HERBERT HOOVER DIKE, FLORIDA

SUPPLEMENTAL INDEPENDENT TECHNICAL REVIEW

REPORT

SEPTEMBER 2006

The Design for the Plans and Specifications
For
HERBERT HOOVER DIKE, FLORIDA
MAJOR REHABILITATION PROJECT, REACH 1, SUBREACH A

Herbert Hoover Dike (HHD)
Supplemental Independent Technical Review (ITR)
Report
Introduction
26 September 2006

This report documents the 2006 HHD Supplemental ITR initiated 7 June 2006. The 2006 HHD Supplemental ITR was implemented in response to the need to revisit the design contained in the HHD Reach 1, Subreach 1A Plans and Specifications (P&S) and the overall approach for HHD Rehabilitation in order to capture lessons learned from the Post-Katrina evaluations of the New Orleans and Southeast Louisiana Hurricane System. The 2006 HHD Supplemental ITR reviewed project activities for compliance with current Corps of Engineers guidance and the lessons learned, conclusions and recommendations contained in the following reports.

a. Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Draft Final Report of the Interagency Performance Evaluation Task Force (IPET), 1 June 2006.

b. Report of Expert Review Panel, Technical Evaluation of Herbert Hoover Dike Lake Okeechobee, Florida released to the public on or about May 2, 2006. The report was prepared by BCI Engineers & Scientists, Inc. for the project sponsor the South Florida Water Management District. The report is the result of an ITR of the stability and safety of the Herbert Hoover Dike around Lake Okeechobee, Florida. The report made recommendations to address safety issues.

GENERAL

This Supplemental ITR reviewed the evolution of the project design, from the Major Rehabilitation Report (MRR) through the Plans and Specifications (P&S), to determine if changes are warranted to the final design. The final design is the Reach 1, Subreach A P&S. The goal was to have an independent review of the assumptions, analysis and design with the intent to validate the conclusions reflected in the final design or recommend adjustments to protect the public interest.

The 2006 HHD Supplemental ITR is atypical in that it differs from a typical Corps of Engineers ITR. Normally, ITR is performed on a product that will incorporate ITR prior to being finalized. The 2006 HHD Supplemental ITR does not follow that pattern. The products under evaluation have been completed and any ITR related updates will be captured in future editions.

The value of the 2006 HHD Supplemental ITR is that future contract sequencing, Plans and Specifications, Design Documentation Reports and Major Rehabilitation Reports will employ the lessons learned and any changes described in the findings and conclusions and comments and responses.

CONTENTS

This report is comprised of the following sections.

a. Supplemental ITR Report Introduction;

b. Findings and Conclusions;

c. ITR Team Credentials and Related Experience;

d. Comments and Responses; and

e. Supplemental Independent Technical Review Plan.

REVIEW SCOPE AND CHARGES

The ITR Team was responsible for making a thorough technical review to insure the design for Reach 1 in the Reach 1, Subreach A P&S, and subsequently other reaches, addresses proper application of established criteria, regulations and professional standards and practices.

The ITR Team addressed each of the following charges as part of their review and provided other comments as appropriate.

Charges:

1. Review and comment on the assumptions, methods, analyses and design and conclusions drawn from the MRR, DDR and VE Study and how they pertain to the design presented in the P&S.

2. Address whether the current models, modeling, solutions and design are consistent with the state of the practice.

3. Address whether the statistical/probabilistic methods used in the Corps of Engineers documents are correct, and if not, what methods and/or analyses should be used.

4. Address whether the current location (and design) promotes seepage and instability of the downstream slope.

5. Review and comment on the elevations and locations of the cutoff walls and repair measures.

6. Address whether the P&S adequately address dike integrity by construction activities.

7. Address whether the P&S adequately address stability during the construction process.

8. Address whether the COE documents provide an adequate basis for the construction plans and specifications.

9. Address whether the plans and specifications conform to the design.

10. Address whether the COE documents address applicable lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System. If not, which lessons learned need to be addressed and what actions need to taken to address those lessons learned.

Herbert Hoover Dike (HHD)
Supplemental Independent Technical Review (ITR) Report
Introduction
26 September 2006

ITR TEAM MEMBERS

As stipulated in COE Engineering and Design ITR guidance, ITR members were sought from the following sources: regional technical specialists (RTS); appointed subject matter experts (SME) from other districts; senior level experts from other districts; Center of Expertise staff; appointed SME or senior level experts from the responsible district; experts from other USACE commands; contractors; academic or other technical experts; or a combination of the above. A brief description of HHD Supplemental ITR member credentials and relevant experiences are attached. The team was comprised of:

- Regional Technical Specialists;
- Post-Katrina Evaluations Experience (IPET participation);
- COE Subject Matter Experts; and
- Project Sponsor Subject Matter Experts.

CONCLUSIONS

ITR Team comments and Jacksonville District responses were discussed with representatives of the South Florida Water Management District and representatives of the United States Army Corps of Engineers, Headquarters, South Atlantic Division and Jacksonville District during a meeting held in Jacksonville 6-8 September 2006.

The Jacksonville District will revisit and address each of the points, comments, concerns and suggestions contained in the 2006 HHD Supplemental ITR in all future plans for HHD. In addition, the Jacksonville District will implement the 12 points for applying lessons learned resulting from Hurricanes Katrina and Rita as stipulated in CECW Guidance Memorandum, Subject: CG Directive #1 - Supplemental Actions to the USACE Campaign Plan, Applying Lessons Learned resulting from Hurricanes Katrina and Rita in all future plans for HHD.

Signed:

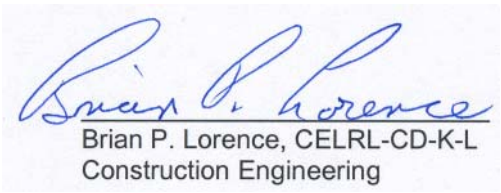
Stephen C. Duba, PE
Chief, Engineering Division

Supplemental Independent Technical Review (ITR)

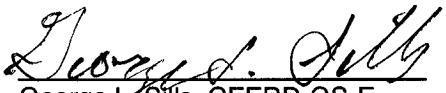
Findings and Conclusions

26 September 2006

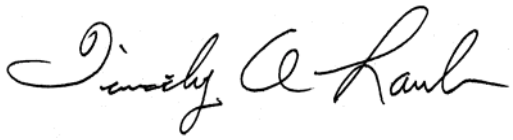
The HHD Supplemental ITR Team has completed its review in accordance with the ITR Plan. All comments, responses, issues and concerns resulting from this ITR have been fully addressed.



Brian P. Lorence, CELRL-CD-K-L
Construction Engineering

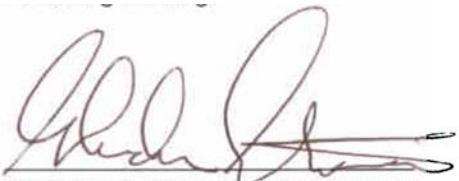


George L. Sills, CEERD-GS-E
Geotechnical Engineering

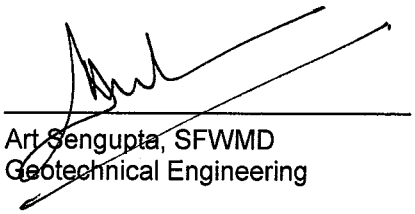


Timothy A. Lamb, CELRL-ED-M
Cost Engineering

Kenneth E. Henn, CELRL-ED-T-G
Engineering Geology

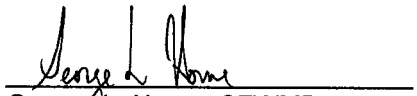


Glendon T. Stevens, CENAP-EC-H
Hydrology and Hydraulics,
Water Management/Dam Safety

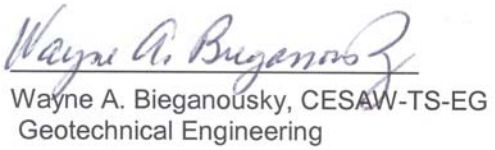


Art Sengupta, SFWMD
Geotechnical Engineering

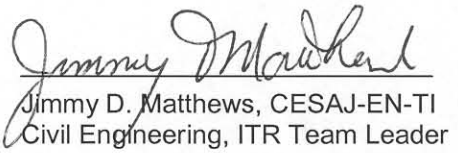
Randall A. Wise, CENAP-EC-H
Hydrology and Hydraulics



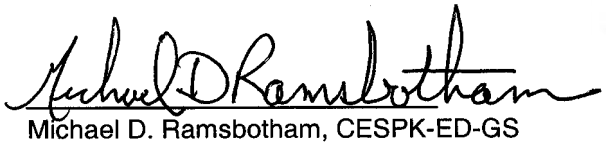
George L. Horne, SFWMD
Operation and Maintenance



Wayne A. Bieganousky, CESAW-TS-EG
Geotechnical Engineering



Jimmy D. Matthews, CESAJ-EN-TI
Civil Engineering, ITR Team Leader



Michael D. Ramsbotham, CESPK-ED-GS
Geotechnical Engineering

Supplemental Independent Technical Review

Findings and Conclusions

26 September 2006

FINDINGS

The ITR Team has conducted its review, provided comments to the Project Delivery Team (PDT), reviewed responses to its comments and met with representatives of the South Florida Water Management District and representatives of the United States Army Corps of Engineers, Headquarters, South Atlantic Division and Jacksonville District to discuss comments, responses, issues and concerns. The meeting was held in Jacksonville 6-8 September 2006.

The ITR Team principal findings are:

- The Jacksonville District has agreed to an appropriate action to each comment;
- The Jacksonville District has shown a willingness and commitment to fully address all of the ITR comments;
- The Corps of Engineers has accepted the recommendation of the ITR Team to remove design constraints and to let the PDT work towards a design solution that is focused on public safety and risk reduction goals; and
- The Jacksonville District has shown willingness and commitment to fully incorporate the IPET overarching lessons learned encompassing resilience, redundancy, systems performance, and risk and reliability.

CONCLUSIONS

United States Army Corps of Engineers as a whole and the Project Delivery Team specifically are now on the right path forward.

Continued Independent Technical Review and Peer Review will be necessary to see the project through to completion.

Some of the major points of discussion and conclusions from the above referenced meeting are as follows:

- All attendees shared/expressed concern over the safety of the project due to potential failure from internal erosion and/or slope stability.
- All attendees agreed that remediation efforts should be expedited.
- The ITR Team expressed concern over the Reach 1A filter design at the toe of the dike. They specifically recommended that the restraints placed on the original designers be lifted, particularly with respect to real estate. They recommended that the open ditch/canal at the toe of the dike be filled with appropriate filter material and a “seepage berm” be adopted in lieu of the current design. Attendees were in agreement with this recommendation.

- The ITR Team expressed concern relative to the design of the cutoff wall. Specifically, they felt that there is not sufficient subsurface data available to fully support the design. Attendees agreed that additional investigations will be conducted to re-evaluate the design. The designers will re-evaluate the location, depth and top elevation of the wall. This will be done considering constructability, stability of the downstream slope with the wall open, under seepage, and the design pool elevation with potential wind impact on lake elevations which may influence the height of the wall. Applying the lessons learned from Katrina was emphasized and in particular with respect to redundancy and resilience.

- Environmental concerns and the need for further coordination with the appropriate agencies were noted with respect to any changes in the design. Specifically, the impact on the groundwater associated with any changes in the design of the cutoff wall as well as the impact of filling the downstream ditch will need to be reviewed. The Jacksonville District is aware of these issues and recognizes the urgency in resolving them.

- The ITR Team cautioned that the design "trail" for this project should be well documented such that it can be easily followed. Attendees concurred.

- The ITR Team, as well as other attendees, emphasized the need to evaluate the integrity of the dike at the interface between the embankment and the structures/culverts and of the structures/culverts themselves to ensure a consistent level of protection is achieved around the entire perimeter of the Dike. This will be done and will be considered as part of the system's performance evaluations.

- Concern over the integrity of the dike was specifically expressed in areas where seepage and piping can not be monitored such as in the areas of the quarries and where deep drainage ditches and/or excessive vegetation exist. Attendees concurred that these areas would receive a high priority for immediate remediation.

- The ITR Team suggested further discussions be conducted on a dike closure plan if a breach occurs. The Jacksonville District agreed to hold such discussions.

- It was noted that the problems with and future actions relative to the existing Subreach 1A Contract are being evaluated by the Jacksonville District.

- The contractor for the Subreach Contract 1A will reconstruct the dike to the pre-construction condition and the toe of the dike will be stabilized as needed.

- The Jacksonville District will develop an overall schedule for the project and update the Project Management Plan accordingly.

- Attendees emphasized the importance and need for a Communication Plan for the project. Jacksonville District representatives noted that it was being worked.

- The Jacksonville District noted that this ITR Team will be retained and used for review of future reports/documents//designs on the HHD project.

COMMENT SUMMARY

The following is a Summary of the ITR comments as provided to the Jacksonville District. The ITR comments with annotated responses by the Jacksonville District follow this section. The Jacksonville District has agreed to an appropriate action to each comment.

The Supplemental ITR team provided its comments with the expectation that this information will assist the design team. The ITR Team's comments, as valuable as they may be, should not be considered design directives. The engineers that have been working on HHD have the experience and knowledge base and overall understanding of the system to take the team's comments and make the best use of them to arrive at the optimum solution for HHD.

OVERALL:

The issue of whether HHD should be evaluated as a dam or a levee should be resolved. HQUSACE should provide additional guidance and clarification to the design team.

Lessons learned from Katrina (IPET Volume 1) with respect to resilience, redundancy, and systems performance should be applied.

- The present analyses and designs do not demonstrate resilience in response to combinations of high lake stage and storm surge. Additional analyses should be conducted to assess wave induced erosion and overtopping either as a separate failure mechanism or as a contributing factor to seepage, piping, and slope stability failure modes.
- The scope of analysis and design does not adequately address systems performance. Variable crest elevations, transitions, and penetrations of the dike, such as the water control features, should be evaluated in greater detail since these locations represent areas of increased vulnerability.
- Right-of-way restrictions along a project should not be used or accepted as an excuse not to obtain adequate project required data. Also these restraints should not restrict final design requirements.

The enhanced design objectives, as stated in the DDR for Reach 1, Subreach A, appear to have prevented the design team from attaining the best geotechnical solution. These constraints should be reevaluated and their impact on the project reassessed. Careful consideration must be given to all tradeoffs such that the primary goal is not compromised.

Methods of analysis and standard of care used in the Rehabilitation Report and subsequent design documents are appropriate and consistent with state of the practice. However, the ability to adequately represent actual and in some cases deteriorated foundation conditions is constrained, particularly given the complex geology and heterogeneity of the dike and foundation. Thus, particularly in these areas, a higher level of conservatism may need to be applied.

The team did not have time to adequately review the MRR statistical/probabilistic analyses performed in support of the determination of relative economic benefits of alternatives. Per guidance levee and dam final design is deterministic and based on factors of safety. Final design

is not based on assessment of risk and reliability of component performance. Additional work at defining risk is justified for this project.

SPECIFIC TO REACH 1 SUBREACH A DESIGN:

The design documentation did not keep pace with the final design. The DDR and DA need to be expanded to include a) seepage analyses for the current design geometry, b) construction stability using wedge analyses, and c) verification/confirmation of the filter design.

The real estate restrictions have negatively impacted the design. In the DDR for Reach 1, Subreach A there are two enhanced design objectives that appear to be constraints. These are a) The design should limit (as much as possible) downstream construction to approximately the midpoint of the existing ditch, and b) The design should not increase real estate requirements beyond the requirements associated with the MRR design.

The current contract sequencing into Subreaches needs to be re-evaluated. Other sequencing appears to be warranted. Reaches with deep excavations along or in vicinity of the land side toe are very vulnerable. The probability of developing high differential heads leading to piping and erosion is significantly greater in these than in other areas. Drainage canals at water control structures and quarries are examples of vulnerable areas. The prospect of foundation failure into the quarry located in Reach 1 is particularly troubling and this area should be addressed immediately.

Failures due to piping and internal erosion are also serious threats to HHD. A history of poor performance at some locations indicates that remedial actions/repairs should be accomplished without delay at those locations. Problem locations should be identified and given highest priority. The current contract installation sequence should also be compared to the needs at those problem areas and adjusted accordingly.

Uncertainties with respect to subsurface conditions should be reduced. A higher level of field explorations and in-situ testing are warranted to reduce uncertainty in subsurface stratigraphy and engineering properties.

The existing toe ditch should be completely filled by constructing an inverted filter/seepage berm. Consideration should be given to deleting the relief trench component of the design. From a practical stand point, filling the ditch should provide the greatest benefit / risk reduction for the project.

Geotextile filters are typically not used in dams or critical locations that cannot be easily inspected, repaired or replaced. Filter performance is critical. The filter design should be reviewed in detail.

At this point the geotechnical reviewers have differences of opinion as to the feasibility or need for a deep cut off wall. There exists enough uncertainty in the foundation materials that a deep cutoff wall should still be considered as a viable option to reduce seepage and piping which may be occurring into the lower formations and bedrock, especially in areas where the toe adjoins areas containing deep excavations or where area to construct an effective seepage berm is restricted. The benefits and impacts of a deep cut off wall should be determined through additional explorations and analyses including, deep exploration holes along the proposed alignment,

modified seepage models, updated seepage analyses, and determination of impacts to local and regional groundwater regimes.

The likelihood a partial cut off wall will intercept existing pipes or seepage paths is high and may be justification for keeping the cut off wall in the design along with a seepage berm, especially in those reaches that have already experience poor performance, e.g. excess seepage, internal erosion, and boils. The cut off wall location is atypical but understandable in light of the design goals which are to reduce seepage volume, reduce exit gradients, and cut off existing pipes and near surface seepage paths. In practice, partial cut off walls have not been successful in significantly reducing seepage or exit gradients in contrast to what seepage analyses typically indicate.

Instrumentation should be a part of every design. An instrumentation system including piezometers, weirs, survey monuments, etc will allow the design team to monitor construction activities, monitor and adapt their designs, and provide valuable long term data on project performance.

A full time field geotechnical engineer with experience in cut off wall installation, similar to an embankment engineer for a dam, should be assigned to each construction contract. This engineer should be familiar with the design and design assumptions; be responsible for making sure the design is correctly applied and when required adapted to field conditions; and confirm that the plans and specifications are being interpreted correctly. Resident Engineer Staff should include inspectors with specialized experience in cut off wall construction.

