approved the charge questions as submitted and the charge was finalized. The charge was presented in comment-response table format, and was organized according to the order of the documents to be reviewed. The charge consisted of 203 questions/discussion points for the IPR panel to respond to, as shown in Appendix B of this report.

The peer reviewers were provided with electronic copies of the USACE Vegetation Policy documents for review, supporting reference materials, and the draft final charge. A full list of the USACE Vegetation Policy documents that were reviewed by the IPR panel (and supporting reference materials) is provided in the charge in Appendix B of this report. Peer reviewers were instructed to submit responses to the charge questions in the format provided. There was no communication between the IPR panel and the authors of the Vegetation Policy documents during the peer review process.

[c] Note: Battelle will be evaluating whether scientists in universities and consulting firms that are receiving USACE-funding have sufficient independence from USACE to be appropriate peer reviewers. See the OMB memo p. 18, "….when a scientist is awarded a government research grant through an investigator-initiated, peer-reviewed competition, there generally should be no question as to that scientist's ability to offer independent scientific advice to the agency on other projects. This contrasts, for example, to a situation in which a scientist has a consulting or contractual arrangement with the agency or office sponsoring a peer review. Likewise, when the agency and a researcher work together (e.g., through a cooperative agreement) to design or implement a study, there is less independence from the agency. Furthermore, if a scientist has repeatedly served as a reviewer for the same agency, some may question whether that scientist is sufficiently independent from the agency to be employed as a peer reviewer on agency-sponsored projects."

2.4 Review of Verbatim Comments

More than 500 verbatim (i.e., individual) comments in response to the charge questions were received from the individual IPR panel members. Battelle reviewed these comments to identify overall recurring themes, potential areas of conflict, and other impressions of the report. As a result of this review, Battelle developed a preliminary list of 43 overall comments and discussion points that emerged from the IPR panelists' verbatim comments, including 14 negative comments, 2 positive comments, and 27 comments that were conflicting among the various reviewers. Each reviewer's verbatim comments were shared with the full IPR panel.

2.5 Independent Peer Review Panel Consensus Discussion

Battelle facilitated a consensus discussion conference call with the IPR panel. The purpose of the consensus discussion was to allow the exchange of technical information among the panel experts, who were from diverse scientific backgrounds. This information exchange ensured that the IPR report represents the consensus of the panel and avoided isolated or conflicting information and analyses. The main goal of the consensus discussion was to review the overall comments and ascertain and confirm their importance to the IPR panel, remove points having a lack of consensus, identify and add any missing issues of high-level importance to the IPR panel, and finally, reach consensus on the final comments to be provided to USACE.

The panel discussion resulted in 10 overall consensus comments. Following the discussion, a summary memorandum documenting each consensus comment identified by the panel (and organized by level of significance) was prepared by Battelle and distributed to the IPR panel. The memorandum provided detailed guidance on the approach and format to be used in the development of the final IPR comments for the USACE Vegetation Policy.[d]

In addition to reaching consensus on the final comments to be provided to USACE, the IPR panel discussed responses to 27 specific charge questions where there appeared to be disagreement among the reviewers. The conflicting comments were resolved based on professional judgment of the panel members and the comment was either incorporated into the final comments, resulted in a new comment being developed, or determined to be a non-significant issue (i.e., either a true disagreement did not exist, or the issue was not important enough to include as a final comment).[e]

2.6 Preparation of Final Comments

The IPR panel used the 10 overall consensus comments as a basis for preparing the final comments. A memorandum was distributed to the IPR panel providing detailed guidance on the approach and format to be used in the development of the final comments. A summary of the directive is provided below:

[d] USACE comment GQ2 references this section. See Appendix C for detailed response.
[e] USACE comment GQ3 references this section. See Appendix C for detailed response.

- Lead Responsibility: A lead reviewer who was responsible for coordinating the development of the final comment and submitting it to Battelle was assigned for each consensus comment. Lead assignments were modified by Battelle at the direction of the IPR panel. To assist each lead in the development of the final comments, Battelle distributed individual verbatim comments in the comment-response table format, a summary detailing each consensus comment (in the memorandum), an example final comment following the five-part structure (described below), and a template for the preparation of the final comments.

- Directive to the Lead: Each lead was encouraged to communicate directly with other reviewers, as needed, to contribute to a particular consensus comment. If a significant comment was identified that was not covered by one of the original 10 overall consensus comments, the appropriate lead was instructed to draft a new consensus comment. If a consensus comment was related to another consensus comment, the lead was to cross reference them.

- Format for Final Comments: Each final comment was presented as part of a five-part structure, including:
    1. Nature of comment (i.e., succinct summary statement of concern)
    2. Basis for comment (i.e., details regarding the concern)
    3. Significance (high, medium, low; see description below)
    4. Comment cross referencing
    5. Recommendation (see description below).

- Criteria for Significance: The following were used as criteria for assigning a significance level to each final comment:
    - High Describes a fundamental problem with the project that could affect the recommendation or justification of the project
    - Medium Affects the completeness or understanding of the reports/project
    - Low Affects the technical quality of the reports but will not affect the recommendation of the project.

- Guidance for Developing the Recommendation: The recommendation was to include specific actions that the USACE should consider to resolve the comment (e.g., suggestions on how and where to incorporate data into the analysis, how and where to address insufficiencies, areas where additional documentation is needed).

As a result of this process, 10 final comments were prepared. Battelle reviewed and edited all final comments for clarity and adherence to the requested final comment template format. There was no communication between the IPR panel and the authors of the Vegetation Policy documents during the preparation of the final comments. The final IPR comments were assembled and are presented in Appendix A.

2.7 Clarifying Questions to the Final Independent Peer Review Report

The Final Report for the Independent Peer Review (IPR) of the U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems, which included the final IPR comments, was submitted to the USACE on October 14, 2008. After the report was submitted, a project team discussion conference call was held on October 21, 2008 with the USACE, Battelle, and members of the IPR panel to discuss general questions from the USACE on the peer review process and address USACE requests for clarifying information on the final IPR comments. Following the conference call, on November 19, 2008, the USACE submitted their official written questions and comments on the final IPR comments to Battelle, who provided them to the IPR panel with detailed guidance for preparing and submitting their responses. The official written questions and comments from the USACE on the final IPR comments were similar in nature to the questions and comments discussed during the project team conference call. Battelle forwarded the written USACE questions and comments to the IPR panel with guidance for preparing and submitting responses as follows:

1. Battelle provided a list of the final comments along with the corresponding official response from USACE, and identified the lead panel member that would be responsible for drafting a panel response to each (i.e., a "lead author").

2. The lead author for each comment was instructed to draft the response and circulate it to the other panel members for concurrence. (The panel members were instructed to not change in any way the original final comments. If clarification was needed, they were instructed to do so in their response to the USACE's comments.)

3. After concurrence, the lead author was instructed to finalize the IPR panel's response and send the response to Battelle for review. Battelle contacted the lead author if any further clarifications were necessary.

4. The lead authors were instructed to submit the final panel responses to Battelle no later than Tuesday, November 25, 2008.

A Revised Final Report (this document) incorporating description and summary of the comment and response activities that took place after submission of the first version of the final IPR report, was prepared and submitted to USACE on December 9, 2008. Final formatted comments, USACE official questions and comments in response to the final 10 IPR comments, and final IPR panel responses is provided in Appendix A. Appendix C provides Battelle's response to USACE requests for clarification on the peer review process itself. The results of this IPR report will be taken into consideration in preparation of the final USACE Vegetation Policy.

3. BIOGRAPHICAL INFORMATION ON INDEPENDENT PEER REVIEWERS

Potential peer review candidates were identified through Battelle's Peer Reviewer Database, targeted internet searches using key words (e.g., technical area, geographic region), search of websites of universities or other compiled expert sites, and through referrals from candidates who declined. A draft list of screened (for availability, technical background, conflict) potential reviewers was prepared by Battelle and provided to USACE. The final list of peer reviewers was determined by Battelle.

An overview of the credentials of the three reviewers selected for the IPR panel and their qualifications in relation to the technical evaluation criteria is presented in Table 2. More detailed biographical information regarding each candidate and his or her technical areas of expertise is presented following Table 2.

Table 2. USACE Vegetation Policy IPR Panel: Technical Criteria and Areas of Expertise.

Name	Affiliation	Primary Areas of Expertise				
		Civil Engineering	Design, construction, and O&M of earthwork structures and other flood control systems	Landscape Architecture	Plant/animal ecology and impacts on earthwork structures for flood control	Reliability analysis of public works infrastructure (earthwork structures) for flood control
	Totals →	**2**	**3**	**1**	**2**	**3**
B. Dan Marks	Marks Enterprises of NC, PLLC, Arden, North Carolina	**x**	**x**			**x**
Dana Nunez Brown	BROWN+DANOS landdesign, Inc., Baton Rouge, Louisiana		**x**	**x**	**x**	**x**
William Rahmeyer	Utah State University, Logan, Utah	**x**	**x**		**x**	**x**

B. Dan Marks, Ph.D., P.E.
Role: This reviewer was chosen primarily for his expertise in the area of civil engineering.
Affiliation: Marks Enterprises of NC, PLLC, Arden, North Carolina

Dr. Marks has been the owner, manager, and consultant for Marks Enterprises since 2000 and previously served as Chief Geotechnical Consultant/Vice President for another consulting firm from 1980 to 2000. His primary interests include geotechnical engineering and foundations evaluations, foundation engineering design and remediation, dams and water retention structures analyses and design, earth retaining structures analyses and design, landslide and slope stability analyses, and seepage analyses and groundwater flow evaluations. He has served as project engineer/senior geotechnical consultant for design of remedial repairs and new dams at approximately 150 sites in Tennessee, North Carolina, Virginia, South Carolina, Georgia, and Kentucky, and senior geotechnical consultant for design and construction of significant slope failure remediations using reinforced earth, gabion walls, tied-back wall systems and shot-rock buttresses. He is a member of the American Society of Civil Engineers. He has served as the Vice Chairman and Chairman of the Affiliate Member Advisory Committee of the Association of State Dam Safety Officials (ASDSO), was Chairman of Steering Committee for ASDSO/FEMA workshop on Plant and Animal Penetrations of Earthfilled Dams (1998-2000), and participates on other committees including the Subcommittee on Dam Safety Research, Interagency Committee on Dam Safety and the Transportation Research Board, National Academy of Sciences. Dr. Marks holds a Ph.D. in Civil Engineering from Oklahoma State University. He is a licensed Professional Engineer in the states of North Carolina, Tennessee, South Carolina, and Georgia.

Dana Nunez Brown, ASLA, AICP
Role: This reviewer was chosen primarily for her expertise in the area of landscape architecture.
Affiliation: BROWN+DANOS landdesign, Inc., Baton Rouge, Louisiana

Ms. Brown has 28 years of experience focused on environmental and community planning projects related to the use of geographic information systems (GIS) in planning and managing public spaces, infrastructure, and natural resources in several states. Ms. Brown has mapped and analyzed dam and flood control levee locations and modeled flood inundation in the event of dam or levee failures in order to site the facilities and manage land uses within potential flood hazard areas. Ms. Brown has served as Principal Investigator on several research grant projects regarding the design, implementation, and testing the efficacy of constructed wetlands in flood control and mitigating impacts of urban storm water runoff. She is a member of several professional societies including the American Society of Landscape Architects (ASLA), the U.S. Green Building Council, and the Urban Land Institute, and serves as President of the Louisiana Chapter of ASLA. She holds a B.L.A. degree from Louisiana State University and an M.L.A. degree from the Harvard Graduate School of Design and is a registered landscape architect, licensed in the states of Louisiana and California.

William Rahmeyer, Ph.D., P.E.
Role: This reviewer was chosen primarily for his expertise in interdisciplinary engineering and vegetation impacts on flood control systems.

Affiliation: Utah State University, Logan, Utah

Dr. Rahmeyer currently serves as the Department Head and a professor of the Civil and Environmental Engineering Department at Utah State University. He also has a joint appointment as the Senior Professor of the Hydraulics and Fluid Mechanics program of the Utah Water Research Laboratory at Utah State University. For more than 30 years, Dr. Rahmeyer has consulted for various engineering firms worldwide and has previously conducted investigations on the resistance and stability of vegetation in flood channels and the effect of shrubs and woody vegetation on flow resistance for the USACE. His primary areas of study include flood control, sediment control and outlet structures, plant ecosystems, riparian, woody vegetation, shrubs, submerged and un-submerged, compound channels, plant distortion, and numerical modeling. He is a member of several professional societies, and serves on numerous committees including the American Society of Engineering Educators and the American Society of Civil Engineers. Since 1986, he has been on the board of directors for the Utah Floodplain and Storm Water Management Association. Dr. Rahmeyer holds a Ph.D. in Civil Engineering (Fluid Mechanics and Hydraulics), from Colorado State University. He is a licensed Professional Engineer in the state of Colorado.

4. RESULTS – SUMMARY OF PEER REVIEW COMMENTS

As a result of the consensus discussion process, the IPR panel identified 10 final comments, segmented into rankings of high, medium, and low significance. In total, as shown in Table 3, seven were identified as having high significance (including one, comment 7, that was designated as "High/Medium"), three were identified as having medium significance, and no comments were identified as having a low level of significance.

Overall, the IPR panel agreed that a tremendous amount of technical work went into the development of the USACE Vegetation Policy – the documents were considered by the panel to be well written, illustrated and comprehensive. However, the panel recommended that the documents be consolidated, categorized, regionalized and supported by extensive research and scientific evidence.

As indicated in Table 3, the majority of the comments focus on areas viewed by the reviewers as needing improvement or additional discussion, or that was omitted. The final IPR comments in their entirety are included in Appendix A.

In addition to the recommendations for improvement summarized in Table 3 and Appendix A, the IPR had a very positive reaction to the figures and illustrations included in the USACE's Vegetation Policy, as well as Attachment 4. They thought that Attachment 4 did an exceptionally good and thorough job of clearly stating the purpose and content. In addition, the panel felt that the figures and illustrations were exemplary and helped significantly to clarify and enhance the text within the document. They emphasized that these types of figures should continue to be used in future guidance documents and could even be useful in design phases .[f]

[f] USACE comments GQ4 and GQ5 reference this section. See Appendix C for detailed response.

Table 3. Overview of 10 Final Comments Identified by the Vegetation Policy IPR Panel.

Significance – High	
1	There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).
2	One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.
3	The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.
4	The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.
5	The policy documents should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.
6	The FDRS inspector must have access to the previous inspection reports and must reference the previous inspections and actions taken between routine inspections. In addition, a national database should be established to share case histories on the performance of levees.
7	Given the estimated timeframe of 1 to 5 years to complete the research outlined in Attachment 6: Effect of Vegetation on Levees, the projected cost of $350K to $2M seems unrealistic.
Significance – Medium	
8	The literature review in Attachment 7 should be more comprehensive and organized by both design and maintenance topics.
9	The method for quantifying risk should be more clearly and specifically defined within the variance permit process.
10	While the definitions for a reliable corridor of access, vegetation-free zone, and vegetation-management zone are clearly stated, the metrics are questionable relative to type of inspection equipment, type of FDRS-pertinent hydrologic/hydraulic data, and overall metrics of adjacent zones.
Significance – Low	
None.	

APPENDIX A

Revised Final Independent Peer Review Comments and Responses on the USACE Vegetation Policy for Local Flood Damage Reduction Systems

Comment 1:

There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).

Basis for Comment:

Existing documents lack specific focus in the areas of overall policy, guidance for design of new or remediation/changes in existing FDRS, and guidance for maintenance to and inspection of FDRS. The repetition of material causes difficultly in cross referencing documents and leads to contradictory recommendations. This also could hinder future revisions to documents, as references to policy, design, and inspection issues are found indeterminably throughout the stated materials. It is recommended when and if these documents are revised that the new documents focus on three important areas: Policy, Design, and Maintenance/Inspection of vegetation and landscaping on FDRS.

The Policy Document must concisely state the purpose of the vegetation and landscaping policy, detail the policy standards and the specifics of the "vegetation regions," and lay out potential implications for the granting of variances. The current policy stated in Engineering Policy (EP) and Engineering Regulations (ER), does not provide such guidance and varying information is presented in both technical/design documents (Engineering Manual- EM and Engineering Technical Letter- ETL).

The Policy Document also must detail the potential implications for variance petitions. The policy also should lay out the justification and identify presumptions in order to justify a variance issuance. The document also should detail the USACE's risk analytical approach and anticipated (and sponsored) scientific research used to periodically reassess vegetation policies. For example, a clear procedure and policy should be established regarding the removal of vegetation: why should it be removed, who has the authority to remove it, what are the qualifications of who decides.

Similarly, the Design Document should contain explicit design criteria and clearly cross reference the specific policy documents. Maximizing the use of graphic illustrations, a Design Document for each region of the country should show FDRS structure types and adjacent functional zones, such as vegetation-free zone, root free zone, and vegetation-management zone as well as permitted landscape types, species, and sizes. Specific design guidance should cross reference the Policy and Maintenance/Inspection Documents.

The Maintenance and Inspection Document should contain specific maintenance and inspection criteria and methodology and, where appropriate, explicitly cross reference both policy and design documents in the text. Maximizing the use of graphic illustrations, a Maintenance and Inspection Document for each region of the country should show FDRS structure types and adjacent functional zones, including vegetation-free zone, root-free zone, and vegetation-management zone. Specific design guidance

should cross reference the Policy and Maintenance/Inspection Documents. Specific maintenance/inspection guidance should cross reference the Policy and Design Documents.

Significance – High:

Each of the documents has a different purpose for the user and should be explicit relative to the intended audience and purpose of the individual documents. The current documents provide general guidance, but in order to fully comprehend the decision-making, the user must reference a multitude of documents for context and process.

Comment Cross Referencing:

The importance of document independence also is incorporated into discussions related to Comments 2, 3, 5 and 6 in the context of different functional needs of the documents:

(2) **One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.**

(3) **The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.**

(5) **The Policy Document should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.**

(6) **The FDRS inspector must have access to the previous inspection reports and must reference the previous inspections and actions taken between routine inspections. In addition, a national database should be established to share case histories on the performance of levees.**

Recommendations for Resolution:

Develop three separate FDRS vegetation/landscaping documents to address the specific purpose and intended audience of each of the documents.

Documents reviewed by the panel to be incorporated into the Policy Document include:

- ER 500-1-1, Employment of Army Resources, Sections 5-13 and 5-22
- Draft EP 500-1-1, Emergency Employment of Army and Other Resources Civil Emergency Management Program- Procedures, Section 5.8.k and Appendix E
- Draft ETL 1110-2-571, Guidelines for Landscaping, Planting, and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures
- EP 1130-2-552 (Owner's Manual for Flood Damage Reduction Systems, including Appendix B- Inspection Template)
- Results of Attachment 8 Draft Scope of Work, Update EM 1110-2-571, last update, 06Dec07

- Results of Attachment 6 research proposal (The Effects of Vegetation on Levees, 20Feb08).

Documents reviewed by the panel to be incorporated into the Design Document include:

- EP 1130-2-552 (Owner's Manual for Flood Damage Reduction Systems)
- ER 500-1-1, Employment of Army Resources, Sections 5-13 and 5-22
- Draft EP 500-1-1, Emergency Employment of Army and Other Resources Civil Emergency Management Program- Procedures, Section 5.8.k and Appendix E
- Draft ETL 1110-2-571, Guidelines for Landscaping, Planting, and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures.

Documents reviewed by the panel to be incorporated into the Maintenance and Inspection Document include:

- EP 1130-2-552 (Owner's Manual for Flood Damage Reduction Systems)
- Draft ETL 1110-2-571, Guidelines for Landscaping, Planting, and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures
- Results from the recommended national maintenance and inspection database (comment 8).

USACE Clarifying Questions/Response:

Question Comment (QC) 1-1: Elaborate on the rationale behind the recommendation to develop this guidance as three independent documents.

IPR Panel Response to Clarifying Questions:

Individuals referring to these documents will likely have quite diverse backgrounds with some having no technical background, some with limited design background, and some with only O&M/Inspection background. As such, the documents must be presented in such a manner as to allow the easiest access to information for individuals of varied technical background.

Comment 2:

One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.

Basis for Comment:

ER 500-1-1 Section 5-13: Environmental Considerations, particularly with regard to routine maintenance, does not address regional differences. The environment and maintenance vary substantially among regions. Section 5.8k does not sufficiently address regional differences in vegetation standards or growth characteristics, particularly regarding what is meant by native, naturalized, and "natural" (volunteer) vegetation using standard definitions of landscape and horticultural industries.

ETL 1110-2-571 lacks regional vegetation guidance. Data and guidance addressing plant species, growth characteristics, root growth patterns, soils, climate, habitats, maintenance, and removal of volunteer vegetation are not provided. Some states provide guidance documents that address local conditions. While not available from all states, these could be the basis for beginning to research and address regionalism.

EP 1130-2-552, Sections 2.4 and 2.20 do not address regional vegetation issues, such as vegetation removal methods, undesirable vegetation, habitat value, and permitted vegetation. Regional differences must be considered in determining whether vegetation is undesirable or contributes to the preservation of natural resources. Guidance should indicate that soils, climate, and plant species vary regionally which affects the actual root-free zone that can be predicted.

Literature Review does not cite scientific references that address regional soil, vegetation, and climate differences and their implications.

Significance – High:

Guidance documents will be less subject to criticism and challenge if regionalized to address vegetation issues. Consideration of regional attributes can reduce maintenance costs (i.e., use of native groundcover species that are adapted to local conditions). This also would bring a better balance between the goal of minimizing risk of FDRS failure and alternative local concerns/issues (i.e., habitat loss and expense of dealing with riparian vegetation).

Comment Cross Referencing:

Concerns associated with regionalism also are incorporated into comments 3, 4, and 9:

(3) **The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.** Recommending and utilizing a broad diversity of scientific areas and disciplines in policy and guidance documents also could point to addressing

regional differences at the local level.

(4) **The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations**. In establishing a clear scientific foundation for policies and guidance, regionalism will emerge as a significant concern to be addressed.

(9) **The method for quantifying risk should be more clearly and specifically defined within the variance permit process.**

Recommendations for Resolution:

To resolve these concerns, the Policy Document would need to be expanded to include:

- References that are regionally specific regarding soils, vegetation, and climate effects on plant growth on FDRS
- References that address the value of FDRS vegetation as critical habitat in different regions
- Research on vegetation types, growth characteristics, root patterns, and vegetation habitats for each major region of the country.

Other recommendations are:

- Results of research should be incorporated into guidance documents
- Policy documents should focus on general performance requirements, such as levee visibility for inspections, while guidance documents should focus on more detailed, specific regional differences in applying the policies.

USACE Clarifying Questions/Response:

QC2-1: Explain "one region's experience"?

IPR Panel Response to Clarifying Questions:

Guidance that refers to tree size limits and removal infers lower rainfall regions as the basis for the standards. The policy and guidance should clarify that standards are minimum and that regional expert judgment could alter local practice.

USACE Clarifying Questions/Response:

QC2-2: Explain "Regional differences must be considered in determining whether vegetation is undesirable or contributes to the preservation of natural resources."

IPR Panel Response to Clarifying Questions:

FDRS using levees are often in less developed areas, near valuable habitat for sensitive species. The panel agrees that the overriding mission is flood protection, but care and consideration should be taken in removing vegetation that contributes to these habitats. Other nearby habitat areas not within the setback zones might need to be enhanced to accommodate species that must be displaced by vegetation removal. This must be considered and applied on a regional basis, based on vegetation species that support sensitive wildlife species.