Timothy A. Lamb, P.E., CCE
Cost Engineer

Mr. Lamb is a Lakes and Rivers Division National Technical Specialist for Cost Engineering. Mr. Lamb has 22 years experience in the preparation of cost estimates and has extensive first-hand knowledge of the design process, including the steps to complete a design and proper estimating standards and rules for producing a design estimate. He has expert knowledge in design and construction processes for civil works, environmental remediation and vertical construction projects. He is a recognized expert in the field of civil works environmental estimating for both the construction and design phases. He is the U.S. States Army Corps of Engineers 2006 National Cost Engineer of the Year. He has a B.S. Applied Science, University of Louisville, 1982 and a M. Eng. Mechanical Engineering, University of Louisville, 1983. He is registered professional engineer.

Brian P. Lorence
Construction Engineer

Mr. Lorence has 28 years experience in construction engineering. His experience encompasses Environmental, Military and Civil Works projects. Related experience is the Mississinewa Dam Remediation Project where he served as Project Engineer and Temporary Resident Engineer. The Missisinewa Dam Remediation project called for the installation of a 2400 lineal foot 150 to 230 foot deep concrete cut off wall along the top of a portion of the flood control dam. He has a BSCE, Michigan Technological University, 1971.

Kenneth E. Henn III, P.G.
Engineering Geologist

Mr. Henn is a Lakes and Rivers Division Regional Technical Specialist for Engineering Geology. Mr. Henn's 15 years of expertise includes: Rock Mechanics (laboratory and applied techniques); subsurface and surficial geotechnical investigations; armor stone, riprap, and concrete materials, including quarry methods, testing and evaluations, and construction applications; Dam Safety Portfolio Risk Assessment evaluations including foundations, instrumentation, and seepage and piping; cutoff walls; grouting; karstic foundations; glacial geology; tunneling investigation and design; navigational structure design and stability analysis; rock anchors; and foundation excavation, preparation, and mapping. He currently serves as Geological lead for all Dam Safety projects in the Louisville District, including reservoirs, levees, and navigational structures. He has a B.S. Geology, University of Cincinnati, 1993 and Intensive Course on Engineering Geology and Rock Mechanics, Virginia Tech, May-July 2004. He is a registered professional geologist.

Wayne A. Bieganousky, P.E.
Geotechnical Engineer

Mr. Bieganousky's is a South Atlantic Division Regional Technical Specialist for Geotechnical Engineering. His expertise includes: shallow and deep foundation design, slope stability analyses and slope stabilization, liquefaction analysis, embankment design, seepage analysis,

lateral earth pressure on bulkheads, retaining walls and braced excavations, filter design for dams, roads and hydraulic structures, slope protection, dewatering analysis, settlement analysis, offshore beach renourishment investigations, characterization of navigation channel soils and rocks for dredging purposes, design of dredged material disposal area dikes, soil stabilization, site and soil improvement, geotechnical site investigations, preparation of design documents, plans and specifications, independent technical review and forensic engineering of failed structures. He has a MSCE, Geotechnical Engineering, Purdue University, 1983; BSCE, The Citadel, 1969 and a LTT, Geotechnical Engineering, University of California, Berkeley, 1979. He is a registered professional engineer.

Michael D. Ramsbotham, P.E., G.E.
Geotechnical Engineer

Mr. Ramsbotham has 30 years of experience in the field of Geotechnical Engineering. He is a South Pacific Division Regional Geotechnical Specialist and a Sacramento District Senior Geotechnical Engineer and Levee and Embankment Specialist. His experience encompasses a variety of design and construction support assignments, involving: instrumentation; shallow foundations; deep foundations, (piles and caissons); emergency levee response and flood fighting; AC and PCC pavements; pavement evaluation and repair; periodic and preflood dam inspections; dam safety training; embankments; rock and soil anchors; levees; slope stability; seepage and seepage analyses; geosynthetics; rock erosion protection; grouting; and slurry walls. Currently Mr. Ramsbotham is serving on the USACE Seepage Committee, the USACE Levee Risk Assessment Methodology PDT, the California Delta Risk Management Study Steering Committee, and the Success Dam Rehabilitation PDT. He has a BSCE, North Carolina State University, 1973 and a MSCE Geotechnical Engineering, North Carolina State University, 1978. He is a registered professional engineer.

Art Sengupta, P.E.
Geotechnical Engineer

Mr. Sengupta has been with the South Florida Water Management District for over 11 ½ years and has been involved in the design of many water resource related projects with a strong emphasis on geology, geotechnical engineering and project management elements. Prior to that, Mr. Sengupta worked in the geotechnical field in both the private and academic areas. He has advanced degrees in engineering, geology and management. He is a professional engineer and a geologist and has designed and constructed a 4 mile long soil-bentonite wall on the L-8 Canal levee in West Palm Beach, Florida. He has taught graduate level classes at Florida International University, Miami. He has a MS Applied Geology, University of Delhi, India (this degree is a 6-year integrated program related to Engineering Geology, Soil and Rock Mechanics); a MS Geology, University of Michigan, Ann Arbor, MI; a MS, Petroleum Engineering, University of Houston, TX and a MBA, University of Houston.

George L. Sills, P.E.
Geotechnical Engineer

Mr. Sills has 32 years experience and is a Geotechnical Specialist/ Research Engineer with the Geotechnical and Structures Laboratory, U.S. Army Engineer Research and Development Center. He is responsible for several major ongoing projects related to dam safety and seepage and piping. He is currently developing a toolbox for the COE to use in performing Probabilistic Risk Assessments (PRA's) for COE dams, and is also rewriting the COE levee design EM, which instructs engineers in proper design procedures for levee under seepage. Mr. Sills was selected to serve on the Corps' National Levee Safety Program to help set policy/methodology for the Corps' levee assessments in the future. Most recently, Mr. Sills was selected to serve on the Corps' Interagency Performance Evaluation Task Force (IPET) following Hurricane Katrina as a member of the Perishable Data Team and also as a member of the Performance Analysis Team. In 1999 Mr. Sills was selected as the U.S. Army Corps of Engineers "Federal Engineer of the Year", and was then selected by NSPE as one of the top ten "Federal Engineers of the Year." He has a BSCE from Mississippi State University, a MSCE from Texas A & M, and is currently a Doctoral candidate at Louisiana State University. He is a registered professional engineer.

Glendon T. Stevens, P.E.
Hydrology, Hydraulics and Coastal Engineering

Mr. Stevens is Chief of Hydrology, Hydraulics and Coastal Engineering for the Philadelphia District, U.S Army Corps of Engineers. He has 27 years of experience in all facets of water resources engineering. He has experience working on 1, 2 and 3d models of surface and subsurface flow, transport and density driven flow problems, development of frequency flow and design storm estimates, reservoir overtopping studies, post construction storm water management plans, erosion and sediment control plans, and flood control and environmental restoration studies. Related work experience includes ITR of the groundwater portion of the Kootenai River Study for NWS, development of Aquifer Storage Recovery models for the Comprehensive Everglades Restoration Project and ITR of hydrologic/ hydraulic aspects of Mississippi and Louisiana Coastal Protection and Restoration Studies. He has a BSCE, University of Missouri at Rolla, 1976 and a MSCE, University of Missouri at Rolla, 1978. He is a registered professional engineer.

Randall A. Wise, P.E.
Coastal Engineer

Mr. Wise is a North Atlantic Division Regional Technical Specialist for Coastal Engineering. He has 15 years experience. Mr. Wise's expertise includes: beach fill design, hurricane and storm damage reduction analysis, coastal hydrodynamic and sediment transport processes, tidal inlet processes, coastal and inlet processes modeling, beach profile and shoreline data analysis, coastal structure design, beach fill monitoring, and project performance assessment. Expertise in modeling and data analysis applications includes: SBEACH, GENESIS, BMAP/RMAP, EST, ADCIRC, STWAVE, IMS, CEDAS, and ArcGIS. His related areas of experience are wave mechanics and wave runup. He has a BSCE, University of Delaware, 1989 and a MSCE, University of Delaware, 1991. He is a registered professional engineer.

George L. Horne
Operations & Maintenance Resources

Mr. Horne was named South Florida Water Management District Deputy Executive Director for Operations and Maintenance Resources in June 2002. He has held executive-level management positions in the District's public works area since July 2001.

In this role, he is responsible for overseeing operations and maintenance of the Central and Southern Florida Flood Control Project, as well as other District water control and conveyance facilities. This water management system includes approximately 1,100 miles of canals, 720 miles of levees, 200 major gate and water control structures and 27 major pump stations across the District's 16-county region.

Mr. Horne has 30 years of District experience in water resource operations and maintenance. His career highlights include pump station design, automation and supervision, engineering management, team building and efficiency expertise.

From 1999 - 2001, Mr. Horne served as director of O&M Field Operations North. Prior to that, he was director of the Pump Station Division from 1993 to 1999, and assistant director from 1991 to 1993.

Jimmy D. Matthews, P.E.
Civil Engineer and ITR Team Leader

Mr. Matthews has 28 years experience in planning and designing civil works water resources projects. In his current position he performs quality control and quality assurance (QC/QA) activities including …Quality Management Program Assessments, Technical Reviews, Independent Technical Reviews (ITR), and QA for Architect-Engineer (A-E) contracts and QA for products prepared by Jacksonville and other COE Districts. He serves as ITR team leader leading and managing (inclusive and diverse) 8-15 member Regional, National and District teams. As a Civil Engineer he provides solutions for a wide variety of projects. Project types include all aspects of the civil works program covering navigation, shore protection, flood control, and ecosystem restoration. He has a B.S.C.E., Virginia Polytechnic Institute and State University, 1978 and has completed graduate course work in Structural Engineering and Construction Management. He is a registered professional engineer.

CHARGES

Charge 1. *Review and comment on the assumptions, methods, analyses and design and conclusions drawn from the MRR, DDR and VE Study and how they pertain to the design presented in the P&S.*

Ch1_MDR-1. Comment: The MRR, various DDRs, VE, ITRs and reviews adequately document the process leading to the Plans and Specifications for Subreach 1A. These documents reveal how a preferred geotechnical solution proposed in the MRR was modified as addition constraints were identified and imposed on the design solution. Numerous seepage and stability analyses were performed to support the evolving design. However, it appears that the DDR did not keep up with the "final" design presented in the Plans and Specifications for Reach 1 Subreach A.
Basis of Comment: Information not found in the Final Design Submittal Design Documentation for the Construction of Herbert Hoover Dike prepared by URS dated October 2004 or the Detailed Design Report and Design Analysis Volumes 1 and 2 prepared by URS dated 9 August 2004.

Refer to EM 1110-2-1913 Design and Construction of Levees and ETL 1110-2-569 Design Guidance for Levee Under seepage.

Significance of Comment: It is critical that the basis of design be completed for the current design and the DDR updated.

Specific Actions Needed to Resolve: The current design configuration with the partial cut off wall and shallow relief trench and partial and completed inverted filter toe ditch lining, should be fully analyzed. Seepage and stability analyses should be performed for all four (A through D) selected subsurface models / design cross sections. Particular attention should be paid to calculated exit gradients in the toe ditch bottom and on the toe ditch side slopes. Exit gradients landward of the toe ditch should also be checked.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The DDR for R1A will be updated. The selected final design configuration will be fully analyzed for each subsurface soil profile / design cross section. Attention will be given to calculated exit gradients within the ditch (lakeside and landside of the toe ditch) to document that calculated factors of safety for piping potential are within acceptable limits. Consideration of areas landward of the toe ditch/ROW will require additional survey coverage.

Ch1_GLS-1. Comment: Reference the design objectives listed on page 7 DDR 1. Remove the real estate objective from the objectives/restraints.
Basis of Comment: After reviewing the MRR, DDR and VE Study it is my opinion that these documents have done a good job in reviewing and designing some potential engineering solutions to the current problems that exist at HHD. After following the documents, it appears that the P&S does reflect the intent of this process. The main problem I see with the process is that it appears USACE may have restricted the designers to a design without complete regard to the overall safety of the public. The design restraints (DDR 1 design objectives) seem more concerned with minimizing small inconvenience to the local residences than overall safety. I believe a better approach would have been to first ask the engineers for a safe positive solution to the problem and then design engineered solutions to minimize the effect on the local area.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will work with SFWMD to ensure that adequate RE is provided. At the time of the design, the design objectives imposed on the project did constrain our efforts to select remedial measures to repair the HHD. The solutions were developed under a set of competing requirements that served to restrict our ability to obtain the best option to promote the safety of the dike.

Ch1_WAB-1. Comment: All models representing the existing conditions should produce a factor of safety of 1 for piping since the geology and permeability is indeterminate. I am not certain that this was done based on a letter from URS to the COE (URS letter dated 10 Jan. 2002) wherein it was stated that the factors of safety for existing conditions ranged from 1 to 10. If the models were not calibrated to a factor of safety of 1 for existing conditions, there may be unconservatism built into the analyses if piping was undiscovered (or imminent). The models are only as good as the data input, and in this case the data is largely indeterminate due to the heterogeneity, anisotropy and structural defects (cracks, fissures, voids in the limestone) that are undefined. Basis of Comment: The potential for a failure of the HHD is well documented and not understated. The geology is very complex and no number of borings or other exploratory means could define it well enough to cover every stratigraphic variation. Failure by piping is the most difficult problem to model as piping depends on spot weaknesses within the foundation or embankment instead of gross or mass properties. Consequently, a higher level of conservatism is warranted for this project given the hydraulic considerations (primarily the lack of hydraulic outlet capacity), the geologic complexity, and the potential for failure to occur during a hurricane when recognition of imminent failure and emergency repairs are impossible. It is in this respect that the Herbert Hoover Dike is most like the New Orleans levees.

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. We will review the geotechnical parameters and design criteria to ensure that adequate safety factors were selected based on heterogeneous nature of the embankment and foundation materials.

The above analysis suggested by the reviewer, if applied to the entire length of the dike, may result in a remedial repair that is overly conservative and extremely expensive. This calibration approach will be considered as a check on the selected repair to ensure the design (under the worse case conditions) will maintain an appropriate level of safety. Furthermore since there are no reports of ongoing piping concerns within Reach 1A, the use of this approach as a design check will provide a higher level of confidence in the selected repair solution.

The calibration approach recommended by the ITR reviewer will be evaluated as a primary design methodology within sections of the HHD with known piping issues.

Ch1_WAB-2. Comment: With respect to seepage and piping, the parametric seepage analyses should be performed over reasonable ranges in permeability and permeability ratios (e.g. EM 1110-2-1901 recommends varying permeability anisotropy as k_h/k_v = 1, 10, 25, 100) to cover the range of expected field conditions and to account for our inability to precisely define the engineering properties. The assumed soil and rock permeabilities may not represent the range of values insitu, and consideration of a greater range of values for seepage analyses is recommended.

Basis of comment: Single values were assumed for permeability in the various stratagraphic profiles. These values were not based on pumping tests, which would give the most accurate measure of the mass permeabilities. Field bore hole permeability tests are limited by the small volume being tested and local conditions in the sidewalls of the borehole and may not be representative of the layer under consideration. Lab tests also are limited by sample disturbance and other test deficiencies. Correlations with field pumping tests in different geologic environments may not be reliable for this geologic setting. To overcome these difficulties a parametric study that covers the range of permeabilities and permeability ratios (to account for anisotropy) will add confidence to the results obtained.

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. We will revisit design input and perform sensitivity analyses as needed. As previously stated we attempted to select worse case soil parameter values for design based on our knowledge of the material present, the laboratory data available and our experience. A limited set of parametric studies were performed during the development of the 30 and 60 percent DDR reports to evaluate the sensitivity of the selected approach on the quantity of seepage that would flow through the repair. A check of selected strata for a range of anisotropic values of permeability is appropriate.

Ch1_WAB-3. Comment: With respect to slope stability, it is recommended that stability analyses consider a range of strength parameters (in contrast to the single values assumed). Since the embankment was built without the benefit of compaction and modern placement control procedures, it may be prudent to choose lower friction angles than normally assumed for loose sands, unless the relative density of the sands in the embankment and foundation are known and can support the assumptions. Strain compatibility does not appear to have been considered in the analyses and this could lead to greater strains during construction and in the long term.
Basis of Comment: The use of peak strength parameters for high strength brittle materials (soil bentonite and the gravel trench) with the peak strength parameters of more ductile behaving materials like peat and loose sands is inconsistent and the strength parameters should be made to be strain compatible. As it now stands, the peak strength of the soil-cement-bentonite wall will be fully mobilized at much lower strains than the peak strength of the loose sands. Thus, loose sand strength parameters should be minimized to account for the lower strength mobilized. This is also true for the peat (peak strength mobilized at 7.5% strain) versus the gravel drain (estimated at 3% to 5%).

Significance of comment:

Specific Actions Needed to Resolve:

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. We will revisit the parameters to ensure the proper shear strengths are selected for the analyses in regards to the above concerns, including strain compatibility. Evaluations using a range in shear strength values will provide additional reliability in the design approach selected. The range of SPT values obtained from the investigation were used to assist in the characterization of the embankment and foundation insitu densities and for the selection of appropriate shear strength values. As such we believe that the density of the embankment fill is relatively well represented. Given the relatively small percentage of the wall in the embankment section under consideration or within a potential failure surface under evaluation, it is not clear to us that this consideration will have a significant impact on the estimated stability of the embankment; we agree to evaluate this issue in current and future designs**.**

Ch1_WAB-4. Comment: The design of the toe ditch inverted filter should be redone without geotextile fabric since clogging of the fabric is likely to occur. Design the graded filters to accommodate the wide range of foundation materials in the toe ditch. Construction of the vertical drain of the toe ditch without fabric will be difficult, if not impossible, and consideration should be given to eliminating the vertical drain.
Basis of Comment: The vertical drain in the toe ditch will be very difficult to construct without geotextiles and may have to be deleted. The use of geotextiles in embankments is a controversial topic in USACE and is currently strongly discouraged.

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Geotextiles used as filters will be eliminated from the design. The use of geotextile in the design of the toe ditch inverted filter was included to accommodate constructability. While we concur that the geotextile is subject to clogging we have concerns on the constructability of a reliable inverted filter in the “wet” as was required in Reach 1A without a significant overbuild in the final section. Also, note that the relief trench (vertical drain) will be eliminated.