USACE Clarifying Questions/Response:
QC2-3: Note that 8 Dutch Documents and 1 French journal article have been translated. The UK guidance has also been obtained. Eight German Guidance reports are being translated.
IPR Panel Response to Clarifying Questions:
The international documents and the research proposed by the USACE should address this issue.
USACE Clarifying Questions/Response:
QC2-4: In reference to last sentence, explain how a public agency with a public safety mission can achieve this balance without compromising its responsibility for public safety. In responding to this question, include explanations for a new structure and for an existing structure.
IPR Panel Response to Clarifying Questions:
The panel agrees that the overriding mission is flood protection, which must not be compromised. The panel also considers some flexibility and special consideration for regional issues to be appropriate. In humid climates, grasses grow at rapid rates, requiring expensive maintenance regimes. Alternative ground cover species that enables levee inspections should be considered. For new structures, regionally appropriate alternative ground covers should be used, particularly in localities where maintenance costs are a burden. For existing structures, the issue is vegetation removal. In such cases it is suggested that, if sensitive habitat is involved, vegetation not merely be removed, but be removed in concert with enhancing habitat elsewhere, but nearby for those species being displaced. A regular, regionalized approach to quickly assessing the value of the vegetation (as sensitive habitat) being removed and enhancement of strategically located nearby habitat should be adopted. This would not apply to vegetation removal during flood-fighting activities or emergency situations.
USACE Clarifying Questions/Response:
QC2-5: Explain why recommendations are divided into two categories.
IPR Panel Response to Clarifying Questions:
Distinguishing between policy and guidance documents in regionalizing the content would allow the continuance of national flood control standards, policy. Specific guidance on how to implement the policies is the more appropriate venue for incorporating regional differences. Furthermore, guidance on maintenance should be much more specific and regional, and should be clearly written and illustrated, as existing documents are now, without complex policy technicalities.

Comment 3:

The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.

Basis for Comment:

The criteria for allowing or denying vegetation growth and landscaping in FDRS must consider a range of scientific areas and disciplines that include but are not limited to: civil engineering, landscape architecture, soil science, agronomy, biology, hydraulics, plant growth, threatened and endangered species, and economics.

Vegetation policy and guidance documents need to provide users with a greater awareness of the breadth of possible species selection and design issues that must be considered. However, it is not reasonable to list every issue, scientific area, and discipline that may need to be considered. An example of this problem is in Attachment 3, Purpose (p. 1-1) where it could be implied that major science areas are civil engineer, landscape architect, levee and/or dam safety engineer, environmental engineer, geologist, and biologist. Although the purpose does state that additional related disciplines may be included, significant disciplines such as hydraulic and geotechnical engineers could be overlooked.

Users must be made aware that it is their responsibility to exercise professional judgment in determining which areas and issues should be considered. Users also must be made aware that there will be issues such as levee design and maintenance that will vary from region to region. It is the responsibility of the user to make sure that professionals selected for a decision-making team have the appropriate experience and knowledge to address the relevant scientific areas and disciplines.

Significance – High:

There is a fundamental problem in the policy and guidance documents that users may not consider all of the necessary selection or design criteria to fully understand the impact of vegetation on levees and flood control structures. This is consistent with a recommendation by the USACE in Attachment 9 for establishing a multidisciplinary Project Delivery Team (PDT) to develop and implement plans.

Comment Cross Referencing:

Concerns associated with the importance of consulting a wide range of scientific disciplines also are incorporated into comment 2:

(2) **One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.** Qualified multidisciplinary teams should include professionals with specialized expertise in the local/regional environment and vegetation.

Recommendations for Resolution:

To resolve these concerns, the vegetation policy documents (each policy and guidance document, as referenced in comment 1) should be amended to include:

- Cautionary language explaining the need for both scientific and engineering professionals in a multi-disciplinary project team
- Language emphasizing that it is the responsibility of the project owner or sponsor to use professional judgment in including professionals from various scientific disciplines on the project delivery team
- Language emphasizing that both scientific and engineering disciplines must understand and respond to regional differences in species composition, soil types, climate factors and other differences
- Recognition that it is not possible for a single document to address all of the possible areas and disciplines. Such a list of disciplines would have to include every possible or imaginable science and engineering area. Even then, a significant discipline could be overlooked because of regional differences or in the confusion of the list.

USACE Clarifying Questions/Response:

QC3-1: Elaborate on the impacts that need consideration.

IPR Panel Response to Clarifying Questions:

Attachment #3 (ETL 1110-2-571, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures) provides guidelines to assure that landscape planting and vegetation management provide aesthetic and environmental benefits without compromising the reliability of levees, floodwalls, embankment dams, and appurtenant structures. The attachment further discusses a coordinated, interdisciplinary effort involving the local sponsor and the following disciplines…… and additional related disciplines, as appropriate However, the list is not complete and does not give guidance on what the additional related disciplines should be. Without such guidance, a needed discipline or scientific area could easily be missed. The "appropriate" disciplines could very well be selected on the basis of landscape planting and vegetation management instead of the necessary engineering and scientific areas such as hydraulic, hydrology, water resources, and floodplain management. The impacts that need consideration for Comment #3 are compromising the reliability and safety of a levee system by either using the wrong disciplines or neglecting to include a significant discipline and scientific area. For example, the impact of flood stage and bank erosion may not be understood by the disciplines mentioned in the Attachment. Bank erosion is discussed in Attachment #4, but no guidance is given on the scientific area and discipline needed by the owner to understand mechanism and the prevention of erosion.

Comment 4:

The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.

Basis for Comment:

ETL 1110-2-571 does not address the use of vegetation in erosion control. The metrics for the Vegetation free zone do not seem to be based on scientific research, but rather from a narrow perspective which values only levee and floodwall protection and inspection. The effects of regional differences in soils, plant species, and climate are not addressed.

ETL 1110-2-571 does not address the erosion control value of vegetation on levees. The growth characteristics of roots vary substantially by plant species and regional growing conditions, yet policies and guidance are apparently based upon broad, general, and homogenous assumptions. Plant roots serving as agents of piping in levee soil is unproven and requires specific research per plant type.

Proposed General Research does not consider climate as a differentiating factor in vegetation growth characteristics. Plant roots serving as agents of piping in levee soil is unproven and requires specific research per plant type. Existing research by other than that from the USACE is not referenced, such as applicable data from the Netherlands, United Kingdom, Germany and Norway, as well as data from other related professions.

Significance – High:

The apparent lack of scientific foundation or reference thereto for vegetation policies and guidance weakens their value and makes them vulnerable to challenges from individuals and agencies that are in disagreement. Use of scientific findings in developing policies and guidance would also be beneficial in facilitating local compliance with maintenance and management requirements, in potentially reducing maintenance costs, and in protecting the integrity of FDR systems.

Comment Cross Referencing:

Concerns associated with the scientific foundation of the policy also are incorporated into comments 2 and 8:

(2) **One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.** Regional differences in vegetation growth characteristics, soils, and species would be addressed in a broad scientific basis for policies and guidance.

(8) **The literature review of Attachment 7 should be more comprehensive and organized by both design, and by maintenance topics.** More diverse and comprehensive literature review, particularly of non-USACE research documents, would facilitate establishing a scientific foundation for vegetation policies and guidance.

Recommendations for Resolution:

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

- A comprehensive review of national (non-USACE) and international research, including research by agronomists, landscape architects, and horticulturalists (this review should be conducted, documented, and referenced in the Policy Document)
- Original research on FDRS vegetation conducted in each major region of the country and focusing on native and naturalized vegetation species, local soils, climate, and environmental habitat value.

USACE Clarifying Questions/Response:

QC4-1: Elaborate on the statement "…but rather from a narrow perspective, which values only levee and floodwall protection and inspection." Explain how to broaden this perspective considering that the mission is flood risk management.

IPR Panel Response to Clarifying Questions:

The document is from the single perspective that vegetation on levees is bad and should be removed. Some vegetation may help stabilize the levees structure.

USACE Clarifying Questions/Response:

QC4-2: The validity of the statement "Plant roots serving as agents of piping in levee soil is unproven and requires specific research per plant type" is questioned. It is equally as valid to state that "plant roots NOT serving as agents of piping in levee soil is unproven and requires specific research per plant type." In the absence of confidence in understanding the positive or negative impacts of roots, what is the responsibility of a public agency for public safety of a structure designed to prevent flooding, in particular for a structure not designed to accommodate roots? What are the short comings of empirical and anecdotal knowledge in the absence of scientific research when having to insure public safety?

IPR Panel Response to Clarifying Questions:

The panel agrees that the mission is flood protection and public safety, and that these are of predominant importance. It is true that not enough research has been conducted on piping effects of plant roots in levee soils. Given this lack of research currently available, the panel agrees that the prudent assumption should be that substantial piping and adverse impacts to levee and floodwall structural stability does occur, and that policies and guidance reflecting that assumption should remain in place. The panel is suggesting that research be conducted, including the proposed USACE research, to understand the mechanics and growth habits of plant roots per species type and the impacts each may cause as agents of piping. Findings of such research may or may not point to the need to modify the guidance.

USACE Clarifying Questions/Response:
QC4-3: Why do the recommendations not include new research to address the public safety aspects of vegetation, to include the full range of potential impacts and associated implications for public safety?
IPR Panel Response to Clarifying Questions:
The recommendations focus on understanding vegetation, climate, and soils on a regional basis as they relate to the structural integrity and ongoing maintenance/management of levees and floodwalls. The panel assumed it was understood that FDRS cannot be compromised, but that vegetation around and on them could be better understood and, therefore, managed.

Comment 5:

The policy documents should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.

Basis for Comment:

The guidance for review and approval of variance requests contained in EP 500-1-1, Employment of Army Resources, Sections 5-13, 5-18k (Appendix E), and 5-22 should be clarified and expanded in the Policy Document. Specifics of why, when, how and where variances are needed should be provided. The sponsor or shareholder that decides to request a variance to the levee vegetation policy standard should have a process for documenting the variance process, the delegation of authority by region, the permits required and the anticipated timeframe involved. The review authority should have available maintenance and inspection records, as well as a previous history of approval or denial of the variance. Situations under which variance may be granted or should never be granted should be clearly defined. In this way, FDRS owners need not be placed in the position where unnecessary professional fees are expended when there is no chance that the request for a variance will be granted based upon the justification utilized for requesting the variance.

Direct reference to Policy Documents where minimum vegetation standards and vegetation-free zones are detailed should be referenced within the process.

Significance – High:

The basis upon which variances are granted or denied to the FDRS vegetation policy is critical to the Policy Document and this process should be clearly detailed in the Policy Document. Present documentation is contained in many documents and little information is available in these documents to make a sound decision.

Comment Cross Referencing:

The importance of a concise and comprehensive presentation on the justifications for variances is related to comment 1, because any changes to this section of the Policy Document will directly impact the Design Document and may indirectly impact the Maintenance/Inspection Document.

(1) **There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).**

Recommendations for Resolution:

To resolve these concerns, the vegetation policy documents would need to be expanded to include:

- Specific criteria that must be met for a variance to be considered and granted
- Specific conditions under which a variance may be considered and granted

- Detailed examples of past variance approvals, as well as the directed process for approval.

USACE Clarifying Questions/Response:

QC5-1: When using "minimum" standards, how does the USACE grant a variance without any diminution of project reliability and public safety? Research can help in designing sustainable flood-management systems, but how is vegetation addressed when it is not included in the design and, therefore, no consideration is given to potential impacts to system reliability? Is it recommended that a variance from minimum standards be granted in the case of unknown potential for negative impacts to project reliability?

IPR Panel Response to Clarifying Questions:

The USACE must eventually (perhaps through the proposed research) establish a levee evaluation system that provides both a Risk Value and a Hazard Value. Variance Applications can then be evaluated on the basis of levee section classifications.

The term "minimum standard" for configuration/design of the woody vegetation root-free zone is redundant unless there are at least two possible "standards." This issue can be easily resolved by establishing an additional "design standard" as follows:

1. Design Standard: The design standard for the woody vegetation root-free zone configuration shall extend a minimum of 25 feet from the toe of both the inside and outside embankments and shall extend a minimum of 12 feet above the surface of the embankment. No trees or woody vegetation shall be allowed to be planted and/or to grow within this root-free zone. Provide an illustration (drawing).
2. Minimum Standard: The minimum standard may be used for design and/or maintenance of the woody vegetation root-free zone only by application for and approval of a Regional Variance. The minimum standard for the woody vegetation root-free zone configuration shall extend a minimum of 15 feet from the toe of both the inside and outside embankments and shall extend a minimum of 8 feet above the surface of the embankment. No trees or woody vegetation shall be allowed to be planted and/or to grow within this root-free zone. Use current illustration (drawing).

The panel had differing opinions on granting variances, which are stated below

a. Some panel members thought that if the USACE truly considered the standards to be minimum standards, then there should be no variances permitted and no process for doing so.
b. Some panel members thought that if variances were allowed through a variance application process, then the criteria should be made clear ahead of time to avoid wasting everyone's time. When the panel discussed the issue, it was not to make it more complicated nor was it to allow for more variances, it was just to make the existing USACE variance criteria clear for FDRS sponsors.
c. Variances were considered to be very rare occurrences, in very specific, almost hardship, situations. So, if the strict criteria are made clear, some panel members

thought fewer sponsors would apply for it and there would be less time wasted on both sides.
USACE Clarifying Questions/Response:
QC5-2: What is the reviewers understanding of a "variance"? What is the reviewers' definition of a "region"?
IPR Panel Response to Clarifying Questions:
A variance is an agreement between the USACE and the shareholders of a particular section of levee that sets forth the limits of variations from the design standards that the USACE is agreeable to approve. This may be alignment, crest width, access, vegetation, number of grazing cattle per acre, crest roadway maintenance, etc. Region as used by one peer reviewer refers to a geographic, physiographic, and/or climatological area where vegetation design and growth conditions can vary significantly, for example Southeast U.S., Northwest U.S., Southwest U.S., Northeast U.S., and then some fringe or combination areas such as Mid-Atlantic, Midwest, and the Mid-South.

Comment 6:

The FDRS inspector must have access to the previous inspection reports and must reference the previous inspections and actions taken between routine inspections. In addition, a national database should be established to share case histories on the performance of levees.

Basis for Comment:

Inspections must be based upon comparative observations and a thorough understanding of historical conditions/problems. If an inspector does not know the contents of the previous inspection report there is no way to formulate comparative observations. Previous inspection report recommendations that required maintenance and/or remediation actions must be known and understood so that the inspector can determine if these actions have been undertaken, completed, or ignored. Inspectors must utilize all levee vegetation policy documents to properly reference observed deficiencies and violations of levee vegetation standards.

Inspector must review previous inspection reports prior to conducting levee inspections, must have access to a copy of the previous inspection report while conducting a levee inspection, and must reference findings of the previous inspection report with findings of the current levee inspection. In addition, inspectors should have access to all three of the vegetation policy documents during a levee inspection. A national database of levee inspections that result in maintenance and remediation actions should be established to provide valuable case history data on the performance of levees. Establishment of a national database will further substantiate the need for regionalization of vegetation policies and add significantly to future research in the area of vegetation on levees.

Significance – High:

The importance of proper inspection cannot be over emphasized. Failure to maintain a continuous record of the performance, maintenance, and condition of levees is vital to public safety.

Comment Cross Referencing:

FDRS inspection issues are also related to comments 1 and 5:

(1) **There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).** The Maintenance/Inspection Document and database is paramount to a contiguous Policy Document and as reference material for the Design Document. A national database can be used for the variance process, matching data on specific situations on a district, region, and national basis.

(5) **The Policy Document should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.** The maintenance and inspection database will be used to determine the validity of granting a variance request.

Recommendations for Resolution:

To resolve these concerns, the vegetation policy documents would need to be expanded to address:

- Revisions to the template contained in EP 1130-2-552 (Owner's Manual for Flood Damage Reduction Systems- Appendix B) to include specific FDRS policy and design data
- Requirements for inspector utilization of previous inspection reports and interim maintenance measures
- Establishment of a database that allows continual monitoring of the performance, maintenance, and condition of levee sections
- Continuous training of FDRS inspectors to update the database and cross reference any new changes to the Policy and Design Documents
- Inspector training and instilling a high degree of responsibility into each inspector. (This is a critical activity and responsibility of the District and Division Levee Safety Officer and Commander. Inspectors often are the only individuals that truly know what is happening in the field on a routine basis.)

USACE Clarifying Questions/Response:

QC6-1: What information or lack of information led the reviewers to believe this is not being done?

IPR Panel Response to Clarifying Questions:

The document as presented does not contain sufficient detail about the process and frequency of levee inspections.

More detail and clarification in the purpose, methodology, and documentation of inspections should be included such as the inspection process, types of critical deficiencies, importance of compliance with design standard and/or granted Regional Variances, and comparative evaluations between conditions existing during the current inspection and those existing in the previous inspection.

USACE Clarifying Questions/Response:

QC6-2: Please explain the last sentence. What do the reviewers perceive as the benefits? (Reference the first sentence in 1st paragraph; is the purpose to better learn positive and negative impacts of various kinds of vegetation?)

IPR Panel Response to Clarifying Questions:

The panel's primary point on this issue is that the vast knowledge being gained each and every year about levee maintenance methods, issues, and problems could be of benefit to others and should be shared. This observation data could provide input to research on vegetation effects on levees. At the time of the peer review, none of the panel members knew that the USACE was in

the process of developing a National Levee Database that will be accessible via Internet similar to the National Safe Dams Program (NSDP) Database. All references to Establishing a National Database could be removed since it is underway.

Comment 7:

Given the estimated timeframe of 1 to 5 years to complete the research outlined in Attachment 6: Effect of Vegetation on Levees, the projected cost of $350K to $2M seems unrealistic.

Basis for Comment:

The attachment may mislead readers to think that (1) either the only effect or the primary effect of vegetation on levees is root interaction, and (2) that the only research that needs to be done on the effects of vegetation on levees is the study of root interaction. If the intent of Attachment 6 is for root interaction (as discussed in the 6 Tasks), then the title of Attachment 6 should mention root interaction. The attachment does use the sentence, "The literature review details a number of documents pertinent to vegetation research and vegetation impacts on soil stability," but later in the attachment confuses the reader in the Objectives, which state, "What is the effect of vegetation, specifically woody vegetation, on levees….etc." However, a preface is needed and the preface should make it very clear that root interaction is not the only effect of vegetation on levees and there are other mechanisms for vegetation effects on levees that are just as significant. Those effects would include (as discussed in some of the other attachments) access for maintenance and inspection, access for flood fighting, and the interaction between vegetation, levee, and the hydraulics of the river channel and floodplain. Other comments on the content of Attachment 6 are presented below.

The areas of research outlined in the proposed scope of work (Attachment 6) are too general to estimate a realistic cost and time of duration. For example, panel comments on Attachment 3, Chapter 3, discuss the need for field and laboratory research in order to understand how vegetation contributes to soil stabilization. Panelists also commented on the lack of science justifying the root-free zone and recommended that additional research be conducted to understand the phenomena of piping caused by roots.

The panelists believe that the six tasks outlined in the General Research Proposal (Attachment 6) are misleading because they limit the needed areas of research to the interaction of plant roots with the soil types and construction of levees. There are other areas of research that need to be conducted such as the interaction of the hydraulics of the river system and floodplain on the vegetation and the resulting effects on the levee stability.

Significance – High/Medium:

If the intent was to focus on root interaction, then this comment would be rated Medium and a change of title to *Effect of Vegetation Root Structures on Levees* should be considered. If the intent was to indicate that roots were the only way vegetation affects levees, then this comment would be rated High.

The research outlined in Attachment 6 is paramount to closing the gaps in science and engineering, yet seems too narrow in focus. Attachment 6 highlights only one research topic on root penetration on sandy levees, but recognizes that this research was limited and has not advanced in almost 20 years. Attachment 6 refers to research for the tools and applications being conducted per Task 3 (understanding the interaction of roots with different soil types) and then implies the need for research "addressing the implications of vegetation on levees relating to stability and seepage or piping." However, this is inherently flawed because it would lead to a limitation of research in areas of plant roots that already have been studied.

Comment Cross Referencing:

Concerns associated with research for the "Effect of Vegetation on Levees" also are incorporated into comments 2 and 4:

(2) **One region's experience seems to be the basis for national policy and guidance, specifically with regard to the root-free zone, maintenance of flood damage reduction systems (FDRS), definition of unwanted vegetation, and removal of vegetation.**

(4) **The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.**

Recommendations for Resolution:

To resolve these concerns, the vegetation policy documents would need to be modified to address so that either:

- The literature review of Attachment 6 should be limited to the interaction of plan roots on levees and the title of Attachment 6 should be changed to reflect this,

OR

- Attachment 6 must clearly define which areas of research regarding the "Effect of Vegetation on Levees" will be considered. This then will require the literature review to be expanded with agreement on the types and priority of research topics that will be needed. Once there is agreement on the types of additional research areas, costs and time durations then can be discussed.

USACE Clarifying Questions/Response:

GC7-1: What is meant by unrealistic?

IPR Panel Response to Clarifying Questions:
It is felt that the estimated timeframe of 1 to 5 years to complete the research outlines in Attachment 6 and the projected cost of $350K to $2M is unrealistic because the effects of vegetation on levees is not limited to just root penetration. It may be possible to conduct several field investigations and a laboratory investigation of limited effects of root resistance for $2M and 5 years. The research would be limited to only a few types of vegetation, soil types, and region and climate. However, there are other mechanisms of vegetation effects such as flow resistance, rainfall erosion, bank erosion, vortex erosion from plant stems, debris collection and blockage, sediment deposition, and the overturning of plant stems and root balls. Research for these types of vegetation effects could take multiple research programs that would cost in the excess of tens of millions of dollars and perhaps 20 to 30 years in duration.
USACE Clarifying Questions/Response:
QC7-2: Provide a specific recommendation as opposed to an either/or.
IPR Panel Response to Clarifying Questions:
The panel recommends the latter: Attachment 6 must clearly define which areas of research regarding the "Effect of Vegetation on Levees" will be considered. This then will require the literature review to be expanded with agreement on the types and priority of research topics that will be needed. Once there is agreement on the types of additional research areas, costs and time durations then can be discussed.

Comment 8:

The literature review in Attachment 7 should be more comprehensive and organized by both design and maintenance topics.

Basis for Comment:

The literature review in Attachment 7 is too limited in research topics and disciplines of the researchers. The literature review is difficult to apply because it is unorganized. It needs to be organized by both research and maintenance topics. There needs to be an index of keywords as well as an index for subject and by authors. The literature review is limited to only a few select researchers. The literature is a good start but significant effort needs to be applied to improve it. The use of reference codes is difficult to use and the papers should be organized in sections by design and maintenance subheadings. For example, to find any literature pertaining to the effect of a super elevated flow (resulting from a river bend) on the potential erosion of the toe of a levee is extremely difficult. It is unclear which reference code would apply. By coincidence the first paper in the literature review has a reference code BKSTAB, but the reader has to exam the abstract of the first paper as well as all of the papers and reference codes in the literature review to determine that there is no publication cited on this subject. An index by subject and keywords would have streamlined the search and would have indicated that the topic probably was not covered. The literature review also should indicate if the publications are from research or from field observations.

Significance – Medium:

The completeness and clarity of the policies and guidance documents are adversely affected by the limits of the literature review, and would be improved with a better organized and more comprehensive literature review.

Comment Cross Referencing:

Concerns associated with the literature reviews of Attachment 7 also are incorporated into comments 3, 4, and 6:

(3) **The policy and guidance documents must alert users of the necessity to include a wide diversity of scientific areas and disciplines to conduct future research and/or modify existing documents.**

(4) **The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.** Many of the challenges vegetation policy and guidance documents have faced could be potentially assuaged by a more comprehensive literature review.