Ch1_KEH-1. Comment:Charge #1; Overall review. More detail as to the judgment which was used to determine how to represent the damaged character of the embankment and foundation materials needs to be documented to justify the reliability of the final design.
Basis of Comment: There appears to be an overall uncertainty on several issues which are impacting the reliability of the proposed remediation. These stem from the overall interpretation of the foundation character and the engineering geology impacts on the structure integrity, the ability to adequately represent these characteristics in the input parameters used to model the situation, and a sound geological or engineering basis for restricting particular remediation methods. It is the opinion of this reviewer that even when you think you have adequately painted

the worse case scenario you possibly can, the actuality that exists is much worse. Again, the ability to adequately represent the true deteriorated conditions of the site is very difficult based solely on limited field investigations and laboratory testing. I don't want to down play the effort exhibited by Jacksonville District or any of their Contractors, because the amount of effort to get to this point is absolutely extraordinary and all should be commended for their hard work and diligence. However, it must be acknowledged that due to the logistics, time, and cost associated with obtaining statistically supportable data, it is impossible to have a high degree of confidence that the true character of the structure is understood. It may appear that there has been much investigation done, however the amount of volume actually observed to make geologic and engineering judgments is but a small fraction of a fraction of the total volume of material comprising the structure and foundation which has been subjected to decades of service. Thus, this uncommon material requires the most conservative scrutiny in order to have a higher confidence that any proposed remediation will serve to help ensure the structural integrity of HHD.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur that the heterogeneity of structure offers unique challenges in characterizing the materials. We will revisit the geotechnical parameters to ensure adequate conservatism is incorporated into design solution. We will pursue additional explorations to support selection of design parameters. The ability to adequately represent the true deteriorated conditions of the site is very difficult based solely on limited field investigations and laboratory testing. Furthermore, the volume of investigative data is not and may never be sufficient to identify all the potential variations that exist within this structure. We have attempted to address this level of uncertainty with the selection of conservative soil parameters used in our evaluations. However, we agree that a reliability analysis would be prudent for the HHD given the unknowns and uncertainties in the available geotechnical data and the potential impacts from a failure of the dike. Design documentation will be enhanced to include detailed discussions on the rationale and judgment used for the final selection of design parameters.

CH1_AS -1. Comment: The current design of the dam is designed to accommodate SPF. Consideration to upgrade the protection to accommodate a PMF should be planned for this reach and other reaches currently under design.
Basis of Comment: 2005 National Inventory of Dams

Significance of Comment: Up gradation to accommodate a PMF will involve significant expenses and should be considered now rather than a future retrofit.

Specific Actions Needed to Resolve: Redesign. Please consider costs of implementing it now vs future up gradation.

Responder Name(s): Sean Smith-CESAJ,
Response: Concur,,. Flood protection is based on the current Federal authorization for SPF level. USACE intends to consider impacts/effects of other storm events through a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

CH1_AS -2. Comment: Storm surge can elevate the water levels as much as 15 feet. Add armoring of the bank to the current design.
Basis of Comment: BCI report, page 19, 30

Significance of Comment: Storm surge could result in erosion of the bank and overtopping.

Specific Actions Needed to Resolve: Armoring of the bank should be an integral part of the design. However this was not considered in the design; please review this requirement.

Responder Name(s): Sean Smith CESAJ

Response: Concur that armoring of the interior slope would be an ideal fix; however, given the size of HHD it would be very costly. We could consider looking at select armoring in areas more prone to damage i.e. look at prevailing winds and historical areas susceptible to the most damage. Storm surge analyses were developed within the Herbert Hoover Dike MRR, resulting in storm surges ranging in magnitude with frequency (relative to wind direction and location). As depicted in the MRR, the areas near Moore Haven received the higher storm surges (14.9 feet of surge based on a 200-yr return interval). An evaluation of pertinent storm surge effects will be considered as part of the Supplemental MRR. In addition, other similar analyses will be conducted as part of a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

CH1_GTS -1. Comment: Breach dimensions from piping or overtopping seem very small given the non cohesive nature of the dike, significant seepage through the dike and volume of the lake. The breach size sensitivity analysis only ranged from 750 to 1000 ft with a corresponding lake level drop of less than a foot in 45 days for each. Recent publications indicate lateral erosion can be significantly larger than predicted by earlier research and is driven in part by lake volume. Consideration should also be given to the occurrence of multiple breaches due to piping or overtopping failures
Basis of Comment: Underlying breach formation assumptions in the MMR analysis may not be applicable to Lake Okeechobee.

See
"Prediction of Embankment Dam Breach Parameters" DSO-98-004 USBR, July 1998.
"Dam Safety Guidelines Tech Note 1 Dam Break Inundation Analysis and Down stream Hazard Classification", Washington State Department of Ecology July 1992

Cursory application of MacDonald et al and Froehlich suggests a single breach may grow to 3 miles in length in 2 days.

Significance of Comment: . Flooding from a failure may be on a much more massive scale and greatly alter the economic analysis.

Specific Actions Needed to Resolve: Re check current literature for breach parameter estimation in non cohesive materials. Test sensitivity to a much larger breaches.

Responder Name(s): Sean Smith-CESAJ

Response: Concur. The breach analysis for the MRR was based on the earlier literature search related to the failure of earthen dams taking into consideration the aspects of HHD. The sensitivity analysis of various dam breach widths revealed minimal differences to impacts resulting in breach. In addition, the tailwater effects and compartmentalization of the surrounding areas would tend to reduce breach width dimension effects. Examination of the material cohesive/cohesionless properties can be re-examined to determine if this would have any differences on the analyses conducted to date.

CH1_RAW-1. Comment: In accordance with the stated problem identification and scope of the MRR, the analyses and design in the MRR, DDR, and VE study focus on failure in the dike due to seepage, piping, and structural stability during high lake levels. The analyses and design do not address wave-induced erosion and overtopping either as a separate failure mechanism or as a contributing factor to seepage, piping, and slope stability failure. This concern was expressed in the BCI review panel report. The Corps response to the BCI concerns, dated 7 May 2006, states that “other COE documents address other failure modes” and “seepage, piping, and slope stability were identified and confirmed as the most significant issues.” The assessment that piping and seepage are the most significant issues appears reasonable for conditions of relatively low return period storm surges combined with moderate lake levels. However for higher return period storm surges combined with the design lake stage, wave induced erosion and overtopping would appear to become very significant as a structural damage/failure mechanism. For example, the SPF lake level of 26 ft NGVD combined with a representative 100-year surge value of 10 ft exceeds the elevation of the lowest segments of the Herbert Hoover Dike. These conditions combined with wave setup and runup would likely overtop even higher sections of the dike. The critical concern is the potential for catastrophic failure due to lack of structure resilience under such conditions.

Basis of Comment: Established engineering practice includes consideration of the full range of potential structural failure mechanisms and incorporation of redundancies in a design to prevent catastrophic failures.

Significance of Comment: Performance and safety of the structure may be compromised under conditions of high lake level and storm surge.

Specific Actions Needed to Resolve: Additional analyses should be conducted to assess wave induced erosion and overtopping during elevated lake stage combined with high storm surge. Designs should be modified as needed to provide required slope armoring against wave erosion and overtopping damage.

Responder Name(s): Sean Smith-CESAJ

Response: Storm surge analyses were developed within the Herbert Hoover Dike MRR, resulting in storm surges ranging in magnitude with frequency (relative to wind direction and location). As depicted in the MRR, the areas near Moore Haven received the higher storm surges (14.9 feet of surge based on a 200-yr return interval). An evaluation of pertinent storm surge effects will be considered as part of the Supplemental MRR. In addition, other similar analyses will be conducted as part of a Limited Engineering Analysis, scheduled for completion in Fiscal Year

2007. Current authorization for rehabilitation is focused on seepage and piping, however, future studies should be performed to address the above concerns.

The analyses of wave-induced erosion and overtopping as a separate failure mechanism have not been addressed in the MRR nor subsequent documents. However direct consideration of high lake levels and storm surge was included.

Seepage and piping concerns are directly related to the change in total head across the embankment. As such high lake levels and storm surge were explicitly included in our evaluations of seepage and stability. However, given the transient nature of a storm surge loading on the embankment and the inability to fully develop a steady state seepage pattern, storm surge loading was not included in the evaluation of piping potential. Future analyses will address the effect of transient seepage resulting from this loading.

Ch1_JDM-1. Comment: Develop a GIS area plot of problems areas for seeping/piping, etc…. Determine the high priority repair areas based on past dike performance and need. Immediate repairs should be done in areas with highest number or more severe problems. Base the first contract on areas needing repair. Include dike through structures in analysis. The high need areas may not match contract reaches.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The GIS efforts will be coordinated with similar efforts by HQUSACE and the CERP Zone to avoid duplication of efforts. Also, rehabilitation efforts will reprioritized based on need.

CH1_JDM-2. Comment: HHD project life cycle documentation, archiving and office file maintenance need to be updated to current industry standards. HHD life cycle documentation needs to reside at one location overseen by file maintenance system that will be in-place for more than 5 years. The following EPA Hudson River site hyperlink is provided as an example of current industry standards and practice. http://www.epa.gov/hudson/background.htm
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ**,**

Response: Concur. Emphasis will be placed on maintaining thorough and comprehensive design documentation and continuity of institutional knowledge.

Charge 2. *Address whether the current models, modeling, solutions and design are consistent with the state of the practice.*

Ch2_WAB-1. Comment: Yes, generally. The analytical tools are state of the art. The design methodology was appropriate, though additional analyses (both seepage and slope stability) will have to be performed. An infinite number of models are possible with such variable conditions and the best that can be done is to bracket the range of stratigraphic profiles and material properties. The A/E attempted to bracket the stratigraphic profiles based on the geologic information available, but the success of that effort is subject to limitations in boring spacing, sampling, testing and interpretation of the data collected. More analyses of the kinds that have been completed are needed to bracket the material properties.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We agree that additional analyses to evaluate potential variations in material properties to improve the reliability of the selected design solution are appropriate and must be strongly pursued.

Ch2_KEH-1. Comment: Charge #2 and #3. It appears that the overall methods are consistent with the current state of practice in USACE design and analysis. It did not appear that it was made absolutely clear in the documentation as to the degree of certainty or uncertainty which all characterization of the foundation soils and bedrock has been made. It must be absolutely clear as to the degree of reliability the information used for modeling the HHD site and the proposed remediation holds. The limitations of the analysis due to the uncertainty of the input must be clearly documented to provide a sense of relative confidence that the proposed remediation will work in the assumed subsurface environment.
.
Basis of Comment: As with anything, the output is only as good as the input and all input parameters must be warranted for current understanding of the structure condition and documented as to their representativeness and degree of reliability or uncertainty.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: We will ensure the documentation adequately discusses the selection of design parameters. Also, further development of the level of uncertainty associated with the input data used in the design is warranted.

Ch2_MDR-1. Comment: The models, modeling, and evaluated measures are consistent with the state of the practice in levee design and repair. However the installation of a cut off wall on the land side or downstream side of a levee or dam is atypical.
Basis of Comment: Common practice is to install cut offs upstream of a levee centerline to obtain the most benefit / head dissipation.

Significance of Comment: It is important to document the benefits provided by the landside cut off wall.

Specific Actions Needed to Resolve: The contribution of the partial cutoff on the landside slope to the overall performance of the repair should be confirmed. Seepage analyses for the current design configuration with the partial cut off wall and shallow relief trench should be performed. In addition, the "during construction" stability analyses should be reviewed / reevaluated. Perform a wedge analysis for all four (A through D) design cross sections. The cut off wall should be modeled as a fluid filled tension crack or a vertical face with distributed hydrostatic load.

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted. The location of the cutoff wall was chosen to ensure full protection that HHD provides. Recent analyses have been performed on conditions encountered during construction and global stability has been ensured for all construction conditions.

While we agree the location of a cut-off wall on the downstream slope of a dike is atypical it is not without precedent. Selection of the cut-off wall location was documented in the DDR report. The design intent of the cut-off wall is to reduce the volume of seepage through the toe of the dike to facilitate a match of pre- and post-repair seepage quantities

Evaluations performed by URS Group have included seepage and stability analyses of construction and post construction configurations to assess the impact of the location of the wall on the dike. These analyses have included wedge stability evaluations of the dike with potential failure surfaces starting from the cut-off wall and surfaces starting from the crest for each subsurface profile identified in Reach 1A.

Ch2_MDR-2. Comment: Geotextile filters are normally not used in dams or critical location that cannot be easily repaired / replaced.

Basis of Comment: Draft guidance in EM 1110-2-1913 Design and Construction of Levees Appendix D Filter Design. Geotextile filter have been installed in many levee repairs with varying degrees of success. In some cases, installation of geotextile filters on wet, muddy subgrades resulted in the immediate clogging of the geotextile.
Significance of Comment: Filter design and installation are critical to the success of the design and long term performance.

Specific Actions Needed to Resolve: Current design guidance should be obtained from HQUSACE. Use of a granular filter layer should be considered.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will modify design to eliminate geotextiles used as filters. As previously indicated the selection of a geotextile filter in the inverted filter at the downstream toe of the dike was made based on constructability considerations.

Charge 3. *Address whether the statistical/probabilistic methods used in the Corps of Engineers documents are correct, and if not, what methods and/or analyses should be used.*

Ch3_MDR-1. Comment: The probabilistic methods used by the Corps in support of the Major Rehabilitation Report were appropriate. The deterministic design methods used to evaluate design measures and the selected final design are in accordance with current Corps guidance. The extrapolation and use of the simplified probabilistic methods to pass judgment on the final design and define risk is not appropriate.
Basis of Comment: EM 1110-2-1913 Design and Construction of Levees and ETL 1110-2-556 Risk Based Analysis in Geotechnical Engineering for Support of Planning Studies.

Significance of Comment: Our simplified methods of risk based analysis used in support of planning and justification for major rehabilitation are useful in comparing alternatives but do not accurately quantify absolute or total risk. The likelihood of miscommunication the true risk is significant when extrapolating our methods to the evaluation of deterministic designs and future conditions.

Specific Actions Needed to Resolve: If it is important to accurately define the risk HHD poses, then a full blown risk assessment for the entire dike considering all potential threats / modes of failure should be undertaken. Also, develop a strategic communication plan that accurately informs the public about the risk of living "downstream" of HHD.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The MRR risk-based analysis meets the criteria and state of the practice that was in effect at the time. It was focused on the economic analysis of the project, as required by the Budget EC at the time, specifically Reach 1A. Certainly, it was not performed to assess the overall risk that the structure represents or to evaluate alternate design solutions based on the risk reduction afforded. The risk analysis advocated by the reviewer, including all failure modes may be warranted for the understanding and communication of the risk that the structure represents. Upon receipt of the criteria under development as a result of IPET efforts, we will evaluate and incorporate in our analysis and design efforts.

Charge 4. *Address whether the current location (and design) promotes seepage and instability of the downstream slope.*

Ch4_WAB-1. Comment: Also see comment BCI_WAB-2. In general the location seems to be the best location for the cutoff wall. Uplift pressures will be higher but manageable if the slope stability factors of safety are adequate. The problem of seepage over the cutoff wall on to the downstream face will only occur with higher reservoir pools than analyzed. A simple solution would be to backfill above the wall with an impervious, non-erodible material or extend the inverted filter drain to a point above the cutoff wall to intercept seepage.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We agree that the potential problem of seepage over the cut-off wall warrants a simple solution similar to the ideas presented by the ITR reviewer if pool storage above the SPF is likely.

Ch4_GLS-1. Comment: The current design reason for the trench (cutoff wall) is to significantly reduce seepage and head at the dike toe. In the information I have reviewed, I do not believe that this is accurately determined. Based on all of my experience, every technical report on partially penetrating cutoffs, and the way this dike was constructed (by dredging form the lake and the heterogeneous makeup of the dike) the reduction shown in the furnished computations appear to be over enthusiastic. One would expect very small reductions from a partially penetrating cutoff like this.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, the cut-off wall was designed to reduce seepage quantities consistent with existing conditions and intercept potentially pre-existing piping paths. It was not our intention to reduce total head at the toe of the dike with this technology. The wall is not deep enough and there is no low permeability strata to act as a basal flow boundary beneath the HHD. The wall was designed as shallow as possible to minimize environmental impacts, mainly groundwater flow and regional hydrology.

Ch4_KEH-1. Comment: Charge #4. The location of the remediation does not appear to promote either seepage or instability of the structure. It appears that sufficient restrictions as to the amount and locations of open excavations have been made to limit any potential instability. It is important for the Contractor to assure trench stability by ensuring the slurry mix design is adequate to prevent trench collapse.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Strict adherence to the requirements in the plans and specifications will ensure the trench stability during construction.

Ch4_MDR-1. Comment: The proposed defensive measures (cut off wall to Elev. -10 ft, relief trench to about Elev. + 9 ft, and inverted filter in the toe ditch) will not cause an increase in seepage volume or cause a landside slope mass movement / failure. However, the proposed measures may not prevent seepage and internal erosion from continuing to increase. The effectiveness of the proposed design should be supported with additional seepage and stability analyses.

Basis of Comment: The seepage and stability analyses presented in the DDR and final DA, which cover a wide range of measures, configurations, alternatives, and variations in subsurface conditions and material properties.

Significance of Comment: The basis of design for the existing preferred alternative is incomplete.

Specific Actions Needed to Resolve: Seepage and stability analyses should be performed on the current design configuration. See comment Ch1_MDR-1.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Additional analyses have been performed and completed and will be included in the updated DDR. The selected final design configuration has been fully analyzed for each subsurface soil profile / design cross section. We agree attention should be given to calculated exit gradients within the ditch (lakeside and landside of the toe ditch) to document that calculated factors of safety for piping potential are within acceptable limits.

Charge 5. *Review and comment on the elevations and locations of the cutoff walls and repair measures.*

Ch5_WAB-1. Comment: The external constraints (groundwater regime, reservoir regulation, rights-of-way, environmental considerations, etc.) have an inordinate influence on the details of the design measures. Within the context of the limitations, the accuracy of the assumptions, and the design criteria, and the ability to define the engineering properties and strength parameters of the highly variable stratigraphic profile, the recommended repairs are probably about as good as can be obtained (exceptions noted in other comments). Relief from any number of the constraints could provide for a more conservative design.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur that relief of the design constraints applied to the design process would enable development of a more conservative design that better provides the resilience, reliability, and safety desired.