(6) **The FDRS inspector must have access to the previous inspection reports and must reference the previous inspections and actions taken between routine inspections. In addition, a national database should be established to share case histories on the performance of levees.**

Recommendations for Resolution:
To resolve these concerns, the vegetation policy literature review would need to be significantly expanded to include: ▪ Research from a wider range of researchers, authors, and topics ▪ Search indexes by topic, keyword, and author ▪ Indication of whether the publication is from conducted research or from field observation ▪ Arboriculture, horticulture, soil science, hydraulics, landscape architecture, biology, and threatened and endangered species research.
USACE Clarifying Questions/Response:
None.
IPR Panel Response to Clarifying Questions:
N/A

Comment 9:

The method for quantifying risk should be more clearly and specifically defined within the variance permit process.

Basis for Comment:

As detailed in comment 5, the process for applying for a permit to obtain a regional variance agreement should be detailed in the new Policy Document. As part of this process, the risk associated with the placement or removal of vegetation should be clearly defined and quantified. Although Draft EP 500-1-1, Emergency Employment of Army and Other Resources Civil Emergency Management Program- Procedures, Section 5.8.k and Appendix E, did loosely define the probable risk, a more detailed definition is needed in order to quantify that risk. Related USACE research contains a thorough explanation of how risk is assigned and should be incorporated into this document.

Significance – Medium

Appendix E of Attachment 2 is fundamentally correct, but needs improvement to provide detailed guidance on the risk associated with the regional variance agreement process

Comment Cross Referencing:

Issues associated with methods for quantifying risk also are related to comment 5:

(5) **The Policy Document should set forth examples of both unacceptable and potentially acceptable reasons for either denying or granting vegetation variance requests.** In order to have the same basis for evaluating each application, the procedure for granting/denying a regional variance permit should include a clear definition and quantifiable analysis of risk as part of the Policy Document.

Recommendations for Resolution:

To resolve these concerns:

- Existing USACE data and ongoing research, along with design and inspection information, should be used in developing a measurable definition of risk
- A clear definition and analysis of risk should be included in the regional variance permit process.

USACE Clarifying Questions/Response:

QC9-1: What is the current state of the profession in its capacity to understand and predict levee reliability? Given the degree of uncertainty and consequences from an error, what is the USACE's responsibility and accountability for public safety? What degree of redundancy should the USACE build into a system to account for the uncertainty in predicting performance and to account for human shortcomings related to the failure?

IPR Panel Response to Clarifying Questions:

These questions reflect exactly the point of Comment #9, and the document needs to answer these questions after the document fully discusses the method for qualifying risk. The answers to the USACE's questions are beyond the scope of the independent review and perhaps should be addressed by a separate document. Answers will have to come from a very thorough study and by a panel of experts on risk assessment.

This issue also relates to comment #5 (which is also focused on minimizing risk) in that the criteria for a variance being granted should be clearly stated. The panel notes that many FDRS sponsors applying for variances will not be capable of a true risk assessment and doing so as part of the application would unduly complicate the process for both the USACE and the applicant.

Comment 10:

While the definitions for a reliable corridor of access, vegetation-free zone, and vegetation-management zone are clearly stated, the metrics are questionable relative to type of inspection equipment, type of FDRS-pertinent hydrologic/hydraulic data, and overall metrics of adjacent zones.

Basis for Comment:

ETL 1110-2-571 (Attachment 3- Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures) does not consider the type of vehicles and equipment that would use the FDRS for inspection and flood fighting, as set forth in EP 1130-2-552 (Owner's Manual for Flood Damage Reduction Systems, including Appendix B- Inspection Report Template and Appendix C- Flood Fighting Techniques).

This makes it difficult to evaluate the appropriateness of the required clearance dimensions. The document also does not account for clearance provided by the vegetation-free zone, vegetation-management zone, transition zone, and root-free zone in requiring clearances for the reliable corridor of access. The adjacency of these zones has not been considered, leading to redundant and cumulative clearance requirements that are excessive. For instance, the eight-foot height clearance requirement seems arbitrary. The transportation corridor and reliable corridor of access seem to be conflated in the clearance requirements, yet larger construction equipment would use the transportation corridor and not the reliable corridor of access.

Significance – Medium:

The required dimensions of a reliable corridor of access, vegetation-free zone, and vegetation-management zone seem arbitrary. Their basis is unclear and the required clearances are overlapping and redundant, making this requirement easily subject to question and challenge. Accounting for and illustrating adjacent clearance and zone requirements could reduce total area requiring vegetation removal, thereby reducing maintenance costs and improving local compliance.

Comment Cross Referencing:

Issues related to FDRS-pertinent definitions and metrics also may be incorporated into comments 1 and 4:

(1) **There should be three independent documents that focus on Policy, Design, and Maintenance/Inspection related to natural vegetation growth on and landscaping of flood damage reduction systems (FDRS).** Design and Maintenance/Inspection Guidance Documents should include clear definitions and graphic illustrations of the reliable corridor of access, vegetation-free zone, and vegetation-management zone.

(4) **The policies and guidance lack scientific foundation, as evidenced by broad anecdotal assumptions and the lack of non-USACE literature citations.** Defensible scientific and engineering data should form the basis for determining the required metrics of the reliable corridor of access, vegetation-free zone, and vegetation-management zone.

Recommendations for Resolution:

To resolve these concerns, the vegetation policy documents would need to be expanded to address:

- Differentiation between equipment and vehicle access requirements for the transportation corridor compared to the reliable corridor of access; specifically, it should note equipment and vehicles needed either for daily inspection and maintenance use compared to flood fighting use. The larger clearance requirements should prevail.
- Clear identification of the types of vehicles and clearance dimensions for which the reliable corridor of access is established, accounting for clearances provided by vegetation-free zone, vegetation-management zone, transition zone, and root-free zone.

Other recommendations are:

- The Policy, Design, and Maintenance/Inspection documents, including the figures, should be revised to reflect changes in metrics.
- The figures must clearly show the relationship of the reliable corridor of access to the vegetation-free zone, vegetation-management zone, transition zone, and root-free zone, as well as relationship to FDRS, floodwall, and seepage zone.
- The vegetation-free zone should be widened and height increased to a minimum of 12 feet. If there is only a 15-foot wide vegetation-free zone with an 8-foot height restriction, the canopy of a 12-inch diameter tree is going to overlap into the vegetation-free zone by about 10 feet. This is going to shade grass ground cover and restrict movement of construction vehicles to about 5 feet, which is not enough. This likely will result in complete removal of trees during flood fighting or maintenance activities that would not necessarily have to be removed if the canopy did not overhang the vegetation-free (access) zone.

USACE Clarifying Questions/Response:

QC10-1: Explain what is meant by metrics? Is the intent of the comment to state that 15 feet may be insufficient?

IPR Panel Response to Clarifying Questions:

Metrics is referring to the measurements for different zones and corridors as prescribed in guidance. Graphics in the appendix are very clear. Additional, similar style composite graphics (plan and section) showing the potential overlap of clearance requirements specifically for vegetation-free, root-free, management zone, reliable corridor of access, etc., would help clarify the overall clearance requirements.

APPENDIX B

Charge to the USACE Vegetation Policy IPR Panel

REVISED DRAFT CHARGE TO THE PEER REVIEWERS
for

INDEPENDENT PEER REVIEW FOR VEGETATION POLICY FOR LOCAL FLOOD DAMAGE REDUCTION SYSTEMS

BACKGROUND

The U.S. Army Corps of Engineers (USACE) Final Draft White Paper, *Treatment of Vegetation within Local Flood-Damage-Reduction-Systems*, is an internal USACE assessment of current policy and practice with regard to vegetation and flood protection systems. It is USACE's current policy to keep local flood protection systems free of vegetation, because empirical experience has demonstrated vegetation can impact reliability, inhibit inspections and the ability to perform a flood fight, and interfere with maintenance. Incidental vegetative growth and subsequent presence of endangered species may prohibit maintenance necessary to maintain integrity. However, opposing opinions also challenge the "science" behind the policy and guidance.

For these reasons, USACE wants an independent and unbiased review of its policy for landscaping and vegetative maintenance of Federal Flood Protection Projects. Battelle, as a non-profit science and technology organization with experience in establishing and administering peer review panels for USACE, was engaged to coordinate the independent peer review (IPR) of the U.S. Army Corps of Engineers Vegetation Policy for Local Flood Damage Reduction Systems ("USACE Vegetation Policy").

The IPR will be external to the agency and conducted in accordance with Office of Management and Budget, *Final Information Quality Bulletin for Peer Review* and *Final Bulletin for Good Guidance Practices*. It will focus on USACE policy and technical guidance for landscaping and vegetation management for Flood Protection Projects, as well as proposed research to resolve gaps in the science and engineering supporting the policy and guidance. The review will include input on whether the policy is practicable and based on reasonable assumptions, with a specific emphasis on the application of this policy to local flood protection systems owned and operated by sponsors and non-Federal flood protections systems within the Rehabilitation and Inspection Program.

DOCUMENTS PROVIDED

The following policy and technical documents will be provided to the independent peer review panel for review:

(1) Draft update, ER 500-1-1, Emergency Employment of Army Resources, Sections 5-13 and 5-22

(2) Draft update, EP 500-1-1, Emergency Employment of Army and Other Resources Civil Emergency Management Program – Procedures, (Section 5.8.k, and Appendix E)

(3) Draft ETL 1110-2-571, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, Embankment Dams, and Appurtenant Structures, 3 Apr 2008

(4) EP 1130-2-552, Owner's Manual For Flood Damage Reduction Systems (i.e., Levee Owners Inspection Guide)

(5) Inspection Report Template

(6) Phase II, Research Proposal, - The Effects of Vegetation on Levees, 20 Feb 2008

(7) Literature Review and Preliminary Assessment, by Corcoran, Bailey, Leach, Little, and Pinkard, ERDC, Aug 07

(8) Draft Scope of Work, Update EM 1110-2-301, EM 1110-2-301, Guidelines for Landscape Planting at Floodwalls, Levees and Embankment Dams, Updated 19 Oct 07, Attachment 1

Other relevant information and publications that will be provided for reference include:

Relevant USACE Reports

(9) Final Draft White Paper, Treatment of Vegetation within Local Flood-Damage-Reduction-Systems, 20 Apr 07 (unedited)

(10) Technical Report, REMR-EI-5, The Effects of Vegetation on the Structural Integrity of Sandy Levees, by Gray, MacDonald, Thomann, Blatz, and Shields, ERDC, Aug 91

(11) Documentation and Analysis of Tree Root Extent and Behavior Along and in Levees and Floodwall in New Orleans District, Jan08

Publications that represent an alternate opinion

(12) Sacramento Area Flood Control Agency (SAFCA): Go to http://www.safca.org/, click on Levee Vegetation Symposium –Supporting Documentation. See links to Related Items. David A. Pezza was the keynote presentation presented by the U.S. Army Corps of Engineers. The other presentations offer various different opinions, 30 Aug 2008.

(13) Draft Research Proposal to Develop Multi Objective Levee – Vegetation Policies and Practices for the California Central Valley, by SAFCA, 25 Feb 2008, Attachment 14.a

(14) State of Oregon, County of Multnomah, Dr. Donald L. Gray Affidavit, 18 Sep 07, Attachment 14

(15) Technical Manual for Dam Owners: Impact of Plants on Earthen Dams, FEMA 534, Sep 05, Evaluation prepared by Donald L. Gary, July 07, Attachment 15

Other Current USACE publications, website: http://www.usace.army.mil/publications/

EM 1110-2-301, Guidelines for Landscape Planting at Floodwalls, Levees and Embankment Dams, U. S. Army Corps of Engineers, 1 Jan 00

EM 1110-2-1205, Environmental Engineering and Local Flood Control Channels, 15 Nov 89 (Sections 4-8.d (4) and 5-1)

EM 1110-2-1913, Design and Construction of Levees, U. S. Army Corps of Engineers, 30 Apr 00 (Sections 4-4 and 8-17)

EM 1110-2-2300, General Design and Construction Considerations for Earth & Rock Fill Dams, 30 Jul 04

EM 1110-2-2502, Retaining Walls and Floodwalls, U. S. Army Corps of Engineers, 29 Sep 89 (Section 7-16)

EP 500-1-1, Emergency Employment of Army and Other Resources Civil Emergency Management Program – Procedures, 30 Sep 01 (Section 5.8.k, and Appendix E)

ER 500-1-1, Emergency Employment of Army Resources, Civil Emergency Management Program, Chapter 5, Rehabilitation and Inspection Program, 30 Sep 01 (Sections 5-13 and 5-22)

SCHEDULE[g]

1.	Battelle confirms final selection of IPR candidates	July 15, 2008
2.	Vegetation Policy review documents distributed to IPR Panel with charge	July 30, 2008
3.	Battelle and USACE Kick off meeting with IPR Panel	*TBD* - Week of August 4, 2008
4.	IPR Panel submits technical review comments to Battelle	September 2, 2008
5.	Battelle identifies key issues/themes in comments and distributes to IPR panel	September 5, 2008
6.	Facilitated teleconference to confirm key issues, determine final comments, and assign responsibility for final comments	September 8, 2008
7.	IPR Panel prepares formatted final comments focused on key issues using formatted structure and submits to Battelle	September 15, 2008
8.	Battelle submits final IPR report to the USACE	September 5, 2008
9.	IPR panel, Battelle and USACE Project Team discussion	*TBD* – week of October 6, 2008
10.	Battelle submits project team discussion report	October 15, 2008

CHARGE FOR PEER REVIEW

Members of this peer review are asked to provide an independent, unbiased review of the USACE policy for landscaping and vegetation maintenance of Federal projects with a specific emphasis of the application of this policy to local flood protection systems owned and operated by sponsors and non-Federal flood protection systems with in the Rehabilitation and Inspection Program. The reviewers are asked to determine if the policy is practicable, and based on reasonable assumptions. The peer reviewers will be using their individual expertise in flood control systems, earthwork structures such as dams, levees, foundation systems and foundation drainage systems, vegetation and animals on flood control systems, and the design and maintenance of landscaping on flood control structures to conduct this review. In addition, the reviewers are asked to determine whether the research that has been conducted and the research proposed will provide sufficient data to address gaps in information that are needed to justify the current policy or changes to the current policy.

[g] Note this schedule was shifted by approximately 2 weeks to accommodate delays with the individual peer reviews. The revised schedule is included in Section 2.1 of this report.

Specific questions for the peer reviewers, by report section, are included following the general charge guidance, which is provided below.

General Charge Guidance

1. Please answer the policy, guidance, and scientific questions listed below as they relate to the specific review documents, and refer to the supporting documents as appropriate. Please focus on your areas of expertise and technical knowledge.
2. Identify, explain, and comment on the current policy, the "science" supporting the policy and guidance, and proposed research to support the current policy and guidance or changes to the current policy and guidance.
3. Evaluate whether the current guidance is clear and well documented.
4. If appropriate, you can offer opinions as to additional research that is needed to support the current policy and guidance or to support changes to current policy and guidance.
5. As appropriate, comments should reference your own experience in conducting research or projects related to vegetation on flood damage reduction systems.
6. If desired, IPR panel members can contact each other. However, IPR panel members **should not** contact anyone who is or was involved in the development of this policy or guidance or the subject documents. It is imperative that this review be unbiased.
7. Please contact the Battelle project manager (Karen Foster, foster@battelle.org) for requests or additional information.
8. In case of media contact, notify the Battelle project manager immediately. No information is to be provided to anyone outside of the IPR panel, Battelle and the USACE.
9. Your name will appear as one of the panelists in the peer review. Your comments will be included in the Final IPR Report, but will remain anonymous.

Please submit your comments in electronic form to Karen Foster, foster@battelle.org, no later than Tuesday, September 2, 2008 5:00 PM EDT.

Independent Peer Review for Vegetation Policy for Local Flood Damage Reduction Systems
Revised Draft Charge Questions

Attachment 1: Draft to ER 500-1-1 *Emergency Employment if Army and Other Resources, Civil Emergency Management Program, 30Sept01.*

Section 5-13: Environmental Considerations

1. Please comment on the requirement to exempt all "routine maintenance" of levees, including tree cutting and tree root removal, from the DA Permit process. Is the term *routine maintenance* sufficiently defined in Section 5-13-3? What additional information, if any, should be included in this definition?
2. Comment on the statement, "…maintenance does not include any modification that changes the character, …, of the levee." Please comment on whether the removal of large trees or other invasive vegetation should be excluded from this process. (5-13-3e).
3. Does ETL 1110-2-571 provide sufficient criteria for the design of landscaping at levees, specifically for the root-free and vegetation-free zones? Are there other documents (FEMA or USACE) which should also be referenced? (5-13-6).

Section 5-22: Regional Variances on Vegetation Standards – Policy

1. Is the justification for a variance sufficiently documented? Why or why not? (5-22-c).
2. Is the point of contact/command and approach clear for approval of a Regional Variance? (5-22-f-1). What additional information should be included?
3. Does Appendix E of EP 500-1-1 provide sufficient information to result in a standardized process for requesting a Regional Variance? (5-22-g-2). What additional information should be considered?
4. Is clarification necessary to explain why the regional variance policy does not apply to the Mississippi River and its tributaries? Why or why not?

Attachment 2: EP-500-1-1 *Emergency Employment of Army and Other Resources, Civil Emergency Management Program- Procedures*

Section 5.8k: Reporting and Processing Results of Inspections, and General Information, Regional Variances for Vegetation Standards

1. Does policy in Section 5-22 of ER500-1-1 and Appendix E provide sufficient clarity and documentation for addressing regional vegetation standards? Should other documentation be referenced?

Appendix E: Regional Variances to Levee Vegetation Standards

1. Please comment on whether the last statement in E-3 b(4)(a) "Levee Materials and Construction Standards" regarding the greater susceptibility of levees constructed of silty sand or other permeable materials to negative impacts of vegetation is consistent with available scientific data, including specifically TR REMR-EI-5 (1991). Is there

justification for excluding all other levee construction materials from the features of special consideration?
2. Is the documentation for 4(b), Hydrologic and Hydraulic Conditions sufficient? Why or why not?
3. What documentation is available to quantify which locations are considered "higher" or "lower" risk (E-4(c))? Please comment on whether the process to quantify "higher" or "lower" risk adequately described and technically sound?
4. Is the chain of command clear in E-5 and E-6? Why or why not?

Attachment 3: ETL 1110-2-571 *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*

Purpose

1. Please comment on the last statement that the *design team* must decide on the appropriate nature of the application of the minimum standards. Should there be an approval process, and, if so, what qualifications should the design team present?
2. Under "Future Guidance" is the rationale for providing case studies of vegetation impacts and information on root system characteristics in the context of supporting the minimum guidelines clear? What additional information, if any, should be included?

Chapter 1

References

1. In your best professional judgment, is the list of references complete? For instance, should other USACE publications, such as EP 1130-2-552 be included?
2. Please comment on the value of referencing select state guidance documents (e.g., CA, OR, PA) , which provides impetus for the current research plans, so as to better frame the current policy debate.

Policy

1. Should performance standards be established to determine if the sponsor has achieved the "proper maintenance of vegetation" that is required.
2. Is there sufficient documentation for a variance request as referenced in the four points? Please comment on the general language used in defining these four points. (1-3-b).
3. Are the four points reasonable and sound?
4. Comment on the benefits of an explicit recognition of the USACE's risk assessment approach in evaluating the merits of variance petitions (see EP 500-1-1 E-3(b)(4)(c).

Chapter 2

Vegetation-Free Zone

1. Is a reliable corridor of access defined sufficiently? Should specific transportation corridors to the levee access points be included and have a separate standard? Are the design standards for access and turnarounds for maintenance and flood-fighting considered as per EM 1110-2-1913?
2. Please comment on the minimum corridor height of eight vertical feet. Does referenced material support the minimum height? Comment on the required vehicles for maintenance/flood-fighting and the specified minimum vertical height minimum width of

the corridor. Are the minimum dimensions detailed for the vegetation-free zones consistent with the requirements of flood-fighting measures such as: construction of temporary access roads; treatment of sandboils, underseepage, erosion, etc; and access for flood-fighting equipment?

3. Should pertinent hydrologic/hydraulic data, such as estimated seepage zones, be included and detailed on all Figures?
4. Are the two exceptions to the vegetation-free zone realistic? Does Figure 2 accurately represent these exceptions?
5. Does the formal variance policy (1-3b) describe a fully referenced and concise method for obtaining such a policy?
6. If potential deviations from the vegetation-free zone requirements could be envisioned under current policy, is there a benefit to identifying the types of scenarios where a variance request for an existing levee system could reasonably anticipate approval?

Vegetation Management Zone

1. Comment on the Vegetation Management Zone and Figure 22. Should the "many scenarios" be further quantified?
2. Should there be guidance for removal of a large tree such that damage to the structural integrity of the flood control structure is minimized? If so, what should the guidance include?

Root Impacts

1. Given the two situations presented for root impacts, is the use of back-up data reasonable and appropriate?

Root-Free Zone

1. Comment on the information provided in Figures 13-19. Are there sufficient data available for the design team? Is the information contained in these figures reasonable for the design team to determine such features as the 3' root-free zone, the toe or foot of the wall foundation, the location of an underground drain? What additional information should be included?
2. Comment on the requirement to know the "rooting habit of each plant selected for use in the root-free zone." Is it reasonable to be able to predict the root growth will not interfere with the 3-foot "root free zone?"
3. Does the presented guidance comply with that presented in Attachment 4, Section 2-7? If not, please list areas of direct conflict.
4. Is there sufficient guidance for the selection of root barriers and the potential scenarios for use?

Chapter 3

General

1. Is there scientific evidence to support each of the six points listed under the statement, "Vegetation must be controlled for the following reasons." If not, what areas are lacking supportive data?
2. Are technical data needed to support site-specific considerations? Why or why not?

3. Please comment on whether the discussion of general vegetation effects should accommodate or acknowledge the findings that certain woody vegetation can contribute to soil stabilization and resistance to riverside levee surfaces from hydrological forces (e.g., Figure 23).

Levees

1. What type of engineering/cost study may be required to design an extension of the internal drains versus the environmental effect of a planting berm.
2. Is there a conflict between providing effective and reliable erosion protection and the vegetation standards? If so, please comment.
3. Is the design criteria outlined for the areas of concern in minimum vegetation-free zone in (a) and (b) complete and reasonable? Please explain.

Floodwalls

1. Is there documentation provided adequate to determine the minimum distance between the large tree and the floodwall. Why or why not?.
2. Comment on available reference material to detail the "potential means by which tree roots may damage floodwalls."
3. Is there sufficient information shown on Figures 16-19, for the design team and owners to implement the vegetation minimum standards? Why or why not?

Embankment Dams and Appurtenant Structures

1. Is there sufficient research available in FEMA and through referenced ASDSO technical papers to document the Purpose and Policy statements in this section?
2. The Vegetation-Free Zone described for embankment dams, dam abutments, spillways, and outlet works discharge channels only addresses mowing heights. Does this section include sufficient information on vegetation planting, maintenance and removal?

Water-Current and Wave Action Barrier

1. Please comment on whether the use of suitable vegetation can be used as a means to moderate erosion and waterside current.