Ch5_GLS-1. Comment: I see no problem with the current location of the slurry trench (cutoff wall). The overall stability of the dike will be improved by this trench (cutoff wall).
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted.

Ch5_GLS-2. Comment: There is a major reason to continue the construction of this trench (cutoff wall). For years HHD has experienced sand boils at the toe of the dike and mainly within the toe ditch. Over the years these boils have moved significant amount of material from under the dike. We were told that at numerous locations these boils now start at greatly reduced lake levels than during previous years. This is a sign of the below ground pipes from those boils getting closer and closer to the lake. This slurry trench (cutoff wall) would cutoff existing pipes and prevent any more material from being piped from under the dike. For this purpose/function of the trench the current location of the trench is ideal.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Implementation of the proposed repair strategy will reduce the potential for development of piping at the downstream toe of the dike and promote the stability of the structure.

Ch5_GLS-3. Comment: Fill the toe ditch and replace this feature of the project.
Basis of Comment: The biggest and most serious problem I saw during our visit was the toe ditch. Most of the piping problems that have been located are within this ditch. SAJ appears to have done a reasonable job at locating many of these problems and trying to prevent their movement of material. The big problem is the ditch itself limits the ability for anyone to find all of these features. It only takes one not found and not controlled to eventually cause failure for the dike. Because of this, I strongly recommend that this ditch be filled. This fill should consist of granular material so as to relieve water pressures within this area. The filling of this ditch will inconvenience some people; however, features to offset this can be designed on a case by case situation. Filling of this will also prevent locals from pumping down the water in the ditch and causing a greater head differential on the dike. The filling of this ditch will greatly increase the overall safety of this structure and thus provide the public a much safer environment to live.

In addition to the ditch, areas where deep excavations exist along and near the dike are very dangerous. These areas include some if not all of the drainage/pumping plant sites. At most of the sites we were shown deep channels come close to the dike. At these sites any piping occurring could be easily hid. The current design/P&S do not seem to adequately cover the special needs for these structures.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will work with our local sponsor, SFWMD, to ensure adequate RE is acquired to implement this recommendation. Local runoff will be addressed and provided for. Filling the ditch at the toe of the embankment will improve the overall safety of the structure. Existing water control structures may require special measures to maintain their utility in the system.

Ch5_KEH-1. Comment: Charge #5. It appears that there is sufficient uncertainty as to the influence the karstic limestone has on the overall seepage and piping condition at HHD. It is very common in karstic limestone, to have piping occur in the foundation with no visible surface expressions as to the condition exists until the embankment is effected. Due that fact, there is question as to the intent and reliability of the proposed cutoff which only partially cuts off the overburden and rarely penetrates the top portion of limestone. If the limestone does in fact play at critical part in the condition, then the proposed partial cutoff wall will not do anything to intercept those seepage and piping pathways.
Basis of Comment: The cost of installing a full depth cutoff wall would appear to be not that much more of an expense than the existing partial wall. The amount of funds spent to install a partial cutoff does not appear to decrease uncertainty that the seepage and piping has been arrested. The additional amount of funds spent to install a full depth cutoff wall appears to increase certainty and reliability that the seepage and piping would be controlled.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future designs will provide for a variable depth of the cutoff wall consistent with the local geology and with the goal of extending the barrier (partial cutoff wall) through the bottom of the limestone units. Installing a deeper cut-off wall have positive benefits on reliability of the repair of the dike.

Ch5_MDR-1. Comment: The ditch lining and geotextile filter should extend up the far slope of the ditch in all cases to guard against boils and erosion. Lining the ditch may also make control of vegetation and maintenance easier.
Basis of Comment:

Significance of Comment: Potentially critical depending on final seepage analyses.

Specific Actions Needed to Resolve: Run seepage analyses for current design geometry.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, the geotextile lining will be used for constructability purposes.

Ch5_MDR-2. Comment: The relief trench could be deleted since it does not extend much below the invert of the ditch. Seepage collection and reduction of uplift pressures may not be significantly different with or without the relief trench.
Basis of Comment:

Significance of Comment: Potential significant cost savings.

Specific Actions Needed to Resolve: Run seepage analyses for current design geometry.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The relief trench will be eliminated as a main design element and the conceptual design will focus on a seepage berm at the toe in combination with a partial cutoff wall or barrier mostly through the center of the embankment, as appropriate. In addition, the toe ditch will be backfilled. Complete deletion of the relief trench is appropriate when additional toe protection is provided through an inverted filter over the entire ditch (additional lining of the ditch) and / or by elimination of the toe ditch in its current location.

Ch5_MDR-3. Comment: The cut off wall could possibly be deleted, particularly where the ditch lining extends up the slope as shown in design sections D & E.
If it is found that the cut off wall provides no or little reduction in seepage quantity and the ditch lining can adequately control exit gradient and collect seepage, then the cut off wall main purpose is to interrupt existing pipes / defects. In this case the cut off wall could be limited to those reaches that have suffered internal erosion and piping into the ditch or exhibit the greatest potential for internal erosion.

Basis of Comment:

Significance of Comment: Potential significant cost savings.

Specific Actions Needed to Resolve: Run seepage analyses for current design geometry.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. One of the main purposes of the cutoff wall is to intercept pre-existing pipes within the HHD foundation. The design selected for Reach 1A is not intended to be the remedial measure of choice for the entire length of the HHD system. Each reach must be evaluated to ascertain how to best address the issues of seepage, piping and stability at that location.

Ch5_MDR-4. Comment: A partial cut off wall will likely be ineffective in reducing seepage volume and exit gradients even though the simplified seepage modeling results indicate otherwise.

Basis of Comment: Sacramento District designed and constructed partial cut offs only to still suffer poor performance (seeps and boils at the levee toe). In general, analyses indicate a cut off needs to be greater than 95% complete to provide significant improvement in conditions.

Significance of Comment:

Specific Actions Needed to Resolve: Run seepage analyses for current design geometry. Evaluate the benefits and costs of the cut off wall component in comparison to modifications to the ditch lining component of the design.

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted. One of the main purposes of the cutoff wall is to intercept pre-existing pipes within the HHD foundation. From this perspective, the cut-off wall by itself is not a viable choice to improve the performance of the HHD against potential piping and slope instability for Reach 1A. Our general design goal remains to avoid the design of a fully penetrating cutoff wall and to build the wall as needed to address foundation defects. Exceptions to this goal will be driven by local circumstances and geologic considerations.

Ch5_MDR-5. Comment: It is unlikely a complete cut off can be constructed in this geologic environment however it may be feasible to construct a cut off wall deep enough to intercept existing or potential seepage conduits.

Basis of Comment: I think there are better alternatives than a deep cut off wall, but others think it is necessary to have a deep continuous cut off wall to assure the integrity of the Dike and prevent failure. It may be best to fully evaluate this measure so there is a rational basis for decision making.

Significance of Comment: Significant increase in cost and impact to current design and construction schedules.

Specific Actions Needed to Resolve: The design team should decide if it is necessary to cut off potential seepage paths in the embankment and deep into the foundation. If so, then add deep exploration drill holes along the proposed alignment to further refine the subsurface stratigraphy. Modify the seepage models, and run seepage analyses as appropriate. Determine impact to regional groundwater.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur, see above response.

CH5_AS-1. Comment: Delete interceptor trench from the scope.

Basis of Comment: Interceptor trench will add more water to the toe of the levee which may be detrimental to the stability of the dike.

Significance of Comment: Dam Safety implications.

Specific Actions Needed to Resolve: Why not eliminate the interceptor trench? Having the trench will result in bringing out more water to the surface than desired.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will revisit the design to eliminate the relief trench. See also response to previous comments.

CH5_AS-2. Comment: The depth of the slurry wall needs to be deeper depending on the geology. At locations the trench will be 60 to 70 feet.
Basis of Comment: The deep slurry wall will reduce the exit velocities at the toe of the levee. In our previous discussions with the COE, we were informed that there was a feeling that a deep wall will cut off water to the adjacent farm lands. Since there are no aquicludes in the subsurface, it is unlikely that the deep wall will cut off the source of water for the adjacent farm lands.

Specific Actions Needed to Resolve: MODFLOW model to model the dike and selected sections can be verified by SEEP/W. I was informed by our modelers that a regional groundwater model exists for the area which could be tweaked to model the lake.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The depth of the cutoff wall will be as needed to ensure all seepage paths are intercepted based on geologic conditions.

Ch5_JDM-1. Comment: Review the depth of the cutoff wall as being one depth over long project reaches. It appears that more than one depth is needed to comply with the varying conditions within each subreach.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The depth of the cutoff wall will be as needed to ensure all seepage paths are intercepted based on geologic conditions.

Charge 6. *Address whether the P&S adequately address dike integrity by construction activities.*

Ch6_WAB-1. Comment: The overall integrity of the dike is adequately addressed by the requirements presented in the plans and specifications.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted.

Ch6_KEH-1. Comment: Charge #6 & #7. The Plans and Specs appear to be adequate to address any structural stability issues during construction. It is up to the Contractor, the Contractor's Quality Control, and the Government's Quality Assurance to ensure that the Specifications are properly implemented.

Basis of Comment: It is this reviewer's opinion that it is quite often the inability of the Contractor to properly initiate a QC program to ensure that the criteria set forth in the Contract Plans and Specifications are implemented properly. It is up to the Governments QA personnel to make certain that the Contractor has a vigorous and competent QC program established that has the power to shut the project down if things are not going according to the P&S. If this is the case, seldom to major problems occur and if they do, they are identified promptly and corrected before either an inferior product is constructed or a catastrophic impacts to the structure occurs.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future contracts will ensure that personnel are on site during construction with experience on the project features under construction to ensure the construction of a quality product fully meeting project requirements.

Ch6_MDR-1. Comment: A 500 ft separation between the cut off wall and the relief trench should be adequate to eliminate the risk of the concurrent construction activities causing a slope failure. Basis of Comment: Cut off wall back fill should achieve adequate strength in the time it takes to build 500 ft of wall. Slope failure or blowouts in slurry trench excavations normally occur in the recently excavated portion of the trench near the advancing excavation face.

Significance of Comment:

Specific Actions Needed to Resolve: Increase the required separation to 1000 ft if there is any doubt.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

Ch6_MDR-2. Comment: There will always be some risk a slope failure or blowout will occur when constructing deep trench excavated slurry cut offs through embankments because of hidden or unknown defects and variations in subsurface layering that can not be accurately modeled. However where weak layers can be identified a wedge type analyses should be performed.
Basis of Comment: Only circular arc stability analyses were found in the DDR and DA.

Significance of Comment: Cut off wall location may have to be changed.

Specific Actions Needed to Resolve: Identify potential weak layers in the foundation (peat, silts) and perform wedge stability analyses with drained and undrained strengths to reinforce conclusions / current design.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. In addition to wedge type analyses, non-circular analyses will also be considered. Also, note that drained analyses for non-circular failure surfaces that exhibit preferential paths through the weaker peat layers have been performed.

Charge 7. *Address whether the P&S adequately address stability during the construction process.*

Ch7_WAB-1. Comment: Stability factors of safety and displacements as modeled in FLAC of the uppermost portion of the cutoff wall trench are marginal when the slurry level drops to 2' below the top of the trench. This may require another look at 18" as the specifications require the slurry to be no more than 18" below the working surface. The Contractor is responsible for the stability of the slope. A distance of 500' between open trenches is adequate.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted. The purpose of the FLAC model was to assess the impacts to embankment geometry associated with construction of the cutoff wall trench as well as potential impacts resulting from trench instability. The model assumes no cohesion of the soils which results in trench instability for only shallow vertical cuts. A slurry level within 18 inches of the working surface is an accepted, and proven safe, practice for slurry wall construction in virtually all types of soil environments.

Charge 8. *Address whether the COE documents provide an adequate basis for the construction plans and specifications.*

Ch8_WAB-1. The COE documents may provide an adequate basis for construction plans and specifications for the dike through Reach 1A. Consideration should be given to additional analyses that bracket potential variations in material properties to confirm that factors of safety are still adequate in the worst case for both seepage and slope stability. From a systems standpoint, additional work is required to ensure that the existing outfall structures are safe.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The documents provide adequate basis for current plans and specifications. However, we further concur with the need to perform sensitivity analyses to validate material properties used and pursue additional field and laboratory investigations as warranted by such analyses. As stated in previous comments, we will update the DDR to address differences between the DDR and P&S. Also, evaluation of the structure under a systems approach and additional related analyses will be considered in future MRRs and DDRs.

Ch8_KEH-1. Comment: Charge #8. Again, there does not appear to be a large amount of discussion as to the degree of uncertainty as to the subsurface investigations, material characterization, the understanding of the total structural system as it performs under fluctuating Pool and Tailwater, and how that all affects the modeling and final remediation recommendations. Basis of Comment: It is understood that an over-conservative approach to characterization and design can lead to exorbitant construction costs for adequate remediation methods. However, the importance of this structure to regional and national economics, as well as the loss of life potential, demands this be scrutinized carefully to ensure that the benefit to the cost of the remediation is acceptable. No matter what, the cost of remediation of this large structure is going to be expensive. It simply needs to be documented carefully as to the decisions which were made and any uncertainty which is bound to exist during the decision making process.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. As stated in previous responses, the revised DDR will be updated to include detailed discussions/explanations that fully document selection of parameters and ensure full documentation of the final design represented in the P&S. We also agree that the importance of the structure, coupled with more recent events such as policy changes after hurricane Katrina, warrants consideration of a conservative approach that includes resiliency and redundancy and a further examination of the current design parameters in light of current levels of uncertainty.

Ch8_MDR-1. Comment: The DDR and DA need to be strengthened or expanded to include a) Seepage analyses for the current design geometry / configuration, b) construction stability using a wedge analyses, c) verification/ confirmation of geotextile filter design requirements.
Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. See response to previous comment.
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Charge 9. *Address whether the plans and specifications conform to the design.*

Ch9_WAB-1. Comment: Generally yes.
Basis of Comment:
Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted.

Ch9_GLS-1. Comment: For current contract, fully enforce the specifications. For future contracts, reduce the number of submittals for "Government Approval"
Basis of Comment: The biggest problem I see with the P&S and trench is the fact that it appears the COE are not making the contractor adhere to the contract. The problems that were discussed with our team appear to be from the trench slurry being out of spec and perhaps from the contractor not properly testing their slurry in the lab with all the components which are present in the actual construction of the trench. The contractor was also not properly cleaning the trench each time the night and morning soundings were out of spec. Also the spec requires for almost every submittal to be for "Government approval." I have found it easier to require "For Information Only" and if you do not like what they are submitting you can write them a warning letter and place them on notice of a potential problem.

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will work within the PDT to ensure that future acquisition strategies fully maximizes the expertise afforded by industry and will explore the use of performance specifications.

Ch9_KEH-1. Comment: Charge #9. It appears that the P&S conform to the design criteria set forth for the remediation proposed.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted.

Charge 10. *Address whether the COE documents address applicable lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System. If not, which lessons learned need to be addressed and what actions need to taken to address those lessons learned.*

Ch10_WAB-1. Comment: See IPET comments also. Comments related to the entire dike, not just Reach 1A. Confirm that the following lessons learned will be considered in the design of the remedial measures for Herbert Hoover Dike.

a. Geodetic survey datum is consistent around the entire dike.
b. Accuracy of the surveys.
c. Settlement of the dike resulting in a lower crest elevation than projected highwater with surge.
d. Re-analysis with additional hydraulic load on sheet pile walls at structures.
e. Resilience. Higher than anticipated loads. Levee criteria versus dam criteria.
a. Worst case dam break analyses and emergency evacuation plans during hurricane.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, some of the IPET lessons learned may be beyond the scope of the currently authorized rehabilitation for seepage and piping. For instance, the interface between embankment and various structures (systems approach) and providing additional level of protection (resiliency). Another funding authorization and appropriate documentation would be needed to address these concerns.

Ch10_GLS-1. Comment: Some of the failures in New Orleans were directly or indirectly tied to putting outside restraints on engineers. At several locations right-a-way or other issues overrode or clouded pure engineering. I hope this will not occur with the recommendation to fill the ditch. Engineers should first be asked to provide a safe structure for the public. After this mission the other issues that are raised from this design should be dealt with. At several locations shown to us on our visit, peat/organic deposits were outcropping on the slope between the dike and the toe ditch. This condition help led to the failure at London Avenue. It is imperative that an analysis be conducted to look into the possibility of these layer heaving and then have a flow type slide failure.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We are going to pursue the recommendation to fill toe ditches, consistent with NEPA, with support from local sponsor to provide Real Estate.

CH10_RAW -1. Comment: The design does not adequately address resilience as identified in the Interagency Performance Evaluation Task Force (IPET) lessons learned. Resilience is defined in the IPET report as "the ability to withstand, without catastrophic failure, forces and conditions beyond those intended or estimated in the design." Although the dike design is constrained by authorization in terms of the level of functional (flood damage reduction) performance, the IPET lessons learned imply that designs must be evaluated beyond conditions associated with the authorized level of protection to assess structural performance and integrity during extreme conditions. The present analyses and design do not demonstrate resilience in response to combinations of high lake stage and storm surge.
Basis of Comment: Lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Volume 1, dated 01 June 2006.

Significance of Comment: Insufficient resilience in the design could result in catastrophic failure during stage and storm surge conditions that approach or exceed those associated with the authorized level of flood damage reduction.

Specific Actions Needed to Resolve: Analyses should be conducted to determine the level of resilience provided by the design, and modifications should be incorporated as needed to prevent catastrophic failure under extreme conditions.