Chapter 4

Feasibility Analysis

1. Does the existing research support the list of "some" important site considerations? What, if any, additional considerations should be included?,
2. In 4-1-c, Environmental Factors, please comment and provide documentation for the assessment of " ... local velocities and shear stresses and comparison of predicted values…for various types of vegetation."
3. Are the data and information presented in Figures 14 and 15 sufficient to design adequate seepage control? What additional information, if any, should be included?
4. What are the standards for emergency access and how are they documented?
5. Please comment on the extent of scientific evidence that tree and/or shrub roots do or do not promote piping; if the evidence for this phenomenon is ambiguous, or limited to certain plant/soil combinations, should the statement in 4.1.a be qualified?
6. Discuss whether these recommendations should be qualified with respect to an existing levee situation as opposed to a new design.

Planting Berms

1. Comment on the specific guidelines for new projects (ER 1110-2-1150) and existing projects (CECW-PB, 23Oct06). Is there sufficient design guidance in these documents for planting berms? Why or why not?

Irrigation Systems

1. Is the detailed potential threat to irrigation system reliability reasonable? Is the chain of command on decision-making (i.e. District dam or Levee Safety Officer) in compliance with set policy? If not, please comment.

Flood-Fighting and Structural Maintenance

1. Should specific vehicles associated with the inspection and flood fighting be incorporated in this document?
2. See Comment #2, Chapter 2, Vegetation-Free Zone. Were access requirements for routine and emergency maintenance/construction considered as detailed in EM 1110-2-1913 and EP 1130-2-552? Were the specific types of vehicles and construction features referenced?

Maintenance of Plantings

1. Should a list of low-maintenance plantings (by region) be included?

Selection of Plant Material

1. Given the long-term financial pressures faced by many floodwater protection systems, discuss the value of considering a plant's successional status as one criterion in determining the list of recommended plants for a region.

Appropriate Ground Cover in the Vegetation-Free Zone

1. Should a list of perennial grasses be included in this document?

Chapter 5

Operations and Maintenance Manual

1. Please comment on the specified annual maintenance program. Is there reference to the operations and maintenance manual? Should routine and periodic inspections be included as detailed in Appendix B of Attachment 4?

Chapter 6

1. Given the data collected each year under the previous EP 500-1-1, Inspection Report, and the updated EP 1130-2-552, Appendix B Template, should this information be referenced as support information (past maintenance, high water, erosion history etc.) for all figures?
2. Would specific design information (hydraulic characteristics of the interior system-storm/drainage outlets, ponding areas, erosion protection, annual exceedance probability) as presented in FEMA 534 be effective in designing vegetation-levee relationships?

3. Is the statement that the minimum vegetation-free zone is not influenced by erosion protection appropriate? Is the exclusion of embankment protection such as riprap from the figures consistent with the vegetation standards?

Attachment 4: EP1130-2-552 *Owner's Manual for Flood Damage Reduction Systems* (also called: Levee Owners Inspection Guide)

Section 1: Introduction

1. Is the general statement, "For example, the system needs to be kept clear of *inappropriate* vegetation, debris, ….." sufficiently detailed in Section 2.7: Vegetation on Levees, Section 6.1: Overview of the Rehabilitation and Inspection Program, and Appendix B: Inspection Report Template? Why or why not
2. Should EP 1130-2-552 be cited in ETL 1110-2-571 rather than the older Levee Owner's Manual for Non-Federal Flood Control Works?

Section 2: Maintenance of FDR Systems

2.1 Erosion

1. Please comment on the repair of FDR systems damaged by erosion. Should repair of the damaged levee include vegetation performance standards other than "seeding and mulching"?

2.2 Encroachments

No Questions

2.3 Slope Stability

No Questions

2.4 Removal of Debris

No Questions

2.5 Animal Control

1. Is FEMA manual 473, "Technical Manual for Dam Owners, Impacts of Animals on Earthen Dams," sufficient documentation for identifying and removing animals/habitat? Why or why not?

2.6 Riprap Revetments and Banks

1. As described, the riprap shown in Figure 2.22 would have been rated as "Minimally Acceptable" due to "unwanted" grass cover. Should a clarification be made between "wanted" and "unwanted" vegetation within riprap placed for erosion control?
2. Is there sufficient detail to detail the process of removing tree roots and replacing/rebuilding the riprap or other revetment bank protection? Why or why not?

2.7 Vegetation on Levees

b. Vegetation-Free Zone

1. Charge Comments were developed for a Vegetation-Free Zone in Attachment 3: ETL 1110-2-571: *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*, Chapter 2 (3Apr08), #'s 1-6. Are the specifications for the vegetation-free zone outlined in Attachments 3 and 4 in agreement with the temporary construction specifications (temporary roadways, etc.) required for flood-fighting as shown in Appendix C? If not, where do inconsistencies appear? Do the figures representing vegetation management zones for specific types of FDR's in Attachment 3 (Chapter 6), mirror those in Chapter 2 of this document?
2. Is the maintenance easement sufficiently designed as a reasonable alternative to increasing the minimum vegetation-free zone dimensions? Comment on the common scenarios presented for the maintenance easement. Are these scenarios in conflict with that presented in ETL 110-2-571?
3. Should there be specific guidance on the process to obtain a maintenance easement? Why or why not?

c. Special Zone

1. Please comment on the need for a "special zone" for a singular type of levee. Is this design consideration appropriate? If so, is there sufficient guidance for planting vegetation within this zone?

d. Root Impacts

2. See comments on Attachment 3 (Chapter 2- Root Impacts and Chapter 6-Figures), for detailed questions on this section. Does the guidance presented for a "zone of reduced root impact" comply with that presented in this document? If not, how significant are the discrepancies?

e. Root-Free Zone

5. Is it reasonable for the design/maintenance team to "…know the rooting habit of each plant selected for use in the root-free zone…"? Is it reasonable that the 3' root-free zone can be managed with the design information presented in the Figure 2.41?
6. Does the presented guidance comply with that presented in Attachment 3, Section 2-5? If not, please list areas of conflict.
7. Is there sufficient guidance for the selection of root barriers and the potential scenarios for use?

f. Appropriate Vegetation

1. Should this section reference the previous section concerning "Special Zone" as a qualification to the general rule provided for the river side of levees and other flood reduction systems?

2. In Figures 2.35 through 2.42, the recommended distances are based on the "ordinary high water" elevation but in the subsequent ETL 110-2-571, the elevation in corresponding figures is based on the "normal water surface." Please comment on how significant this discrepancy is relative to the design specifications.

g. Maintenance of Woody Vegetation

1. Should the maintenance requirements for woody vegetation mirror that detailed in Attachment 3, Chapter 5- Vegetation-Related Maintenance and Repair? Why or why not?

h. Variances for Vegetation

1. Does this section comply with the process detailed in ETL-1110-2-571? Why or why not?

i. Illustrations

1. Do Figures 2.35 through 2.42 and 2.80-2.83 represent the vegetation management section (Appendix B) of the Inspection Report presented in Appendix B? Are these figures adequately represented in ETL 1110-2-571? If not, where are the discrepancies?
2. Is it reasonable to be able to achieve the 3' root-free zone in Figure 2.41, given routine and periodic maintenance practices? Why or why not?
3. Should riprap and other embankment protection be shown on the figures to illustrate the minimum vegetation-free zone and corresponding restrictions?
4. Figure 2.36, *Proper application of the vegetation-free zone*, endorses the "temporary intrusion" of shrubs limbs and crown from mature trees and shrubs. Is this a reasonable statement given the location of access points and underdrains along the FDR?
5. Is it reasonable that the minimum zone dimensions can be managed with the trench and relief well design information presented in the Figures 2.39 and 2.40?
6. Should Figure 2.42, *Levee section with ordinary high water mark above the riverside toe*, be included in ETL 1110-2-571? Why or why not?

to 2.19

NONE

2.20 Vegetation around Floodwalls

1. Is the statement regarding the ability of certain tree species to uplift floodwall structures supported in the scientific literature?

2. Please comment on the basis for establishing a minimum distance of half the mature tree height to protect floodwalls against overturning trees; do pertinent scientific data exist and if so is this a reasonable guideline or not?

2.21 Internal Drainage Systems

No questions

2.22 Pump Stations

No questions

2.23 Flood Control Rivers and Channels

1. Should any details of the method to remove vegetation and downed trees be included? Why or why not?

2.24 Debris Basins

No questions

2.25 Floodways

1. Where the "floodways" are coincident with the 100 year floodplain are the management specifications consistent with the Executive Orders 11988 and 11990 and Section 404 of the Clean Water Act?

2. Is there sufficient documentation to make an informed decision between undesirable vegetation and vegetation growth that contributes to the preservation of natural resources?

Section 3: Flood Preparedness

No questions

Section 4: Actions during High Water

1. 4.1.c Patrol Responsibilities: Should the list of items that is used during the inspection include a section on vegetation concerns such as recently exposed roots and toppled trees?

Section 5: Additional Sponsor Responsibilities

5.1 Annual Pre-Flood-Season Inspection

1. Is it appropriate to use the template inspection report found in Appendix B as a guide? If Appendix B is used for referral purposes only, what vegetation control methods should be added to the list of documented items?

5.2- 5.3

No questions

5.4 Permits

1. Is it appropriate to reference the Vegetation Variance permit in this section? Why or why not?

5.5 Records

No Questions

Section 6: The Rehabilitation and Inspection Program

6.1 through 6.3

No Questions

6.4 Maintaining an Active Status (Continuing Eligibility Inspections)

1. Is it reasonable to include an inspection of vegetation, with supporting documentation, within the referenced zones as detailed in supporting Figures 2.35-2.42 and 2.80-2.83, as part of the routine and periodic inspections of FDR's?

6.5

No Questions

6.6 Requesting Rehabilitation Assistance

1. (6.6c) Is it reasonable to include the cost to replace vegetation on the levee or other FDR be included in the cost/benefit calculation?

Section 7: Other Types of ACE Emergency Assistance

No Questions

Appendix A: Acronyms and Definitions

No Questions

Appendix B: Inspection Report Template

FDR: Public Sponsor Pre-Inspection List

1. Is it reasonable to include a review of vegetation within the referenced zones in supporting Figures 2.35-2.42 and 2.80-2.83 for maintenance required, performed, and planned on the referenced report format?

Appendix C: Flood Fighting Techniques

1. Please comment on the Plates detailing the construction of temporary facilities during flood-fighting with respect to the minimum standards used to designate vegetation-free zones. Are the minimum dimensions detailed for the vegetation-free zones consistent with the construction of temporary access roads; treatment of sandboils, underseepage, erosion, etc; access for flood-fighting equipment; and other flood-fighting measures?

Appendix D: Sample Notice to Sponsors

No Questions

Appendix E: Rehabilitation Request Form

No Questions

APPENDIX F: Cooperation Agreement for Rehabilitation of Federally Constructed FDR Systems

No Questions

APPENDIX G: Cooperation Agreement for Rehabilitation of Non-Federally Constructed Systems

No Questions

APPENDIX H: Cooperation Agreement for Flood Fight

No Questions

APPENDIX I: Cooperation Agreement for Advance Measures Assistance

No Questions

APPENDIX J: Useful Internet Addresses

1. Please comment on the comprehensiveness of the documents listed: were any significant areas of related or applicable laws and regulations overlooked? Are the listed references the most recently published?

Attachment 5: Inspection Report Template

Levee Embankments

Unwanted Vegetation Growth

1. Do the performance standards conflict with EP 1130-2-552, ETL 1110-1-571, EM 1110-2-301, (per template), or other referenced vegetation growth, maintenance, and removal procedures?
2. Is reasonable to suspend inspection on the levee until the animal burrow or other items are corrected? Why or why not?
3. Should figures detailed in Chapter 6 be included in the Inspection Report to advise as to minimum standards for each type of FDR?

Attachment 6: Proposed General Research- The Effects of Vegetation on Levees

Overall

1. Does the proposed research demonstrate a comprehensive understanding of the existing data and substantive data gaps related to potential impacts (both positive and negative) of vegetation on levee structure and function; and, will the research substantively advance scientific understanding concerning the priority data needs?
2. What is the likelihood that the proposed research would achieve the stated goals?
3. Please comment on how well the proposed research compliments other recent or ongoing research programs (e.g., Documentation and Analysis of Tree Root Extent and Behavior Along and in Levees and Floodwall in New Orleans District [JESCO, 2008]).