Responder Name(s): Sean Smith-CESAJ

Response: Noted. The current MRR did not address resiliency as noted in the IPET report due to the nature of the authorization of the time and the necessity to do so – we have learned much from the Katrina events. Storm surge analyses were developed within the Herbert Hoover Dike MRR, resulting in storm surges ranging in magnitude with frequency (relative to wind direction and location). As depicted in the MRR, the areas near Moore Haven received the higher storm surges (14.9 feet of surge based on a 200-yr return interval). Such surges indicated that overtopping of HHD would not be an issue for the events given, however, an evaluation of pertinent storm surge effects will be considered as part of the Supplemental MRR. In addition, other similar analyses will be conducted as part of a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

CH10_RAW -2. Comment: The scope of analysis and design does not adequately address systems performance as identified in the IPET lessons learned. The IPET report concludes that "all components that contribute to the performance of the overall system must be treated as an integral part of the system." This applies both to the plan and elevation dimensions of the dike. In terms of plan dimension, the variable crest heights along the length of the Herbert Hoover Dike point towards potential weak links in the system that could become controlling components in a catastrophic failure. For example, if the lowest segments of the dike are exposed to the highest local storm surges during an event, potential for breaching becomes focused in that area. Even if other segments of the dike retain structural integrity and provide local flood damage reduction, an uncontrolled breach at a weak point could have significant consequences in terms of both localized damage and regional impacts. While 99% of the length of the dike may withstand the design SPF event, localized failure at discrete points could produce a general system failure.

Likewise in terms of elevation dimension, adequate design to prevent failure through piping and seepage at the base of the dike would be negated by any failure that may occur at the crest of the dike due to overtopping.
Basis of Comment: Lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Volume 1, dated 01 June 2006.

Significance of Comment: The regional implications regarding performance of the Herbert Hoover Dike warrant a systems approach to investigate all aspects of performance and potential failure, not just those identified as the most significant or likely.

Specific Actions Needed to Resolve: Analyses should be conducted to identity and address weak components throughout the full plan and elevation dimensions of the dike.

Responder Name(s): Sean Smith-CESAJ

Response: Concur, the current MRR did not address resiliency as noted in the IPET report due to the nature of the authorization of the time and the necessity to do so – we have learned much from the Katrina events. MRR surges indicated that overtopping of HHD would not be an issue for the events given, however, an evaluation of pertinent storm surge effects will be considered as part of the Supplemental MRR. In addition, other similar analyses will be conducted as part of a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

CH10_RAW -3. Comment: A robust and comprehensive life cycle analysis was conducted as part of the scope of the MRR to determine base condition probabilities of dike failure and economic benefits of alternatives. However, while adequately addressing project economics, the risk and reliability analysis was not applied directly to design selection and functional performance assessment. Design alternatives evaluated in the MRR and subsequent changes implemented in the VE study and DDR are somewhat arbitrary and not based on assessment of risk and reliability of component performance. There appears to be no risk or reliability assessment in selecting designs (MRR recommendations vs. VE recommendations vs. DDR design) or in selecting specific design dimensions (e.g., how effective is one cutoff wall depth vs. another in terms of performance risks and structure reliability). Therefore little information entered the design or can be communicated to decision makers regarding relative levels of vulnerability associated with the selected vs. alternate designs. In this way, the scope of the present analysis does not adequately address the IPET lessons learned regarding Risk and Reliability.
Basis of Comment: Lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Volume 1, dated 01 June 2006.

Significance of Comment: Because of a lack of risk assessment of the functional aspects of the design, there is little information available to understand the level of reliability or vulnerability associated with various alternatives. The design has been modified through several iterations from the MRR to construction without any quantitative or objective basis of evaluating relative performance and risk.

Specific Actions Needed to Resolve: Analyses should be conducted to identity relative risk and reliability of alternate designs.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Future documents will address IPET lessons learned. Also, the evaluations performed thus far have been deterministic in nature. While our analyses and evaluations were performed in accordance with the current standard of practice, we agree that an evaluation of repair options in terms of relative risk or reliability was not performed but should be pursued. The requested evaluations should provide further assurance that the selected remedial approach to repair the HHD is appropriate.

Ch10_KEH-1. Comment: It appears that the HHD Plans and Specifications address the lessons learned from the New Orleans levee failures covered in the IPET report. The only potential concern which may be considered may be related to a mention during the site visit of embankment fractures which are exposed on the crest of the structure and may penetrate down to an unknown depth of significance into the structure. If these embankment fractures do penetrate to a significant depth, then there is a possibility that if loaded by a high water event that a wedge failure of the downstream embankment could occur. It needs to be verified that any observed embankment fractures which have occurred do not penetrate into the embankment to a significant depth. It also needs to be verified that if the fractures are charged with water pressures from high pool events or overtopping that the water pressures and uplift pressures which may exist behind and under the downstream portion of the embankment are not excessive and cause instability.
Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Vertical cracks that become filled with water present a serious concern with respect to lateral displacement and potential failure. The locations discussed above were defined as vertical cracks due to differential settlement from two stages of levee construction. Further investigation of these cracks as they occur is appropriate to clarify if the cracks are shallow in nature or extend into the embankment foundation. In either case, we also agree that evaluations of lateral stability are warranted to evaluate the impact of vertical cracks filled with water on the stability of the embankment.

Ch10_MDR-1. Comment: Lessons learned identified in the IPET report are certainly applicable to HHD, particularly the overarching lessons learned with respect to resilience, systems performance and knowledge, technology and expertise and the principal lessons learned on vertical and water level datum, and performance.
Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve: a) make sure you are working from 1 datum for the entire dike, b) look very hard for potential failures at the discontinuities, particularly where water control

features penetrate the dike, and transitions in design alternatives, and c) strive to increase knowledge and preserve expertise in the Corps at the local level. (This project deserves an engineering presence in the field almost full time, akin to an embankment engineer for a dam. Engineering Considerations and Instructions to Field Personnel should be prepared. A post construction performance and criteria report should be prepared for each construction project.)

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

CH10 GTS-1 Comment: Dike may not meet new levee certification for 100 yr protection levels. HHD is a unique situation. If coastal criteria are applied for surge, waves and freeboard top of levee may be exceeded. Also seepage and embankment protection criteria may not be met. This happened in New Orleans for the restored levees.
Basis of Comment: Guidance on Levee Certification for the National Flood Insurance Program – FEMA Map Modernization CECW-P/CECW-E ltr dtd 23 June 2006

Significance of Comment: Flood insurance rates may be increased for residence surrounding the lake because 100 yr protection is not provided according to FEMA Levee Certification Criteria.

Specific Actions Needed to Resolve: FEMA Criteria should be reviewed for compliance.

Responder Name(s): Sean Smith-CESAJ

Response: Concur, protection is based on the current Federal authorization for SPF level. USACE intends to consider impacts/effects of other storm events through a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

CH10 GTS-2 Comment: Redundancy, Resilience and System Wide Performance could be greatly improved by significantly increasing the outlet capacity of Lake Okeechobee thereby reducing lake stages for larger events. This in turn would reduce overtopping and piping threats. While I realize there are conflicting environmental, socioeconomic and political reasons for not doing this, applying Lessons Learned in New Orleans would lead to this solution.
Basis of Comment: IPET Lessons Learned

Significance of Comment: Lake stages drive all other safety issues at HHD. No other solution addresses all failure modes as directly or will provide as high a level of safety for HHD. While larger outflows may cause flooding, a controlled release is always safer than a catastrophic failure at a random location.

Specific Actions Needed to Resolve: Existing outlets need to enlarged and/or an emergency spillway provided and additional flow easements obtained.

Responder Name(s): Sean Smith-CESAJ

Response: Concur, protection is based on the current Federal authorization for SPF level. USACE intends to consider impacts/effects of other storm events through a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

IPET EXECUTIVE SUMMARY

REVIEWER NAME: **Wayne A. Bieganousky**

IPET_WAB -1. Comment: Overtopping in NO was due to bust in geodetic surveys, ground settlement and storm surge. Is survey data of Herbert Hoover Dike accurate?

Basis of Comment: IPET findings

Significance of Comment: not expected to be significant

Specific Actions Needed to Resolve: Confirm accuracy of surveys.

Responder Name(s): Luis Ruiz-CESAJ

Response: We agree that the accuracy of surveys should be confirmed. Ongoing topographic surveying efforts will fully address this issue.

IPET_WAB -2. Comment: Settlement of soft ground in New Orleans led to loss of crest elevation. The geologic conditions in South Florida are different from New Orleans, so differential settlement leading to a significant loss of crest elevation is not anticipated. Can this be confirmed?

Basis of Comment: IPET findings

Significance of Comment: not expected to be significant

Specific Actions Needed to Resolve: Review survey data.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Current and ongoing topographic surveys should be reviewed to identify the low spots with highest potential for overtopping. Also, crest grade restoration, where required, will be considered a high-priority repair. Differential settlement at HHD is expected to be different than the regional subsidence experienced in New Orleans and could be identified by survey and visual inspection methods.

IPET_WAB -3. Comment: Resilience is stressed in IPET. HHD is not designed for storms greater than current SPF. Under the present authority the structure is treated as a levee, even though it is used like a dam. Policy decision of HHD status must be addressed. If it is concluded that the dike must be analyzed as a dam and meet the more stringent requirements, can the preferred alternative be easily modified to account for more stringent criteria and higher loading?

Basis of Comment: IPET findings

Significance of Comment: could be significant

Specific Actions Needed to Resolve: Establish controlling criteria.

Responder Name(s): Sean Smith-CESAJ

Response: Concur, protection is based on the current Federal authorization for SPF level. USACE intends to consider impacts/effects of other storm events through a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007. The current preferred conceptual design solution (consisting of a toe berm and a partial barrier wall) will be evaluated as required to determine what modifications would be appropriate to meet a higher level of protection. The toe berm portion of the conceptual design solution will require modification to extend the repair to address the loading conditions. At this time we do not anticipate changes to the depth of the partial barrier wall. Changes to the top elevation of the wall will be evaluated during the embankment raising to meet the revised level of protection.

IPET_WAB -4. Comment: Failure of the New Orleans I-Walls due to unanticipated hydraulic loading was a common failure mode during Hurricane Katrina. Tie-in of the cutoff wall to the sheet pile walls of the hydraulic structures may result in greater hydraulic stresses on those structures. Were increased hydraulic loads used in a reanalysis of the existing sheet pile wing walls at the multiple structures in Reach 1A?

Basis of Comment: IPET

Significance of Comment: could be significant

Specific Actions Needed to Resolve: Analyze existing structures for new loading conditions.

Responder Name(s): Luis Ruiz-CESAJ

Response: Evaluation of the additional loading on the existing hydraulic structures due to the tie-in with the cut-off wall has not been performed. Future design documents will address adequacies of hydraulic structures to provide the same level of protection as the embankment rehabilitation, including the interface between structures.

MAJOR REHABILITATION REPORT (MRR)

REVIEWER NAME: **Wayne A. Bieganousky**

MMR_WAB-1. Comment: Topographic surveys and hydrographic surveys for the entire length of the dike to determine most critical sections in all reaches for monitoring and subsequent design are desirable.
Basis of Comment:

Significance of Comment: not expected to be significant for Reach 1.

Specific Actions Needed to Resolve: Get survey data and determine most critical dike segments based on geometry and foundation conditions for the entire dike structure.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

MMR_WAB-2. Comment: Page 24. Were sinkholes carefully traced to determine origin? Is there a pattern to the sinkholes? What layer was the source of the piping? How were they backfilled?
Basis of Comment:

Significance of Comment: Significant: not significant for Reach 1

Specific Actions Needed to Resolve: Document actions taken to understand genesis of sinkholes.

Responder Names(s): Luis Ruiz-CESAJ

Response: Sinkholes were not traced “all the way out”. There is no known pattern to the sinkholes other than they could be occurring at the interface where the dike was raised during the 60’s. The fine sands above the limestone are most probable source of piping materials. The sinkholes were excavated and then backfilled with coarse-grained materials. We concur that embankment erosion sinkhole exploration and documentation of sinkholes within the embankment is desirable when they are encountered and should be compiled with previous MRR sinkhole documentation.

MMR_WAB -3. Comment: I did not note references to any dye tests. Have any been performed to try and track seepage through the embankment or foundation? It may be a help to know how the lake water chemistry affects the carbonate sands and limestone. Is the rate of solutioning something that would be a concern for the life of the structure? Can groundwater chemistry be used to differentiate seepage paths?
Basis of Comment: Karst conditions.

Significance of Comment: Not known.

Specific Actions Needed to Resolve: Examine solubility of the carbonates.

Responder Name(s): Luis Ruiz-CESAJ

Response: Dye tests were performed to determine in-situ permeabilities but not to study seepage paths. This area is not known for karstic sinkhole activity. Solutioning as a part of the natural weathering process may be on-going but at an extremely slow rate to not immediately affect life of structure.

MRR_TAL -1. Comment: Recalculate and check the cost estimates for the Deep Cutoff Wall and determine the affects the new cost estimates may have on the selected alternative. Given the above discussion and the following supporting discussion, it can be stated that the cost basis for the elimination of the Alternate C Deep Cutoff Wall option from consideration as the proposed solution for the MRR is unsupported.

Background and Supporting Commentary:

Reference Comment VES_TAL-1. From the MRR appendix D Cost Estimate the following information is taken from page D-2. The estimated cost of Alternative C "Impervious Cutoff Wall" is $13,847,200 per mile. Converting this to the same unit basis as the VE study costs ($/1000 LF Repair) yields a comparison cost of $2,387,448 per 1000 LF. Escalating this from the MRR estimate date of Feb 1999 (index value 2067) to the VE study date of July 2000 (index value 2118) gives and escalated cost of $2,446,354 per 1000 LF. This is in general magnitude agreement with the value used in the VE study of $3,078,312 per 1000 LF.

Deep Wall Cutoff Cost Reference	Cost per 1000 LF of Cutoff Wall	% (Other Cost/Racer Cost)
VE Study (FY 2002)	$3,078,312	659.4%
MRR App D (FY 2002)	$2,446,354	524.0%
Racer (FY2006)	$466,843	100%

As the determination of the appropriate technique to repair the Herbert Hoover Dike is based on technical and cost issues and accepting that the cost used to represent the Deep Cutoff Wall is unsupported and substantially overstated. This leads to the statement that the determination of the appropriate strategy for the solution of repairing the HH Dike is unsupported as to cost. Thus all decision as to the types of repairs to be made to the HHD that relied on the cost information in the MRR is possibly unsupported.

As to the cause of this issue it is unclear. It is reasonable that the costs stated in the MRR were correct at the time of development and that technology changes and process changes have allowed for a substantial decrease in cost for this option over the intervening years. However, it is clear that all future decisions as to repair strategy should not use the cost information contained in the MRR or the VE Study as these are unsupportable.

Basis of Comment:

Significance of Comment: Could change the selection of the repair method towards the “deep cutoff wall”.

Specific Actions Needed to Resolve: The costs for the various options should be reevaluated at the earliest possible time. New estimates for the potentially acceptable alternatives should be developed using recent cost information. Then the alternatives should be reevaluated using this new cost information.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. The deep cutoff wall solution was eliminated from consideration based on technical reasons (i.e. impact on regional groundwater hydrology). Accordingly, refinement of cost comparison was not considered necessary.

KEH MRR Comment Background. The overall emphasis of this Reviewer was to attempt to determine the relative amounts of both uncertainty and reliability of the information which was used to determine the remediation design. These relative amounts are directly related to the probability of continued seepage and piping further deteriorating the structure. No attempt to determine relative risk was made here, since consequences are best left to the Jacksonville District personnel versed in that topic. The probability of continued deterioration is directly related to the relative adequacy and reliability of the remediation method to contend with the distress of HHD. Also, since the cost associated with such an endeavor is extremely expensive, the reliability as compared to the cost of implementation needs to be reasonable. In addition, the remediation method needs to be evaluated as to its effectiveness once complete. It is therefore important to understand how uncertainty in the subsurface could impact the ability to monitor performance of the completed remediation.

MRR_KEH -1. Comment: Geotechnical Appendix: Piezometer Plots. Plots should be made of instrumentation results with pool and Tailwater over the life of the instrument. These plots need to be analyzed to understand how subsurface conditions have changed over the life of the instrument, how the changes are triggered by not only high pool elevations but by net head fluctuations, and if the rate of subsurface changes are increasing or decreasing at the same rate or speeding up over time. Thus, depending on the subsurface characterizations at the PZ locations, it can be determined as to the effectiveness of the current remediation design.
.
Basis of Comment: There appears to only be instrumentation plots covering selected years and each of those plots only cover one year of data. Plots should be made which show long term trends of individual piezometers along with associated Lake and Tailwater elevations. Based on the available plots, it is very difficult to understand the net head dissipation which occurs through the embankment or foundation due to either Lake and/or Tailwater fluctuations. When only looking at plots which depict one year, it is also difficult to understand the overall piezometeric trends which may have occurred since the instrumentation installations. It has been found in LRL that trends over time associated with net head prove invaluable to better characterizing the foundation materials and subsurface conditions.

Significance of Comment: Required for reduction in uncertainty and increasing confidence in the understanding of foundation conditions and potential probabilities of seepage and piping, as well as structural stability.

Specific Actions Needed to Resolve: Make sure information from long term the plots are addressed in design process.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Future instrumentation reports will address history of instruments. Piezometers were installed during preparation of MRR so no history was available at time of report preparation. Also, additional instrumentation will be added consistent with the ITR comments and the structure behavior.

MRR_KEH -2. Comment: Geotechnical Appendix: Piezometer Plots. In the same vein as Comment #1, I do not see instrumentation plots which depict Net Head Dissipation (NHD) plots of instrumentation results normalized with Pool and Tailwater over the life of the instrument.
Basis of Comment: There do not appear to be calculations which convert the piezometric levels of the instruments to NHD percentages, based on the Pool and Tailwater fluctuation. If not, recommend they be done to fully understand the internal behavior of the structure and foundation materials.

The calculation is simple but effective:

$$\frac{\text{Pool Elev.} - \text{PZ Elev.}}{\text{Pool Elev.} - \text{Tailwater Elev.}}$$

The piezometric levels of the PZs are fairly meaningless unless given in context of Pool and Tailwater fluctuations, especially since it appears that our overall control of the Tailwater is minimal when the agricultural demand can change the net head with no Pool changes. The percent of the total possible net head felt at the PZ sensing zone is much more appropriate to understanding material characteristics and especially behavioral changes over time.

Significance of Comment: Required for reduction of uncertainty and increase of confidence in the understanding of existing and changing foundation conditions, potential probabilities of seepage and piping, structural stability, and ultimately the adequacy of the proposed repair option.

Specific Actions Needed to Resolve: If the plots are not available, please ensure the overall instrumentation evaluation has taken this type of information into account in order to reduce uncertainty of the foundation characterization.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Future instrumentation reports should address this.

MRR_KEH -3. Comment: I do not find any specific scientific basis which prevents the installation of a deeper more complete cutoff wall through bedrock. It is essential that we document the reasoning behind not treating potentially detrimental features in the foundation.
Basis of Comment: Geotechnical Appendix: According to page H5-8, the results of a USGS Report in 1971 determined the following:

The current surface water table is controlled by operations of the drainage ditches which are operated for the benefit of agricultural interests. During rainy periods, when the water table rises, water is directed out of the agricultural lands and pumped into Lake Okeechobee. During dry periods, when the surface water table falls and the fields dry out, water is taken from Lake Okeechobee to irrigate the fields. Excess waters not needed for agriculture are discharged through control structures and principal canals out of the region.

5.5.2. Underseepage from Lake Okeechobee. Underseepage from the lake has minimal affect on the ground water table in the agricultural lands. Normally, Lake Okeechobee is higher than the controlled water tables in the agricultural lands. Seepage would then occur under the Dike towards the agricultural lands. The seepage paths are principally through limestone layers and shelly horizons. The limestones and shelly horizons were exposed to direct contact with the Lake waters by deep borrow areas within the Lake that were excavated for the construction of Herbert Hoover Dike.

In addition, according to USGS Circular 1182, it is surficial sheet flow, both pre-HHD and post-HHD that charges the Everglades Ecosystem, not seepage water from through or under HHD.

At the same time, there is an overall reluctance to install a complete cutoff wall within the Dike and its foundation in order to arrest damage that currently exists in the Dike and its foundation. The full depth cutoff wall would also help ensure that future damage is prevented. When downstream consequences include life risk, providing a safe operating structure should be paramount before any other obligation. While it is understood and appreciated that there are vast complexities surrounding the operation of HHD, from an Independent standpoint, it is difficult to not make the structural stability of the structure the primary goal. This is especially true when there appears to be only unsubstantiated speculation that a deep cutoff methodology will have detrimental impacts on the “regional groundwater”.

Significance of Comment: While it is still uncertain as to the degree of influence of the limestone formation on the seepage and piping scenarios (to be addressed in later comments), it is the opinion of this ITR Reviewer that anything short of a deep cutoff may not adequately contend with the current and future seepage and piping damage and deterioration within and beneath the HHD. It also appears that there is no conclusive evidence that such a methodology would detrimentally impact “regional groundwater” regimes. While some impact to groundwater seepage at a very close proximity is not ruled out, these potentially minor impacts should not influence the requirement to promote the integrity of the structure.

Specific Actions Needed to Resolve: Please either point out where the information exists in the documentation or provide specific geologic, hydrologic, and groundwater studies which indicate that the deep cutoff method would adversely impact groundwater on a regional scale.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. Future plans include performance of a regional groundwater study, however our current opinion is that the current design does not significantly impact regional groundwater. Our current conceptual solution for the embankment rehabilitation addresses seepage and internal erosion potential at the toe of the embankment; the main function of the partial barrier wall is to address preexisting foundation defects, including foundation damage due to past internal erosion activity. Although the barrier will be deeper under this conceptual solution, it will not be a deep penetrating cutoff wall, except on special circumstances.

MRR_KEH -4. Comment: General Boring Logs and Geological Descriptions. Please provide discussion of the boring log results, how they were used to characterize the foundation and embankment, and how they were used to determine analysis parameters and final remediation design.

Basis of Comment: In general the boring logs show the limestone to be highly weathered, severely fractured, containing voids and sand filled cavities. It is not clear however as to how these features are explained in the context of seepage and piping and how these detrimental rock characteristics were specifically utilized in the ultimate design of the current remediation? The logs also show overall low percentages of recovery, low RQD values, and drill water losses. Also, the geologic descriptions of the rock mass state that the limestone is highly weathered and permeable. Specifically, it is not clear in the discussions as to whether the low recoveries and RQD values are a result of void spaces within the limestone formation or simply drilling methodology which prohibited good recoveries of rock which does exist. It is also not clear as to the origin of the sand infilling the noted voids and cavities. If the limestone contains open voids which can accept material from above, and if the infilling sediments are actually material which has migrated from above, then it is highly probable that the limestone formation is having a huge effect on the seepage and piping beneath HHD.

Significance of Comment: Normally, the presence of these low quality rock characteristics have to be investigated fully and understood in order to make sure that the adequacy of the remediation has a high amount of confidence and reliability. Since there appears to be a large uncertainty as to the full effect of these detrimental characteristics have on the seepage and piping of HHD, there is a low confidence level as to the adequacy of the shallow cutoff wall remediation contending with active deterioration of the foundation.

Specific Actions Needed to Resolve: Please address these detrimental formation characteristics. Either specifically address why these characteristics can be discounted as not having seepage and piping impacts and therefore do not require attention in the remediation or address how these detrimental characteristics were incorporated into the design of the remediation and how it reliably contends with these features.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. The available information will be improved in further editions of any reports such as, MRRs and DDRs, including detailed discussions of the analyses and judgment used to arrive at design solutions. There are no plans to update the existing MRR. For the record, for Reach 1A the design was based on laminar flow characteristics not turbulent flow. In laminar flow velocity is proportional to the hydraulic gradient and in turbulent flow velocity is proportional to the square root of the hydraulic gradient; exit gradients and flow quantities were conservatively estimated assuming laminar flow. The design intent of the shallow cutoff wall in Reach 1A was to reduce the volume of seepage through the toe of the dike to facilitate a match of pre- and post-repair seepage quantities.

MRR_KEH-5. Comment: I do not see detail on how scale effects of the rock mass were incorporated into the design parameters.

Basis of Comment: One of the most critical issues affecting the final remediation design is the seepage analysis. The most critical input parameter in the seepage modeling is the permeability values for the materials. Defining permeability in rock is extremely difficult and is also highly subjective, creating a high level of uncertainty as to the reliability of the values. It should be expended as to the methodology of how .25 ft/min (360 ft/day) was chosen based on the reliability of the available testing, reliability of the knowledge of the rock mass, and influences of scale effects within the rock mass. Since the permeability of the rock mass is subjective, it must be specifically defined in the documentation as to how the values were determined. If the permeability of the rock mass is mostly influenced by vertical and horizontal solution features, it should be determined as to how reliable are the values of horizontal and vertical permeabilities.

Significance of Comment: This could greatly influence the seepage modeling which the remediation is based.

Specific Actions Needed to Resolve: Provide or point out documentation which explains foundation permeabilities and the methodology used to explain the conversion from field testing and lab samples to the actual values used in the final analysis.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future explorations and analyses will be conducted, including statistics, to ensure permeabilities are appropriately characterized. We will perform sensitivity analyses during design to analyze impacts of range of permeability values. Please see also the response to MRR KEH-4 Comment above.

DDR_JDM-1. Comment: Reference VE Study 4Dec01 Minutes and exterior land use map for an example of the varied landward land use. Design measures need to address the particular land use tailwater management requirements for each dike exterior land use area. Drainage, agricultural water supply/drainage, discontinuities such as quarries and canals, etc. pose different tailwater conditions and project considerations.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, our current strategy is to have a design that avoids tailwater management. Also, note that to the extent appropriate, site and sub-reach specific tailwater conditions were used in our design evaluations. Furthermore, each selected section analyzed was evaluated for a range of tailwater elevations to assess stability, seepage, and piping concerns. The design criteria for Reach 1A included no tailwater control. Reach 1A does not have unusual toe ditch or tailwater conditions when compared to other reaches of the HHD.

BCI REPORT

REVIEWER NAME: Wayne A. Bieganousky

BCI_WAB -1. Comment: While it is true that hydraulically-deposited fill materials are liquefiable, the seismic and monotonic loading conditions that could produce liquefaction are unlikely for the conditions and location of the site. Monotonic loading induced liquefaction would require such a large portion of the downstream toe of the embankment to be removed that the dike would have essentially failed from other causes. Seismicity is not a problem in Florida; peak particle acceleration of 0.03g is too small to produce liquefaction. Dynamic loading from wave action has not caused liquefaction in previous storms and is unlikely to be a source for liquefaction failure. The wave impact may produce a temporary increase in pore water pressure in the saturated zone on the upstream surface (though the breaking wave may be well above the saturated zone), but the low frequency of wave impact probably allows any excess pore water pressures to dissipate before the next wave, hence reducing liquefaction potential. Transmission of the excess pore water pressure in the saturated portion of the embankment due to wave loading may not be significant due to impact location (above the saturated zone) and geometric damping of the wave energy.

Basis of Comment: Page 38, 3rd paragraph.

Significance of Comment: None

Specific Actions Needed to Resolve: None

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur.

BCI_WAB-2. Comment: The location of the cutoff wall on the downstream slope does appear to have some potential for creep of the slope. This is borne out by the FLAC analyses presented by URS. The advantage of placing the cutoff wall on the downstream slope is two-fold. It maintains the height of the crest during construction which protects against overtopping, and it cuts off piping at the early stages in its development, lessening the chance for collapse of the embankment. The risk of local sloughing on the downstream slope above the cutoff wall bench is not as hazardous as exposing a degraded crest to potential overtopping during hurricane season.

Basis of Comment: BCI objection to location of cutoff wall.

Specific Actions Needed to Resolve: None

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

DDR

REVIEWER NAME: **Wayne A. Bieganousky**

DDR_WAB-1. Comment: Slope stability calculations were performed using single value shear strengths for dikes that are highly heterogeneous. The use of upper and lower bounds would have been preferable. Some of the strength parameters were based on SPT N-values, others came from CU tests with pore water measurements. SPT tests results are highly dependent on many variables subject to operator and equipment changes (was equipment calibrated for 60% energy?). The sampling and handling stresses on undisturbed samples and the consolidation phase of a CU test will densify a test sample (lower void ratio) and lead to unconservative shear strength estimates. Though some values seem reasonable, others seem high, particularly the peat friction angle and soil-cement-bentonite mixture.

Basis of Comment: Slope stability analyses

Significance of Comment: significant if FS falls below 1.5.

Specific Actions Needed to Resolve: Parametric studies using upper and lower bound values to establish range of factors of safety.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Shear strength parameter selection will be revisited. However, slope stability analyses for Reach 1A were performed using conservative selections of shear strength values obtained based on an evaluation of laboratory testing data from p-q plots on similar soil materials as presented in the MRR, a limited literature search, and previous regional experience. A parametric evaluation of slope stability using a range of strength values will provide a validation on the values obtained from this approach.

DDR_WAB-2. Comment: Slope stability calculations should consider strain compatibility in calculating factors of safety to limit displacements. Reviewing the CU tests on the peat, peak strengths occur at strains of roughly 5% to 7.5%. Strain to failure for dense or brittle materials like the gravel backfill (filter drain) or the soil-cement (cutoff wall) will reach their peak strength well in advance of the peat or possibly the loose sands in the embankment. If strain compatibility is not considered, the use of peak shear strengths for the loose sands and peat overestimates the factor of safety. Large strains in peat, which constitutes a large proportion of the failure surface in the “B” analysis, could result in unacceptable displacements in the gravel drain, if not an unacceptable factor of safety. Large displacements of the high strength and brittle cement-soil wall would be required to mobilize the shear strength of the loose sand and peat in the “A” analysis.

Basis of Comment: Slope Stability Calculations

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Perform slope stability analyses considering strain compatibility of constituent materials.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Strain compatibility was not included in the design approach to date. Given the relatively small percentage of the wall in the embankment section under consideration or within a potential failure surface under evaluation, it is not clear to us that this consideration will have a significant impact on the estimated stability of the embankment; however, we agree to evaluate.

DDR_WAB-3. Comment: Assuming homogeneous well-defined geologic conditions, the theoretical seepage analyses seem to adequately address piping and flow rate in Reach 1A, though the use of geotextiles will be problematic if clogging of the pores becomes an issue.

Basis of Comment: Prohibition of use of geotextiles in embankments

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Avoid use of geotextiles.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Geotextiles will not be used as filters in the final design solution. However, the use of geotextiles in the design was based on constructability concerns for construction in the wet.

DDR_WAB-4. Comment: Recommend that the toe ditch be fully lined rather than extending to the midpoint of the ditch. Piping of the unprotected soils in the ditch may cause the filter materials to unravel.

Basis of Comment: DDR

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Extend inverted filter to cover entire ditch.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Extending the toe ditch inverted filter will increase the resilience of the design solution and improve the stability of the dike toe.

DDR_WAB -5. Comment: According to the MRR document, the many geologists/drillers created an unsure picture of the geology. “Interpretation of actual conditions is practically impossible as the data that these interpretations are based upon is colored by the experience of the field geologist describing the materials”, according to the MRR. URS has performed seepage

analyses with models that they believe are representative of the foundation conditions, but their models calculated factors of safety that ranged from 1 to 10 in areas were piping has been observed (CESAJ, URS letter dated 10 Jan. 2002). Given this result there is some concern about the level of conservatism in the computed factors of safety for piping and clarification is required. Design of the remedial measures should have been based only on models that produce factors of safety of 1 for existing conditions where piping has occurred. Was that the approach used in all cases? If not, the model used to design seepage remedial measures does not represent the worst case, and an element of unconservatism is introduced into the design. Even if piping has not been observed in Reach 1A, the model should be calibrated to a FS = 1 to account for undiscovered piping, potential foundation degradation, and consistent application of the design criteria. Second, a factor of safety of 5 is considered more appropriate for the Herbert Hoover Dike in my opinion. I base my opinion on the lack of consistent interpretation in the very complex geology (as noted above), the inability to detect impending failure conditions during an extreme event, the operation of the dike as a dam that lacks hydraulic discharge capacity to draw down the reservoir and keep the pool from rising above El. 26, the inability to regulate the tailwater, the potential for incrustation of the filter materials, and the consequences of failure.

Basis of Comment: MMR Report and DDR Report

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Base design on higher seepage/piping factors of safety to account for complex geology.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur with heterogeneity comment. While it is true that many geologists have included their own interpretations of the geology, we will revisit boring logs to provide uniformity and consistency in the lithologic descriptions. Do Not Concur with FS of 5 as an overall design criteria. Future analyses will address appropriate factors of safety and geotechnical parameters to be used, consistent with parametric studies and extent of available data. The ITR reviewer is correct in stating that piping has not been observed within Reach 1A. Calibration of the seepage models to set the piping factor of safety to one may result in an overly conservative and expensive design. However using this procedure on the selected remedial design will provide a valuable check that the selected approach is a valid solution.

DDR/P&S MDR-1. Comment: Include a geologic profile for the design reach. Show the bottom elevation of the cut off wall and relief trench on the profile.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We agree this illustration will improve the clarity of the presentation.

DDR/P&S_MDR-2. Comment: Property acquisition should not be a constraint to the detriment of the design.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Will coordinate with local sponsor to acquire real estate as necessary to provide a more robust solution.

DDR/P&S_MDR-3. Comment: It appears the best overall design fix would be an inverted filter / seepage berm without a relief trench at the landside toe.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will also incorporate a partial cut-off wall or barrier to address foundation defects and pre-existing foundation damage due to past incidents of internal erosion.

DDR/P&S_MDR-4. Comment: The fix should include filling the existing toe ditch.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Will coordinate with local sponsor to provide real estate.

DDR/P&S_MDR-5. Comment: A culvert may not be needed in the seepage berm. The drain rock layer can be sized to provide the capacity need to handle the expected volume of water. A

collection pipe could be installed to monitor and record seepage quantities to verify design assumptions and long term performance.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s)**:** Luis Ruiz-CESAJ

Response: Concur. However, the current design and P&S does not include a culvert/collection pipe within a gravel berm, this was a feature of the MRR. Also, to achieve the full benefit of this recommendation, we should be able to control pumping into/out of the ditch from neighboring properties, limit interaction with the canals, etc. We agree that the collection and monitoring of seepage volumes is an important tool for evaluating long term performance.

DDR/P&S_MDR-6. Comment: In order to accurately monitor seepage flow / dike performance collected seepage flow should be kept separate from surface runoff / irrigation water.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. This is a good idea that will be evaluated further; however at this time we do not have the real estate necessary to implement this.

DDR/P&S_MDR-7. Comment: A new toe ditch or "storm drainage system" could be constructed to handle surface flows.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

DDR/P&S_MDR-8. Comment: Surface flow / runoff / irrigation ditches should be designed and located such that under seepage from the lake into the dewatered ditch does not exceed critical exit gradients.
Sacramento District has general guidance on minimum setback and ditch depth depending on how close the toe ditch is to the levee, but always we always check seepage conditions with a model / seepage analysis. If exit gradients are too high, we recommend the ditched be moved farther away.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Real estate constraint will be lifted in future designs and we will coordinate with our local sponsor to provide adequate lands. We would be interested to see SPK's guidance on setback requirements. We also agree that confirmation of satisfactory exit gradients into any toe ditch is necessary.

DDR/P&S_MDR-9. Comment: An Instrumentation program should be a part of all designs. An Instrumentation system should be designed to monitor construction activities and long term performance.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Instrumentation systems are an important component of dam safety programs and such a system should be part of an overall dam safety monitoring program for HHD.

DDR/P&S_MDR-10. Comment: The quarry site shown us on the field trip, as well as any others like it, should be fully explored and protective designs developed sooner than later. This is a site that probably needs a deep cut off wall. First step may be to fill in the rim canal and dredge a new one 1000 ft or so away from the dike. Fill material could include material that could act as a "crack / pipe stopper".

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Further explorations are warranted at the quarry areas to determine impacts.

DDR/P&S_MDR-11. Comment: Water control features / penetrations through the Dike may be the weak link in the system. Make sure these structures are evaluated in detail, particularly for seepage and the potential for piping / internal erosion.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Will ensure that future reports document existing conditions of control structures and will add design features as necessary to meet seepage and stability requirements.

DDR/P&S_MDR-12. Comment: For future work consider increasing the frequency and coverage of explorations.

Basis of Comment: Sacrament District has a target of 4 exploration holes in cross section approximately every 1000 linear ft of levee for final design.