Background

1. Please comment on whether a synthesis of identified data gaps (as established in the recent USACE literature review, various guidance documents, and the conferences) should be provided to support the apparent research focus on root growth patterns and soil stability.

Research on Levee Vegetation

1. Is the linkage between potential data gaps and the research summary provided evident?

Objectives

1. Are the objectives of the proposed work clear?

Proposed Scope of Work

1. Please comment on the components of the proposed research; is the logic clear and do the assumptions and research priorities appear to be reasonable? Are there any general data gaps or issues that ought to be investigated as part of the preliminary phase that were not provided for?
2. Do the proposed costs and schedule seem reasonable?

Attachment 7: Literature Review and Preliminary Assessment of Vegetation on Levees

Section 1 – Introduction

1. Is the purpose, and context, of the review clearly stated?

Section 2 – Format of Literature Review

1. Please comment on the comprehensiveness of the analysis: did the authors review a majority of the important documents related to the topic area and were any significant areas of related or applicable research overlooked?

Section 3 – Background – No Questions

Section 4 – Federal Guidance Documents, Manuals, and Principles

1. Does the section adequately characterize the range of applicable agency opinions/positions?

Section 5 – International Guidance Documents and Manuals

1. Does the section provide a comprehensive summary of international guidance; is there additional information available that could help better frame the potential range of policy options?

Section 6 – Research Programs and Projects

1. Is the information on research programs and projects sufficient to understand the rationale and objectives of the major research programs related to this topic; are all technical areas requiring additional scientific research adequately identified?

Section 7 – Ecosystem Considerations

1. Is the review of ecosystem issues comprehensive and appropriate?

Section 8 – Newspaper Articles

1. Does the inclusion of this information contribute to the report's objectives?

Section 9 – Summary

1. Please comment on whether the analysis accurately identified all significant scientific issues related to the presence of vegetation on levees and whether all pertinent data gaps were adequately characterized for each.

Appendix A

1. Please comment on the presentation of information provided in the appendix; was sufficient information provided regarding the scientific and/or policy issues related to both regional/international approaches and effects of different substrate/vegetation/climate characteristics? Is the information presented in a fashion such that one can quickly appreciate the nature and limitations of information available for each of the formats?

Attachment 8: Draft SOW Update 18Oct07

1. References
    1. Please comment on the comprehensiveness of the listed publications; are there any other relevant documents that should be included for consideration in developing the new manual?

2. Tasks
    1. Comment on the sequencing of elements to be addressed in Phase I and Phase II – are there any issues that ought to be switched between the two (either to maximize review and feedback or based on relative priorities)?
    2. Are there any issues (e.g., regional considerations) that are not specified in either Phase I or Phase II that should be in included in the manual?

3. Establish an interdisciplinary team …
    1. Comment on the composition of the interdisciplinary team; are all necessary technical specialty areas covered and are the specification criteria provided appropriate and/or sufficient?

4. Format the document in accordance with OM 25-51. N/A

5. Conduct reviews
    1. Is the process logically envisioned and adequate to ensure that the document has undergone a thorough review?
    2. Should the IPR include non-ASCE reviewers?

6. through 10. – No Questions

APPENDIX C

Battelle/IPR Panel Responses to USACE Clarifying Questions on the Main Body of the Final IPR Report

Comment/Question: GQ1 (Section: 2.0/Page: 2)
Reconfirm this report complies with the three documents referenced above.
Battelle Response:
Battelle has reviewed the following documents for compliance: • Office of Management and Budget's *Final Information Quality Bulletin for Peer Review*, released December 16, 2004; • Supplemental guidance on evaluation for conflicts of interest used the National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports*, dated May 12, 2003; • *Peer Review of Decision Documents* (EC 1105-2-410) dated August 22, 2008. As stated in the *Final Information Quality Bulletin for Peer Review,* peer review has "diverse purposes" as some federal agencies make use of peer review to obtain evaluations of draft information that contains important scientific determinations. Battelle follows the guidelines in this bulletin that state, "the selection of participants in a peer review is based on expertise, with due consideration of independence and conflict of interest" and strives to ensure that peer review practices are characterized by both "scientific integrity and process integrity" referring to such issues as expertise of panel members, clarity of the charge to the panel members, the quality and depth of the discussion of the issues by the IPR panel members, and the accuracy and clarity of the panel report. Final comments provided to the USACE often suggest "ways to clarify assumptions, findings, and conclusions…and may encourage authors to more fully acknowledge limitations and uncertainties." Furthermore it states that "reviewers may be compensated for their work" - Battelle has compensated the reviewers at an hourly rate through a time and material contract for a specific number of hours (for which they can not exceed). Supplemental guidance on evaluation for conflicts of interest for each peer review is derived from the National Academies' *Policy on Committee Composition and Balance and Conflicts of Interest for Committees Used in the Development of Reports*. Specifically the policy states, that the term "conflict of interest" means any "financial or other interest which conflicts with the service of the individual". Battelle employs a two part screening process to determine that the each of the panel members is free of conflict. The first screening is conducted during the initial contact with candidate reviewers via telephone or email. The candidates are asked if they have been involved in the preparation of any of the subject reports or had a key role in the subject project. The second screening is conducted when the subcontract is prepared. Section 2.2 of the main body of this report describes the screening criteria for conflict of interest used in part two of the screening. All Battelle staff participating in peer reviews have been provided with and instructed to review The Engineering Circular (EC) dated August 22, 2008 *Peer Review of Decision Documents* (EC 1105-2-410). Battelle specifically follows the procedures in Appendix D

Section 2 of the EC guidance, the only two exceptions for this IPR being that public comments were not provided for this review and the comments and responses were not documented in DrChecks[sm].

Comment/Question: GQ2 (Section: 2.5/Page: 6)

Is it usual to have 10 consensus comments in response to 203 questions presented to reviewers?

Battelle Response:

The number of consensus comments is not atypical in this case. Based on six other peer reviews, approximately 60-130 charge questions are generated, resulting in 250-500 verbatim responses from the panel. After a review of all the responses, identification of common themes and differences, and the consensus discussion, the process can yield from 10 to 20 final comments. The number of final comments is specific to each project, the review documents and the panel. Smaller panels do not necessarily yield fewer final comments.

Comment/Question: GQ3 (Section: 2.5/Page: 6)

Please identify the 27 specific charge questions.

Battelle Response:

The 27 specific charge questions in which Battelle identified a potential conflict among reviewers (after a review of all responses to the charge questions) are listed below, in no order of importance. The conflicting comments were all resolved based on professional judgment of the panel members and the comments were either incorporated into the final comments, used to develop a new comment, or determined to be a non-significant issue (i.e., either a true disagreement did not exist, or the issue was not important enough to include as a final comment).

- Q8 (Attachment 1): Is the justification for a variance sufficiently documented?
- Q16 (Attachment 2): Does policy in Section 5-22 of ER500-1-1 and Appendix E provide sufficient clarity and documentation for addressing regional vegetation standards?
- Q19 (Attachment 2) : Is there justification for excluding all other levee construction materials from the features of special consideration?
- Q23 (Attachment 2): Please comment on whether the process to quantify "higher" or "lower" risk adequately described and technical sound.

- Q32 (Attachment 3): Please comment on the value of referencing select state guidance documents (e.g., CA, OR, PA), which provides impetus for the current research plans, so as to better frame the current policy debate.
- Q38 (Attachment 3): Is a reliable corridor of access defined sufficiently?
- Q39 (Attachment 3): Should specific transportation corridors to the levee access points be included and have a separate standard?
- Q40 (Attachment 3): Are the design standards for access and turnarounds for maintenance and flood-fighting considered as per EM 1110-2-1913?
- Q51 (Attachment 3): Should the "many scenarios" be further quantified?
- Q60 (Attachment 3): Is it reasonable to be able to predict the root growth will not interfere with the 3-foot "root-free zone?"
- Q64 (Attachment 3): Is there scientific evidence to support each of the six points listed under the statement, "Vegetation must be controlled for the following reasons."?
- Q66 (Attachment 3): Please comment on whether the discussion of general vegetation effects should accommodate or acknowledge the findings that certain woody vegetation can contribute to soil stabilization and resistance to riverside levee surfaces from hydrological forces (e.g., Figure 23).
- Q72 (Attachment 3): Is there documentation provided adequate to determine the minimum distance between the large tree and the floodwall?
- Q79 (Attachment 3): Does this section include sufficient information on vegetation planting, maintenance, and removal?
- Q81 (Attachment 3): Does the existing research support the list of "some" important site considerations?
- Q87 (Attachment 3): Please comment on the extent of scientific evidence that tree and/or shrub rots do or do not promote piping; if the evidence for this phenomenon is ambiguous, or limited to certain plant/soil combinations, should the statement in 4.1.a be qualified?
- Q96 (Attachment 3): See Comment #2, Chapter 2, Vegetation-free Zone. Were access requirements for routine and emergency maintenance/construction considered as detailed in EM 1110-2-1913 and EP 1130-2-552?
- Q118 (Attachment 4): Are the specifications for the vegetation-free zone outlined in Attachments 3 and 4 in agreement with the temporary construction specifications (temporary roadways, etc.) required for flood-fighting as shown in Appendix C?
- Q155 (Attachment 4): Should any details of the method to remove vegetation and downed trees be included?
- Q158 (Attachment 4): Is there sufficient documentation to make an informed decision between undesirable vegetation and vegetation growth that contributes to the preservation of natural resources?

- Q172 (Attachment 5): Do the performance standards conflict with EP 1130-2-552, ETL 1110-1-571, EM 1110-2-301, (per template), or other referenced vegetation growth, maintenance, and removal procedures?
- Q177 (Attachment 6): Will the research substantively advance scientific understanding concerning the priority data needs?
- Q178 (Attachment 6): What is the likelihood that the proposed research would achieve the stated goals?
- Q187 (Attachment 7): Please comment on the comprehensiveness of the analysis - did the authors review a majority of the important documents related to the topic area and were any significant areas of related or applicable research overlooked?
- Q196 (Attachment 7): Please comment on the presence of information provided in the appendix - was sufficient information provided regarding the scientific and/or policy issues related to both regional/international approaches and effects of different substrate/vegetation/climate characteristics?
- Q197 (Attachment 8): Is the information presented in a fashion such that one can quickly appreciate the nature and limitations of information available for each of the formats?
- Q201 (Attachment 8): Comment on the composition of the interdisciplinary team - are all necessary technical specialty areas covered and are the specification criteria provided appropriate and/or sufficient?

Comment/Question: GQ4 (Section: 4.0/Page: 11)

Did you have sufficient time and the correct mix of disciplines to perform the review?

Battelle/IPR Panel Response:

IPR panel members felt they had sufficient time to perform the review and there was a correct mix of disciplines. To improve future peer reviews, panel members suggested a one-day (minimum) meeting with key USACE personnel as it would have significantly benefitted the review process even though it may have added costs. Conference calls are beneficial, but do not allow personal contact and exchange of specific ideas as well as a well facilitated meeting with plenty of breaks for individuals to share similar concerns and ideas. Additionally, peer reviewers felt they could have communicated directly with each other more during the review process.

Comment/Question: GQ5 (Section: 4.0/Page: 11)
Given your review of these documents, do you have any major concerns with the USACE continuing to use them while considering the recommendations contained in this report?
Battelle/IPR Panel Response:
IPR panel members did not have any concerns about using the documents being reviewed while this report is completed. It is more important that this review process be carefully followed, leading to thoughtful and defensible changes to guidance. One concern raised however was regarding the use of Attachment #6 (The Effects of Vegetation on Levees). It is felt that this attachment will mislead readers into either thinking that the effect on levees is due solely to root penetration or that root penetration is the only effect of vegetation that needs to be considered.