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future explorations will endeavor to be more thorough. Earlier explorations efforts were constrained by the use of O&M funds during the early part of the process. As we move into the construction phase, CG funds will be available for site explorations and we will reexamine our data to identify data gaps and pursue necessary explorations.

DDR/P&S_MDR-13. Comment: The ditch lining in the most important feature of the proposed Reach 1A design and the geotextile filter design is the most critical part of the ditch lining and relief trench. The geotextile filter design should be checked / reevaluated and the geotextile filter should be confirmed as appropriate for this structure/ project.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve: The design analysis used only two sand gradations to select the geotextile. A gradation band for the "base" soil should be developed. Plot all the available subgrade soil gradations on a single sheet. Since the subgrade sands appear to be gap graded with shells a decision will have to be made on what the "base" soil gradation will be for design of the filter. This requires considerable judgment and good case histories to get the fabric right. Use the most recent Corps draft guidance on filter design.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The use of geotextiles as filters will be avoided

DDR/P&S_MDR-14. Comment: In the current design the geotextile filters place in the relief trench through polymer slurry. Confirm the slurry and the additive used to "neutralize" the slurry does not damage the geotextile.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, the relief trench feature will be eliminated from design.

DDR/P&S_MDR-15. Comment: Evaluate the potential for the geotextile filter fabrics to become clogged from turbid water, soft fine grained subgrade soils, biological growth (algae), or chemical precipitates from ground water / seepage.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. However, geotextiles used as filters will be eliminated from design.

DDR/P&S_MDR-16 Comment: Confirm that limestone (which is soluble) is the appropriate stone to use as relief trench, ditch lining, and ditch connector aggregate. If other aggregate is not available consider adding a minimum specific gravity (2.6) to the material requirements and reducing the acceptable LA abrasion loss to less than 30%. (Make sure the right LA abrasion test is cited for the required gradation.)

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Do Not Concur. This was evaluated during the design. Rate of solution of this material is not a concern for the life of this project. This material is used around the state of Florida for similar projects.

DDR/P&S_MDR-17. Comment: The specified aggregate gradation does not match ASTM #57 or #67 stone gradation. Confirm that the specified stone gradation is adequate.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. During P&S preparation the final gradation was selected based on local material availability. The specified gradation was considered adequate to meet the design intent.

DDR/P&S_MDR-18. Comment: Recommend that an “expert” in the design and use of geotextile filters in seepage control review (ITR) the basis of design and geotextile specification.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Noted. Geotextiles used as filters will be eliminated from design.

DDR/P&S_MDR-19. Comment: Construct the ditch lining in the dry. Require the Contractor to dewater the site and provide for temporary diversions. Geotextile filters when place on soft, saturated, or unstable fine grained subgrade soils will likely clog and never perform as designed.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve: A section should be added to the specifications covering "Care and diversion of Water"

Responder Names(s): Luis Ruiz-CESAJ

Response: Geotextiles used as filters will be eliminated from design. The preferred construction approach would require construction in the dry however tailwater may not be controlled.

DDR/P&S_MDR-20. Comment: If the relief trench component of the design is retained, review the specifications to confirm there are adequate QC requirements on slurry testing, aggregate placement and subgrade preparation to ensure the final in-place product will be in compliance with the contract.

Basis of Comment: From my experiences here in Sacramento where we have constructed or tried to construct relief trenches with slurry in loose sands, we found that the placement of the geotextile and aggregate through the polymer slurry is difficult and requires a great deal of care. It is hard to assure a quality installation when you never get to see or test the final product.

Significance of Comment:

Specific Actions Needed to Resolve: Review the specification with constructability and QC/QA testing in mind. For example, what testing will the Contactor be required to do to confirm a) the slurry is properly degraded (Section 2300 paragraph 3.10.9), b) the aggregate is placed in 8-inch loose lifts and compacted to firm unyielding state (Section 2300 paragraph 3.11.3, and c) the subgrade is free of unsatisfactory materials (Section 2300 paragraph 3.7.1.)

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

REFERENCES:

a) Final Design Submittal, Design Documentation for the Construction of Herbert Hoover Dike, Rehabilitation and Repair Reach 1, Subreach A, Martin & Palm beach Counties, Florida, prepared for Jacksonville District, U. S. Corps of Engineers. Prepared by URS Group Inc August 2004.

b) Final Submittal Detailed Design Report and Design Analysis Volume 1 and 2 for the Herbert Hoover Dike, Rehabilitation and Repair Reach 1, Subreach A, prepared for Jacksonville District, U. S. Corps of Engineers. Prepared by URS Group Inc October 2004.

GENERAL

GEN_WAB-1. Comment: Field needs a full-time experienced geotechnical (embankment) engineer to document construction, ensure product is in adherence with the intent of the designer and interpret contract documents and intent of design to the Resident Engineer. Data analysis needs to be real time.

Basis of Comment: Field office visit.

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Place full-tome Jacksonville District geotechnical engineer on project during construction.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. In future contracts, we will pursue full-time oversight by experienced staff on the features being built. This may include TDY QA personnel, Title 2 A-E services, full time in-house personnel, etc., consistent with the size and scope of the contracts.

GEN_WAB-2. Comment: Based on the FLAC analyses and slope stability analyses performed by URS, the trench wall factor of safety is inadequate when the slurry falls to 2' below the working surface. Specifications allow for maximum of 18" drop in slurry below working surface. An analysis should be performed to see the effect of 18" slurry drop. Level of slurry may need to be closer to surface to support the trench walls during construction.

Basis of Comment: FLAC Analysis of trench behavior

Significance of Comment: Potentially significant.

Specific Actions Needed to Resolve: Analysis for 18" depressed slurry level.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future analyses will continue addressing this concern. The purpose of the FLAC model was to assess the impacts to embankment geometry associated with construction of the cutoff wall trench as well as potential impacts resulting from trench instability. The model assumes no cohesion of the soils which results in trench instability for only shallow vertical cuts. A slurry level within 18 inches of the working surface is an accepted, and proven safe, practice for slurry wall construction in virtually all types of soil environments.

GEN_TAL -1. Comment: State Of the Art Procurement. Recommend the procurement process be changed to the Two Phase Design Build Contracting (FAR 36.3) with Best Value; Tradeoffs selection and Firm Fixed Pricing. In my opinion this method would allow us to state our needs (i.e. stop leakage under dike, etc) and then have the Offerors propose design solutions to us. All of the information that has been developed over the years would be made available to the

Offerors to help them develop their technical solution. This would allow the entire range of solutions to be available to the group of Offerors and allow us to accept the solution that best met our needs.

Background and Supporting Commentary: The solicitation type used for the HHD Reach 1A procurement was the standard Civil Works type of "Design, Bid, Build". The selection process chosen for the Reach 1A procurement was Best Value: Tradeoffs. These are standard techniques with a long track record in Federal Procurement. However to me there appears to be a problem with this process for the HHD repairs in that the COE must choose a repair method from a small number of reasonable alternatives. This COE decision is based on design and cost assumptions that are made internal to the COE. This requires a significant balancing act between design, stakeholders and cost. Where cost is the least of the factors as relates to reliability; but certainly of significant interest to stakeholders and cost share partners. It is not secrete that cost estimates are unreliable as the difficulty of predicting the future is well known.

What I am proposing is a procurement method that allows the COE to move the decision process as to selecting alternative from before solicitation advertisement to after receipt of proposals. This would allow the COE to use the knowledge base of the Contracting and Design community combined together to propose both technical and cost solutions to the HHD repair problem. Since technical and cost would be melded into a single process proposed by the Contractor that would actually be executing the process the COE will be able to choose from these complete alternatives based on the complete evaluation of these combined proposals.

I would recommend that all of the stakeholders be brought into the selection process to facilitate a fully supported joint decision. With such a large group of stakeholders it is difficult for the COE to drive to a consensus. Limiting the alternatives on the table to those that would represent actual offers should at least tightly bound the number of options the team would consider. In other words the team would be expected to embrace the consensus accepted offer.

Other values of the design build process are the use of performance specifications in lieu of prescriptive specifications. In the solicitation for Reach 1A we advertised for a single solution (shallow cutoff wall and toe ditch work) with only two construction options through two prescriptive specifications. With the Design build approach we can open the procurement to all of the investigated alternatives along with any other alternative that an Offeror may determine is valid. This would allow the deep cutoff wall, toe dike and inverted filter to be evaluated from a factual technical/cost/constructability position. As I'm sure you are aware the development of a factual state of the technology cost estimate is the area where we are the least likely to succeed. Through a Performance based Design/Build approach we allow the Designer and Constructor to team together to provide a synergistic solution to our requirements.

There are hurdles:

Reference the following ER 1180-1-9 excerpts:

Para. 8
c. *Civil Works Design-Build.*
(1) *Design-build contracting is authorized for Civil Works projects only when:*
(a) *Use of design-build contracting is specifically addressed in an executed Project Cooperation Agreement (PCA); or the cost sharing partner has otherwise agreed to the use of design-build for a particular part of a project.*

(b) *Construction has been authorized;*
(c) *Based on sound acquisition strategy as indicated in Appendix A and the DBI;*
(d) *Full funding is available for the design-build contract at the time the contract is awarded; and*
(e) *Approved by the appropriate Commander as identified in paragraph 10.*
(2) *The use of design-build is unlikely to be appropriate for the entire design and construction of large, complex civil works projects the design and construction of which cover many years, are typically accomplished by a number of construction contracts and which are incrementally funded. However, since these types of projects are typically accomplished in stages utilizing a number of separate design and construction projects portions of the project may be a candidates for design build contracting, e.g., a visitor center in conjunction with a lock and dam project.*

And from Appendix A:
A-6. *For Civil Works projects, selection of design-build will normally only be appropriate for contracts where full funding is available at the award of the contract.*
a. *Examples of buildings where design-build is likely to be most appropriate are visitor centers, recreational facilities and similar buildings.*
b. *When a project funding is shared, coordination to ensure commitment of the funds (for the design-build portion of the civil works project) is extremely important. The funds necessary for the design-build portion of the project are required in advance of advertising the RFP.*

Basis of Comment: FAR part 36.3

Significance of Comment: Acceptance of this suggestion may allow the COE to accelerate the repair process by allowing the Interested Partners to allow the market to establish a technically and cost effective path forward. From my perspective of looking into this project from the outside and based on my experience it seems that this alternative has great merit as to achieving the program goals in a reasonable time with reasonable efficiency.

Specific Actions Needed to Resolve:

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur.

GEN_AS-1. Comment: Land acquisition and other land issues.

Basis of Comment: Herbert Hoover dike repairs are on an aggressive schedule however the District has not been made aware of land requirements for other reaches. Several private homes and farms abut toe of the levee. Therefore, land acquisition and construction easement may need extended period of time for acquisition.

Specific Actions Needed to Resolve: Provide the SFWMD with land acquisition needs as soon as possible.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur.

GEN_JDM-1. Comment: Add an evaluation of possible project design modification alternatives to change from Levee criteria to Dam Criteria. A preliminary analysis needs to be performed to outline what measures will be used to modify the installed section should the dike criteria be changed from levee to dam criteria. The least cost total modification alternative may be the best choice.

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Sean Smith-CESAJ

Response: Concur, protection is based on the current Federal authorization for SPF level. USACE intends to consider impacts/effects of other storm events through a Limited Engineering Analysis, scheduled for completion in Fiscal Year 2007.

VES

VES_TAL-1 Comment: Recalculate and check the cost estimates for the Deep Cutoff Wall and determine the affects the corrected costs may have on the selected design for the P&S for Reach 1, Subreach A.

Background and Supporting Commentary:

Reference: Value Engineering Study on the MRR. Reference page 5-12 of the VE study specifically the Table presented under paragraph 5.6 Cost Comparisons.

Referencing the following table from the VE Study

Repair Method	Comparative Cost per Foot of Dike
JAXCOE Toe Berm with Relief trench and Culvert	100%
Inverted filter and Relief trench	75%
Shallow Cutoff Wall and Relief trench	130%
Deep Cutoff Wall	385%

The value stated as the comparative cost per foot of dike for the “Deep Cutoff Wall” option is substantially over stated. I have reviewed the supporting cost estimates included in Appendix O of the VE proposal and using the quantity and construction methods described in these estimates have developed independent cost validation estimates using the RACER parametric cost estimating program. The following table is a summary of the results of the evaluation:

Repair Method	VE study Cost	RACER Cost	Variation VE/RACER Cost
Toe Berm w/Relief Trench and Culvert	$798,993	$804,851	0.7%
Inverted Filter w/ Relief Trench	$584,330	$644,406	10.3%
Shallow Cutoff Wall and Relief Trench	$1,039,095	$1,172,583	11.4%
Deep Cutoff Wall	$3,078,312	$466,843	659.4%

This table shows that the RACER parametric program estimates match closely with the costs developed for three of the proposed alternatives. This statement is further supported by the fact

that the same RACER "technology" (this would be termed an assembly by MCACES) is used to develop the cost for the Shallow Cutoff Wall and as is apparent from the table gives good agreement with the VE study cost for this work. This assures us that the use of the RACER is valid as a comparison tool. The point here is that the cost difference between the RACER and the VE study for the Deep Cutoff Wall is substantially out of bounds.

Accepting this we are lead to the conclusion that the VE study cost comparison for the alternatives is unsupportable. It is unclear what impact this would have had on the conclusions made in the study.

Basis of Comment/Citation of Authority: ER 200-3-1 RACER was accredited on 11 July 2001 in accordance with DOD Instruction 5000.61, Modeling and Simulation, Validation, and Accreditation (VV&A). It was accredited to provide an automated, consistent, and repeatable method to estimate and document the program costs for environmental cleanup of contaminated sites, and to provide a reasonable cost estimate for program funding purposes consistent with the information available at the time of the estimate preparation.

Significance of Comment: The Cost comparison basis of the VE study is unsupported. I do not believe that the Deep Cutoff Wall would have been the least cost alternative; however, based on this analysis it could have been very competitive. This may have caused a revision in the VE study conclusions.

Specific PDT Actions Needed to Resolve: All decisions that have used the VE study as a basis for selection should be reviewed. But first it is recommended that new cost estimates be developed for all reasonable alternatives.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur with the recommendation of comment VES_TAL-1 that concluded the cost basis of the 2002 VE study is somewhat dated and may not reflect the latest pricing influence on methods and production used to develop a cost ($/1000 LF) for the deep cut-off wall. While costs were escalated using index values, it does not consider emerging technology, equipment and expertise that would influence current competition and pricing.

VE1_KEH-1. Comment: Is there written documentation which explains the reasoning for reducing the original permeabilities?

Basis of Comment: It appears that the permeability values for the limestone units in the original MRR on page H4-7 are listed as 0.25 ft/min (360 ft/day), however the permeability listed on Exhibit 4.7 of the URS VE Study for Reach 1-6 is listed as a range between $15x10^{-4}$ (4.25 ft/day) to $300x10^{-4}$ (85 ft/day). Since the reliability of the remediation is directly related to the design analysis, which is directly related to the input parameters, which is impacted by the reliability of the confidence of the understanding of the material characteristics, it is imperative to document all judgment made as the subsurface interpretations.

Significance of Comment: Much more seepage could be occurring in actuality than that modeled.

Specific Actions Needed to Resolve: Documentation of the sound engineering geology judgment which went into changing the values needs to be made. In addition, any other material types

which have been changed from the original MRR and DDR (since the values presented there also appear to be no greater than 85 ft/day for horizontal and 28 ft/day for vertical) need to be documented well.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Permeability values were selected based on an evaluation of laboratory testing data on similar soil materials as presented in the MRR and DDR Appendices, a limited literature search, and previous regional experience. We will ensure proper documentation is included in the revised DDRs.

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VE1_KEH-2. Comment: Are all permeability values documented, as to the engineering and geological representativeness? In addition, are all values conservative enough as to adequately represent the damaged character of the embankment and foundation materials which most certainly occur in and under HHD?

Basis of Comment: While it is difficult to depict materials which have been severely damaged by active piping, the over uncertainty which exists as to the material integrity warrants a conservative approach to the analysis process in determining the reliability of a proposed remediation method. This is not a typical case of insitu unaltered overburden and rock. This material has been altered over nearly 7 decades of induced seepage and piping which has detrimentally impacted the internal character of the materials within and beneath the structure. Increased permeability and decreased seepage pathway length due to piping needs to be accounted for in the seepage analysis and documented as to the engineering and geological judgment used to determine those values.

Significance of Comment: Much more seepage could be occurring in actuality than that modeled.

Specific Actions Needed to Resolve: Documentation of the sound engineering geology judgment which went into changing the values needs to be made. Also, any other material types which have been changed from the original MRR and DDR need to be documented well. In addition, simply stating that these values are reasonable due to “previous experience with similar materials” is not an acceptable response. The conditions which may exist in and under HHD are not routine, nor similar to most if any other situation with materials of this type. Undamaged areas of the structure and foundation are most likely not going to cause unsatisfactory performance when loaded. The areas of the structure which are already damaged will be the most prone to unsatisfactory performance or failure when loaded. Thus, only depicting and modeling undamaged characteristics of the materials is not prudent for this structure.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. We will ensure proper documentation exploring use of different values for parameters between MRR and DDR and adequate conservatism is built into the design.
As previously described, analyses were based on evaluations of laboratory data, review of system performance via a seepage model to calibrate the values used and our knowledge and experience with similar materials. Based on the questions and concerns expressed by the ITR reviewer we believe the best way to respond to these concerns is to perform a parametric study

to evaluate the impact of a wide range in anticipated permeabilities and anisotropy values on expected seepage quantities and associated exit gradients.

P&S

P&S_BPL- 1. Comment: Section 00100A-1 INST-1.1, The contract has adequate specifications for the qualifications and experience of the "Cutoff Wall Specialist". The review and approvals of these qualifications and experience are critical to successful project completion.

Basis of Comment: The environment that this wall is being installed in includes calcium in the soil and rock. The skills of the Cutoff Wall Specialist are critical.

Significance of Comment: Bentonite has a chemical reaction with calcium which changes its ability to hold up the trench walls. If the Cutoff Wall Specialist does not test and adjust for the calcium in the soil and rock the ability of the bentonite and water to support the trench wall could be an issue. The performance of the Cutoff Wall Specialist is critical to avoid construction modifications and deficiencies.

Specific Actions Needed to Resolve: A detailed and extensive review of the Cutoff Wall Specialist qualifications and experience should be made prior to award. The follow up Quality Assurance inspection after award needs to be made of the Cutoff Wall Specialist performance to verify that the Cutoff Wall Specialist is enforcing the specifications on bentonite/water, SCB and CB materials and their installation.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur.

P&S_BPL- 2. Comment: Section 00800, EFARS 52.249-5000 BASIS FOR TERMINATION SETTLEMENT PROPOSALS. This paragraph does not seem to include items (1) and (2).

Basis of Comment: As read in the copy of the specifications provided, the clause does not seem to be complete.

Significance of Comment: This contract clause may be used and needs to be clear.

Specific Actions Needed to Resolve: Review this clause and correct if necessary.

Responder Name(s): Luis Ruiz-CESAJ

Response: The paragraphs are in the specifications without paragraph numbers. Future P&S will include the paragraph numbers.

P&S_BPL- 3. Comment: Section 02262 Cement – Bentonite Slurry Trench Cutoff Wall, Paragraph 3.10.4.1 Cutoff Wall Measurements. The specification recommends using a Koden to take width measurements for – CEMENT BENTONITE SLURRY – I am not sure if a Koden machine can take readings in this material. The cement setting up may cause problems for any mechanical testing instrument.

Basis of Comment: The Koden has problems in dense materials and its successful use is highly dependent on the skill of the operator. Any other mechanical measurement system may have problems also.

Significance of Comment: Quality Control and Quality Assurance

Specific Actions Needed to Resolve: Verify standard practice for measuring trench depth and width in CEMENT BENTONITE SLURRY construction.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur, will take into account on future contracts. In our opinion, trench width measurements provide important information to verify trench stability during the progress of the work and to assist with the identification and evaluation of potential trench stability issues. It is true that the Koden may be ineffective at higher slurry densities, however, alternative mechanical means have been used on previous projects and may be improved to produce the required information.

General comments:

P&S_BPL- 4. Comment: Section 02261 Soil-Cement-Bentonite Slurry Trench Cutoff Wall and Section 02262 Cement-Bentonite Slurry Trench Cutoff Wall. Add a performance criteria to the specifications for both SOIL CEMENT BENTONITE and CEMENT BENTONITE SLURRY WALLS sections for an in place test wall of a specified length to be built and tested with coring of the finished test wall prior to starting the production work.

Basis of Comment: The amount of construction variables is too large not to test the construction system on site. The system check needs to include the personnel, equipment, materials and facilities.

Significance of Comment: The test wall should be constructed to assure that the construction system is adequate to provide a quality product during production.

Specific Actions Needed to Resolve: Insert a requirement and the performance criteria for a test wall. Provide the necessary contract time and possible termination if not successful.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur. This technical requirement will be added to future contracts.

P&S_BPL- 5. Comment: Section 000110A LINE ITEMS AND PRICING SCHEDULE. Add a bid item CORING OF FINISHED WALL to the bid items.

Basis of Comment: Under the current contract clause Section 00700 – CONTRACT CLAUSES paragraph 52.245-12 INSPECTION OF CONSTRUCTION (AUG 1996), the contractor can be required to core the finished wall if the government doubts his Quality Control.

Significance of Comment: The final depth, no pockets of reduced permeability and in place quality of backfill using Soil-Cement-Bentonite Slurry Trench Cutoff Wall and Cement-Bentonite Slurry Trench Cutoff Wall can not be assured unless the wall is cored after installed. The INSPECTION OF CONSTRUCTION clause requires the contractor to pay for the testing if the test fails and the government to pay if the test does not fail. This puts the cost of the tests that do not fail on the government and will require a modification during construction.

Specific Actions Needed to Resolve: Insert a line Item CORING OF FINISHED WALL. Insert an estimated quantity and obtain a unit price from the contractor. Provide the performance criteria for the coring and note that the location and depth will be at the direction of the COR.

Responder Name(s): Luis Ruiz-CESAJ

Response: Concur, this is an excellent idea and we will add verification borings to future contracts.

P&S_AS-1. Comment: Use of soil cement bentonite mix for the slurry wall needs to be replaced with soil bentonite option.

Basis of Comment: Problems with curing and sand layers within the slurry wall probably resulting from the action of rolling the mix down the slope of the trench

Significance of Comment: The integrity of the wall is in question

Specific Actions Needed to Resolve: Need to look at the soil bentonite option rather than soil cement bentonite. Concerns raised by URS in their July 26, 2006 letter are unfounded and needs to be revisited. SFWMD has installed over 3 miles of soil bentonite wall along the L-8 levee less than a mile away from the COE trailer. Hydrofracturing and desiccation cracks were not evidenced during this project construction.
I have discussed this with other experts with past local experience in soil cement wall with local experience in slurry wall installation and none have reported the above.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Our main concerns are directly related to the SB material erodibility and the potential for shrinkage cracks in the SB wall due to the lack of a high pool to maintain the soil-bentonite mix hydrated and in a plastic state. The SB wall will be built to around 32-foot top elevation and this extraordinary pool may not occur for a long time. We have evaluated the potential adverse chemical reactions at the site which may prevent the Portland cement from performing in this environment or may cause the bentonite to flocculate and this has been demonstrated to be non-issues. We do not rule out the potential for using SB walls in the future if the conditions are deemed appropriate for their use.

P&S_AS-2. Comment: The plans and specs needs to clearly spell out a fool proof QA/QC plan which should be verified and inspected by COE inspectors daily.

Basis of Comment: Several of the problems with the slurry wall have been identified to QA/QC problems. A suitably sized desander and a mobile lab on site will provide data to the construction and QA staff to monitor the viscosity and other variables that affect the slurry.

Specific Actions Needed to Resolve: QA/QC plan

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Will ensure an adequate QA/QC plan is incorporated into P&S documents.

P&S_AS-3. Comment: Work on the project has currently been suspended however the contractor has cut into the entire reach to create the platform. The understanding was that the levee will be returned to its original cross section before the onset of the hurricane season. URS has evaluated the stability of the dike with the working platform in place and have determined that its presence does not result in less than satisfactory stability of the overall levee. However, it is important that disturbed areas be re-vegetated to prevent erosion. Additionally, the local stability of the lower slope in design subreach D was less than satisfactory both before and after construction of the temporary working platform. Accordingly, ballast fill should be placed at the toe within this subreach to enhance stability.

Basis of Comment: The excavation into the dike remains open and could pose a serious danger to the integrity of the levee should there be storm surges from hurricanes crossing the lake.

Specific Actions Needed to Resolve: Repair the levee.

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. The Dike will be restored to its pre-construction condition including re-vegetation. In addition, ballast fill will be placed under the current contract at the toe of the embankment within this section to enhance stability.

P&S_JDM-1. Comment: The P&S should require a test section be built and all performance criteria checked and calibrated prior to proceeding with contract placement.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future contracts will provide for test sections at the beginning of the contract to evaluate and concur with construction practices and means and methods. Some of the test sections will take place off the embankment to avoid unnecessary detrimental impacts to the structure.

P&S_JDM-2. Comment: The P&S should require acceptance sections verified with testing prior to proceeding with subsequent acceptance sections. There needs to be some limit as to how many feet of project features can be installed without QA/QC verification.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. This will be included in future specifications.

P&S_JDM-3. Comment: The P&S Hurricane Protection/Severe Plan needs to include specific limits on installation work within a certain amount of time prior to a hurricane or tropical storm being in the area. Lake levels also need to be addressed in the plan.

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s): Luis Ruiz-CESAJ

Response: Concur. Future specifications will include restrictions that do not permit trench construction when the lake level rises to a safe specified elevation (determined during design). Also, the exposure of the embankment will be reduced by limiting the linear extent of the dike where construction activities can take place at any given time. Restrictions to work associated with storm events will be requirements to be addressed within the Contractor's Site Safety Plan.

Supplemental Independent Technical Review Plan

GENERAL SCOPE

This ITR will review the evolution of the project design, from the Major Rehabilitation Report (MRR) through the Plans and Specifications (P&S), to determine if changes are warranted to the final design. The final design is the Reach 1, Subreach A P&S. The goal is to have an independent review of the assumptions, analysis and design with the intent to validate the conclusions reflected in the final design or recommend adjustments to protect the public interest. The ITR Team will be issued additional requests to perform ITR for subsequent reaches and subreaches.

Review materials will consist of a Major Rehabilitation Evaluation Report (100-200 pages), Design Documentation Report (~100-200 pages), Value Engineering Study (~50 pages), BCI Report (~90 Pages), Comments on BCI Report (13 pages), technical plans and specifications (~50 sheets, ~100 pages) and the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Draft Final Report of the Interagency Performance Evaluation Task Force, Volume I – Executive Summary (~50 pages). In addition, previous technical reviews and other expert opinions and assessments will be made available to the ITR Team.

DESIGN DESCRIPTION AND PROJECT STATUS

The HHD is about 143 miles in length and about 25-30 feet in height. Due to the possibility of failure in the dike due to piping when lake levels are high, a Major Rehabilitation Report (MRR) was prepared for the entire dike, with specific focus on Reach 1. The MRR plan of action involves utilizing a covered pipe in the toe ditch with a seepage trench beneath the pipe for collection of water as well as being a piping barrier and also requires the addition of a new drainage swell for conveyance of storm and irrigation water, constructed along the landside toe of the dike. A VE study was done on the MRR-Reach 1. The recommended plan utilized a gravel filter/seepage trench similar to the MRR, but relocated the trench lakeward to the toe berm of the dike. The VE study also utilized the existing drainage toe ditch for conveyance of water, but with no tailwater management.

While preparing the DDR, the VE recommendation was tested and found to result in too much water entering the toe ditch. The VE was modified with a combination cutoff wall and seepage trench. This selected design is being applied throughout Reach 1A. The completion of the MRRs for Reaches 2 & 3 are on hold. The MRR lengths are: MRR Reach 1– 22.4 miles; MRR Reach 2 – 20.4 miles; and MRR Reach 3 – 6.7 miles. Reach 1 is further divided into four subreaches: sub-Reach A - 4.6 miles; B - 3.7 miles; C - 6.5 miles; and D - 7.3 miles.

The construction contract for Reach 1, Subreach A was awarded September 2005. That work involved improvements to Reach 1, Subreach A of the Herbert Hoover Dike including a low permeability cutoff wall, relief trench, ditch lining, ditch drain connectors, and an access berm. Work also includes erosion and sediment control measures, grassing, overhead power line modifications, and incidental related work. The contractor, through the Request for Proposal process, was allowed to use one or any combination of the following methods: Soil-Cement-Bentonite Slurry Trench Cutoff Wall, Cement-Bentonite Slurry Trench Cutoff Wall, or Vibrated Beam Cutoff Wall.

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On or about May 2, 2006, the "Report Of Expert Review Panel, Technical Evaluation Of Herbert Hoover Dike Lake Okeechobee, Florida" was released to the public. The report was prepared by BCI Engineers & Scientists, Inc. for the project sponsor The South Florida Water Management District. The report is the result of an independent technical review of the stability and safety of the Herbert Hoover Dike around Lake Okeechobee, Florida. The report made recommendations to address safety issues.

REVIEW SCOPE AND CHARGES

The ITR Team is responsible for making a thorough technical review to insure the design for Reach 1 in the Reach 1, Subreach A P&S, and subsequently other reaches, addresses proper application of established criteria, regulations and professional standards and practices.

The ITR Team will address each of the following charges as part of their review and provide other comments as appropriate.

Charges:

1. Review and comment on the assumptions, methods, analyses and design and conclusions drawn from the MRR, DDR and VE Study and how they pertain to the design presented in the P&S.

2. Address whether the current models, modeling, solutions and design are consistent with the state of the practice.

3. Address whether the statistical/probablistic methods used in the Corps of Engineers documents are correct, and if not, what methods and/or analyses should be used.

4. Address whether the current location (and design) promotes seepage and instability of the downstream slope.

5. Review and comment on the elevations and locations of the cutoff walls and repair measures.

6. Address whether the P&S adequately address dike integrity by construction activities.

7. Address whether the P&S adequately address stability during the construction process.

8. Address whether the COE documents provide an adequate basis for the construction plans and specifications.

9. Address whether the plans and specifications conform to the design.

10. Address whether the COE documents address applicable lessons learned from the Draft Final Report of the Interagency Performance Evaluation Task Force for the Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System. If not, which lessons learned need to be addressed and what actions need to taken to address those lessons learned.

SCHEDULE

The level of effort is envisioned to be about 80 hours per reviewer including travel. Thirty-two of those hours are for the project orientation, document reading prior to site visit, and site visit/kickoff meeting. The remainder will be used to review documents and to prepare and resolve comments. The ITR Team will reaffirm scope and costs of the ITR effort after the kickoff meeting.

Milestones	Date
Complete External ITR Plan	30Jun06
Start ITR – Provide MIPRs and Review Materials	7Jul06
Kickoff Meeting – Site Visit	Week of 19 July
Complete Review and Submit Comments to ITR Lead	1Aug06
Consolidate and Provide Comments to PDT	5Aug06
PDT Response to Comments Completed	22Aug06
Issue Resolution & Final External ITR Team Concurrence	24Aug06
ITR Certification	30Aug06

COMMENT DOCUMENTATION

All comments are part of a professional work product that will be coordinated internally and reviewed prior to release. Comments will be provided in the required format exhibited in Appendix A.

In addition to comments and responses, a summary memorandum will be prepared by the ITR team leader that indicates which issues are resolved, which are unresolved, and what actions are needed.

ISSUE RESOLUTION AND ITR TEAM MEMBER RESPONSIBILITIES

Each team member should focus on their acknowledged area of expertise and provide comments accordingly. If they have issues or comments regarding other technical areas, they should discuss the issue or comment with the appropriate ITR team member to become that team member's comment.

Open discussions are encouraged to facilitate the understanding of review materials and project scope.

Comments will be consolidated and packaged by the ITR team leader and forwarded to the Project Engineer.

The ITR team is not responsible for the completed P&S or other work products. The final resolution of comments resides with the Jacksonville District Engineering Division Chain of Command.

SUBMITTALS for ITR

Project Presentations;
Related news articles;
The MRR, DDR, BCI Report, previous technical reviews and P&S.

DELIVERABLES: The following are the ITR deliverables.

ITR Plan for inclusion into PMP;
ITR Comments;
ITR MFR and Report and
ITR Certification

TEAM MEMBERS AND DISCIPLINES

Construction Engineering	Brian P. Lorence, CELRL-CD-K-L
Cost Engineering	Timothy A. Lamb, CELRL-ED-M
Hydrology and Hydraulics, Water Management/Dam Safety	Glendon T. Stevens, CENAP-EC-H
Hydrology and Hydraulics	Randall A. Wise, CENAP-EC-H
Geotechnical Engineering	Wayne A. Bieganousky, CESAW-TS-EG
Geotechnical Engineering	Michael D. Ramsbotham, CESPK-ED-GS
Geotechnical Engineering	George L. Sills, CEERD-GS-E
Geology	Kenneth E. Henn, CELRL-ED-T-G
Operation and Maintenance	George L. Horne, South Florida Water Management District
Geotechnical Engineering	Art Sengupta, South Florida Water Management District
PED and Construction Overview ITR Team Leader	Jimmy D. Matthews, CESAJ-EN-TI

Appendix A – ITR Documentation

For each comment made during ITR, reviewers shall provide the following four pieces of information:

1. A clear statement of the comment: Review comments shall state the reviewer's comment as clearly as possible. Comments shall be related to policies, guidance, and/or technical issues. Editorial comments will not be included as part of the ITR documentation (however reviewers are encouraged to identify editorial comments to the PDT separately). Each ITR comment shall include specific page numbers, paragraphs, sentences, plans and or table/figure numbers when appropriate.

2. A citation of authority related to the comment, if appropriate: Citations of authority may include Corps guidance, regulations, manuals, legal statutes, academic guidance or other appropriate authority. Citations should be clear and specific. A citation of authority is not required for all comments.

3. An indication of the significance of each comment: The significance of each comment shall be based on an assessment of the likelihood that the comment may impact the final design, document recommendations and conclusions or some other key element or aspect of the project.

4. An explanation of what the PDT needs to do to resolve the comment. The ultimate purpose of ITR is to improve the quality of the product; therefore each comment shall indicate specifically what the Project Delivery Team needs to do to resolve the comment if appropriate.

Project Delivery Team responses to ITR comments will also be fully documented in writing. Each response will provide the name and office of the team member who is providing the response to the comment, whether the PDT agrees or disagrees with the comment and the exact location and content of any revisions that are being made to the document. The ITR comment/response format for this review follows.

Once the independent technical review has been completed the ITR team members will certify it by signing a "Completion of Independent Technical Review" form. In signing this form, ITR team members indicate that they have performed their assigned task of conducting an Independent Technical Review. Their signatures do not necessarily indicate that they agree with the resolution of all disputes that occurred during the ITR process. After the Completion of Independent Technical Review form is signed, a representative of the SAJ Office of Counsel will sign a "Certification of Legal Review" and the appropriate functional Chief's will sign the "ITR Certification."

ITR COMMENT FORMAT EXPLANATION

ITR comments will be numbered and indexed in the following manner. Indexing is needed for final compilation of comments. Include document target for comment. Some comments may be General and not document specific.

MRR_JDM-1, MRR_JDM-2, DDR_JDM-1, DDR_JDM-2, P&S_JDM-1, P&S_JDM-2. General_JDM-1, etc… except put reviewer's initials in the comment.

MRR

Main Report

1. (MRR_JDM-1)

2. (MRR_BAR-8)
…..

Engineering Appendix

30. (MRR_HAR-6).

31. (MRR_GHD –15)
….

P&S

Specifications

10. (P&S_JDM-6) Section 01000, Para. 3.5

CHARGES

Charge 1

1. Ch1_JDM-1.

And so forth.

ITR COMMENT FORMAT

MRR

REVIEWER NAME: Jimmy D. Matthews

MRR_JDM -1. Comment:

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Name(s):

Response:

DDR

DDR_JDM-1. Comment:

Basis of Comment:

Significance of Comment:

Specific Actions Needed to Resolve:

Responder Names(s):

Response:

CHARGES

Ch1_JDM-1. Comment:

Basis of Comment:

Specific Actions Needed to Resolve:

Responder Names(s):

Response: