RD 2062

RIVER ISLANDS AT LATHROP STAGE 1 LEVEE SYSTEM

REPORT OF ADEQUATE PROGRESS TOWARDS AN URBAN LEVEL OF FLOOD PROTECTION

JUNE 2016

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INTRODUCTION

In 2007, the California Legislature passed Senate Bill (SB) 5, which requires all cities and counties within the Sacramento-San Joaquin Valley to make findings related to an urban level of flood protection for lands within a flood hazard zone. The bill defined "urban level of flood protection" as the level of flood protection necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources (DWR). Further, the legislation required a city or county, prior to making any number of land use decisions beginning in July 2016, to demonstrate that there is an urban level of flood protection, impose conditions that will achieve the urban level of flood protection, or demonstrate adequate progress toward providing an urban level of flood protection. In November 2013, DWR released guidelines for implementing the legislation titled, *Urban Level of Flood Protection Criteria* (ULOP Criteria).

The River Islands at Lathrop (River Islands) project is a master planned community located within the limits of the City of Lathrop on Stewart Tract. The River Islands project area is coterminous with Island Reclamation District 2062 (RD 2062) and RD 2062 is both the local maintaining agency for River Islands levees and the local flood management agency as defined by State law for the River Islands project area.

Stewart Tract is an island in the Sacramento-San Joaquin Delta and is surrounded by federally authorized "Project" levees with RD 2062 comprising the area of the Stewart Tract north of the Union Pacific Railroad and Reclamation District 2017 (RD 2107) comprising the southern portion. As Project levees, these levees fall within the State Plan of Flood Control. In addition to the Project levees surrounding Stewart Tract there are two non-Project levees within RD 2062's jurisdiction: the Interior Levee and the Cross Levee, which are certified for the 100-year event and accredited by the FEMA, but are not federally authorized. These levees are not in the SPFC. The Interior Levee and Cross Levee together create a smaller ring levee within the larger ring levee surrounding Stewart Tract. The area within this smaller ring levee is called Stage 1 of the River Islands at Lathrop development. Figure 1 depicts the Stage 1 area and levees.

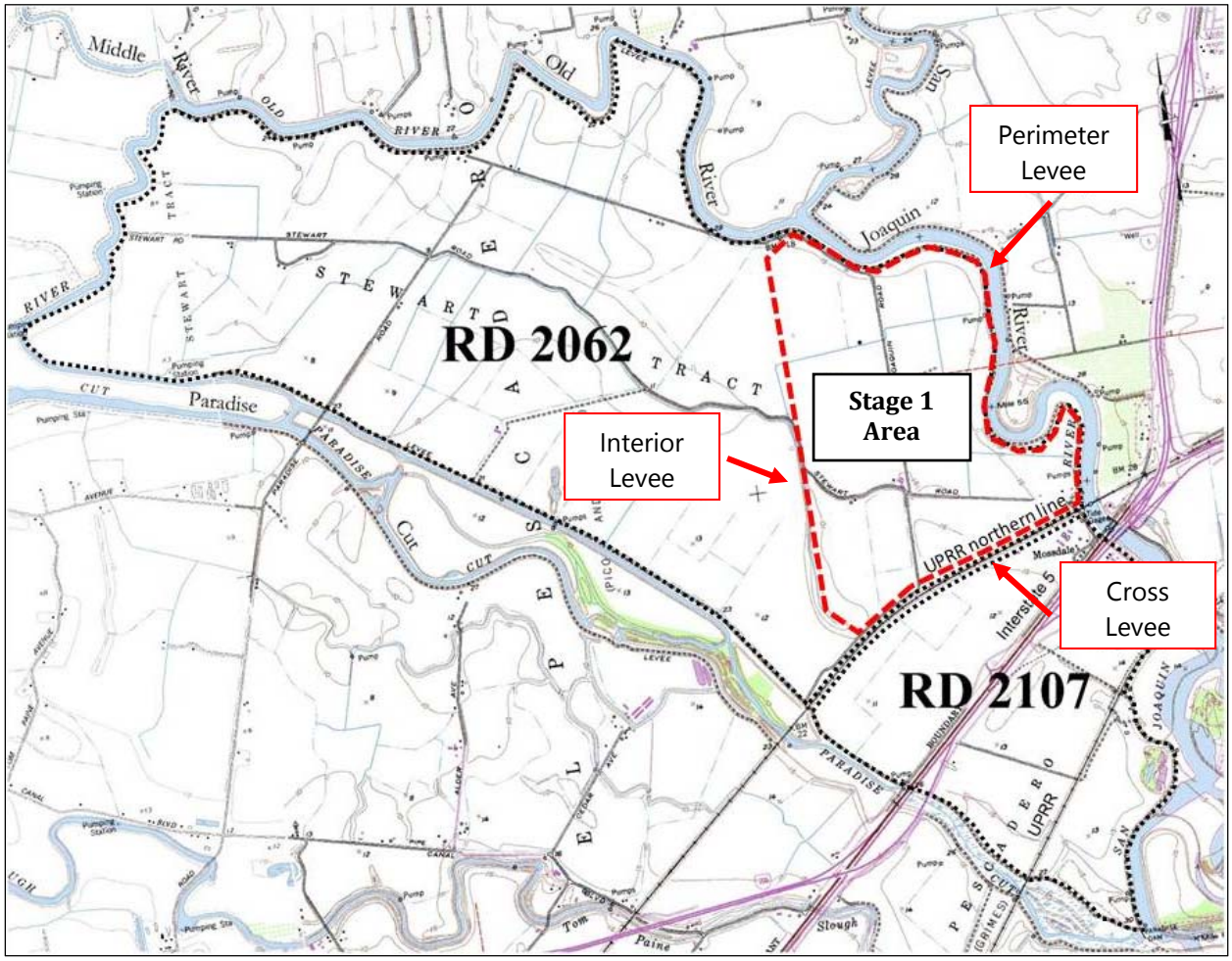

Figure 1 – River Islands at Lathrop, Stage 1 Levee System

To support the continued development of the River Islands project in accordance with the ULOP Criteria, RD 2062 has prepared this report to support an Adequate Progress Finding (APF) by the City of Lathrop. Typically, an APF would be made when flood protection features do not provide an urban level of flood protection, but there is adequate progress in improving these facilities to provide an urban level of protection by 2025. However, in the case of River Islands Stage 1, the City of Lathrop is making an APF to support the development of the Stage 1 area while RD 2062 completes the procedural requirements for a full compliance finding; see *Scope for Providing an Urban Level of Flood Protection* below. To support this finding, EVD-3 of the ULOP Criteria requires that substantial evidence in the record include, at a minimum, the following:

- A report prepared by the local flood management agency demonstrating adequate progress as defined in California Government Code Section 65007(a). This document is this report.
- A report prepared by a Professional Civil Engineer registered in California to document the data and analyses for demonstrating the property, development project, or subdivision will have an urban level of flood protection at the time when the flood protection system is completed. Appendix D of this report is the *RD 2062, River Islands at Lathrop Stage 1 Levee System, Urban Level of Flood Protection Engineer's Report, March 2016, Final* (*Engineer's Report*) which upon

completion will support a future ULOP Finding. The Professional Civil Engineer's certification is provided as Appendix A.

- A report by an Independent Panel of Experts (IPE) on the review of the report prepared by the Professional Civil Engineer. Appendix C is the IPE's Report to support an APF.
- A response by the Professional Civil Engineer to the comments from the IPE. Specific comment responses are included in Appendix C, the IPE's Report; a response by the Professional Civil Engineer to the IPE's report is provided as Appendix B.
- The most recent annual report prepared by the local flood management agency that was submitted to the Central Valley Flood Protection Board documenting the efforts in working toward completion of the flood protection system. This is non-applicable because this is the first report.
- Any additional data and information that cities or counties use to make the finding.

PURPOSE OF REPORT

The ULOP Criteria requires a report be prepared by the local maintaining agency, in this case RD 2062, demonstrating adequate progress as defined below:

- *The total project scope, schedule, and cost of the completed flood protection system have been developed to meet the appropriate standard of protection.*

The scope, schedule, and cost for providing an urban level of flood protection are discussed individually below.

- *Revenues that are sufficient to fund each year of the project schedule developed in paragraph (1) have been identified and, in any given year and consistent with that schedule, at least 90 percent of the revenues scheduled to be received by that year have been appropriated and are currently being expended. And, notwithstanding this, for any year in which state funding is not appropriated consistent with an agreement between a state agency and a local flood management agency, the CVFPB may find that the local flood management agency is making adequate progress in working toward the completion of the flood protection system.*

As discussed below in Scope for Providing an Urban Level of Flood Protection, the Stage 1 Levee System is of recent construction and has been evaluated for compliance with ULDC. Based on this evaluation, the certifying engineer believes no additional structural actions are required for the Stage 1 Levee System to provide an urban level of flood protection. Therefore, there is no need to identify future revenue sources.

- *Critical features of the flood protection system are under construction, and each critical feature is progressing as indicated by the actual expenditure of the construction budget funds.*

Construction of the critical features of the Stage 1 Levee System is complete, as discussed below in *Scope for Providing an Urban Level of Flood Protection*.

- *The city or county has not been responsible for a significant delay in the completion of the system*.

Construction of the critical features of the Stage 1 Levee System is complete, as discussed below in *Scope for Providing an Urban Level of Flood Protection*. Neither the City of Lathrop nor San Joaquin County has been responsible for any delay.

- *The local flood management agency shall provide the DWR and the CVFPB with the information sufficient to determine substantial completion of the required flood protection. The local flood management agency shall annually report to the CVFPB on the efforts in working toward completion of the flood protection system.*

Construction of the critical features of the Stage 1 Levee System is complete, as discussed below in *Scope for Providing an Urban Level of Flood Protection*. This report, and its appendices will be provided to the DWR and CVFPB and will serve as the substantial evidence record for demonstrating substantial completion of the Stage 1 Levee System. Annual Reporting is discussed below.

Scope for Providing an Urban Level of Flood Protection

Structural actions necessary to provide an urban level of flood protection to the Stage 1 area were completed in 2005 and 2006. These actions are described in the *Engineer's Report*. To support a future City of Lathrop ULOP Finding, RD 2062 has been compiling the required substantial evidence record which is currently largely comprised of the *Engineer's Report,* and its associated appendices and references. The *Engineer's Report* and supporting documents have undergone several rounds of review with the IPE. To complete the substantial evidence and support a future ULOP Finding, the following actions are necessary:

- Complete engineers' responses to IPE comments
- Finalize Engineer's Report
- IPE completes IPE Report
- City of Lathrop adoption of Grading Ordinance (occurred June 6, 2016, with second reading scheduled for June 20, 2016)
- RD 2062 adoption of Final Engineer's Report

The *Engineer's Report* (Appendix D) is provided as substantial evidence in the record for the purposes of demonstrating adequate progress.

Schedule for Providing an Urban Level of Protection

It is anticipated that the actions identified above will be completed no later than August 2016.

Cost for Providing an Urban Level of Protection

Review by the IPE has already been scoped, budgeted, and funded. A requirement for additional funds is not anticipated.

Annual Reporting

RD 2062 intends on adopting an urban level of flood protection in late summer/early fall 2016. Therefore no annual reporting would be required as the requirements of an ULOP Finding would then apply. In the unlikely case that an ULOP Finding is not made by the City of Lathrop prior to August 2017, RD 2062 will report on its progress in providing an urban level of protection on an annual basis. The progress reports will include an update on the progress made towards the scope of work, an updated schedule, and the expenditures made to date, and estimated remaining costs.

Appendices

Appendix A Engineer's Certification

Appendix B Engineer's Response

Appendix C Report by the Independent Panel of Experts

Appendix D Engineer's Report

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APPENDIX A

ENGINEER'S CERTIFICATION

MBK ENGINEERS

Water Resources ◆ Flood Control ◆ Water Rights

GILBERT COSIO, JR., P.E.
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WALTER BOUREZ, III, P.E.
RIC REINHARDT, P.E.
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DARREN CORDOVA, P.E.
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ANGUS NORMAN MURRAY
1913-1985

CONSULTANTS:
JOSEPH I. BURNS, P.E.
DONALD E. KIENLEN, P.E.

CERTIFICATION

This certification is provided to the City of Lathrop, River Islands at Lathrop, and Reclamation District (RD) 2062 for the sole purpose of supporting an Adequate Progress Finding (APF). This certification is made in accordance with the requirements, definitions, and descriptions in the State of California Department of Water Resources' (DWR) *Urban Level of Flood Protection Criteria* (November 2013), Section 2, Subsection *EVD-3* and *Urban Levee Design Criteria* (ULDC) (May 2012), Section 7.0 *Urban Levee Design Criteria*.

All information, calculations, definitions, descriptions, restrictions, limitations, or other pertinent data contained or referenced in this document form the basis of this certification. This certification does not constitute a warranty or guarantee of performance, expressed or implied. This certification is made with respect to the River Islands at Lathrop Stage 1 Levee System (Levee System), as described in the *Reclamation District 2062, Adequate Progress Towards an Urban Level of Flood Protection Engineer's Report, March 2016 Final* (Engineer's Report) and my letter to the Reclamation District 2062 Urban Level of Flood Protection Independent Panel of Experts, dated June 1, 2016.

Limits and Conditions of This Certification

This certification shall expire or become invalid at the earliest time any of the following conditions are met for any particular levee system:

- A certification of an urban level of flood protection for the facilities.
- Integrity of the levee systems have degraded to the point that the identified improvements will not be adequate to provide an urban level of flood protection, as determined by me, or a duly qualified designated successor.
- Discovery of any substantive defect in the condition of any component of the levee system that was not known at the time this certification was made, and which materially affects the system's ability to provide protection relative to the 0.5 percent annual flood, as determined by me, or a duly qualified designated successor.

Certification Statement

At the request of RD 2062, as supported by the information contained and referenced within the Engineer's Report, this is to certify the following:

- *Certification of Data and Information* – The data and information presented in this report are accurate to the best of my knowledge.

- *Certification of Analysis* – To the best of my knowledge, the analyses conducted were performed in accordance with DWR's ULDC and/or sound engineering practices, in a manner consistent with the degree of skill and care ordinarily exercised by members of the civil engineering profession currently practicing in the same locality under similar conditions.

I, Richard Reinhardt, PE, a professional registered civil engineer in the State of California, certify that the aforementioned levee system, as described in the *Reclamation District 2062, River Islands at Lathrop, Stage 1 Levee System Urban Level of Flood Protection Engineer's Report, March 2016 Final* will provide an urban level of flood protection upon completion of the substantial evidence record.

June 10, 2016
Date

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APPENDIX B

ENGINEER'S RESPONSE

ENGINEER'S RESPONSE TO

INDEPENDENT PANEL OF EXPERTS REPORT ON THE REVIEW OF THE RECLAMATION DISTRICT 2062, URBAN LEVEL OF FLOOD PROTECTION ENGINEER'S REPORT, DEMONSTRATING ADEQUATE PROGRESS

PREPARED BY: RICHARD G. REINHARDT, P.E.

JUNE 10, 2016

Reclamation District 2062 issued its final *Urban Level of Flood Protection, Engineer's Report (Engineer's Report)* in March 2016. Subsequently, the RD 2062 Urban Level of Flood Protection Independent Panel of Experts (IPE) reviewed the Engineer's Report and issued its own report (Letter, Subject: *River Islands at Lathrop, Stage 1 Levee System, Adequate Progress Towards an Urban Level of Flood Protection, Independent Panel of Experts Review of Engineer's Report)* on their review on June 9, 2016. State of California Department of Water Resources' Urban Level of Flood Protection Criteria (ULOP Criteria) requires a response by the Engineer to the IPE's report.

The IPE reviewed a draft (November 2015) and final (March 2016) version of the *Engineer's Report,* as well as draft and final versions of the associated appendices to support an Urban Level of Flood Protection Finding (ULOP Finding), as demonstrated in the comment and response tables attached to the IPE report. However, in light of the approaching July 2, 2016 deadline for making findings and the IPE's comments, the City of Lathrop is now proceeding with an Adequate Progress Finding (APF).

After review of the IPE's report, I concur with the IPE's comments regarding the need to complete the substantial evidence record to support a future ULOP Finding. In support of the APF, there are no outstanding or unresolved comments from the IPE.

Signed,

Ric Reinhardt, PE
MBK Engineers

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APPENDIX C

IPE REPORT

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Dr. David T. Williams, PE, PH, CFM, DWRE
DTW and Associates, Engineers, LLC
1112 Oakridge Drive, Suite 104, PMB 236
Fort Collins, Colorado 80525

June 9, 2016

Ms. Susan Dell'Osso, President
Reclamation District 2062
73 West Stewart Road
Lathrop, CA 95330

Subject: River Islands at Lathrop, Stage 1 Levee System
Adequate Progress Towards an Urban Level of Flood Protection
Independent Panel of Experts' Review of Engineer's Report

Dear Ms. Dell'Osso:

Introduction

This letter serves as the Independent Panel of Experts' (IPE) report on the review of the Reclamation District (RD) 2062, *River Islands at Lathrop Stage 1 Levee System, Urban Level of Flood Protection Engineer's Report, March 2016* (Engineer's Report) for levees protecting the Stage 1 development area of River Islands on Stewart Tract. The Engineer's Report was prepared by MBK Engineers. The original intent of the Engineer's Report was to demonstrate by substantial evidence in the record that a 200-year Urban Level of Flood Protection currently exists within the Stage 1 area by the levee system currently in place. As of this date, the record is not yet complete or sufficient to support an Urban Level of Flood Protection Finding. Consequently, the engineers and managers associated with the project have requested that the IPE review the documentation with respect to an Adequate Progress Finding (APF) and whether the Stage 1 levee system would provide an Urban Level of Flood Protection if additional substantial evidence were provided. The IPE believes that the current Stage 1 levee system meets most of the requirements needed to meet an Urban Level of Flood Protection, but that additional evidence and documentation needs to be completed and submitted into the record in order for a full finding to be reached that an Urban Level of Flood Protection exists. Based on the analyses performed and the information presented to date, the IPE concurs that there is currently substantial evidence in the record demonstrating that the Stage 1 levee system will provide a 200-year Urban Level of Flood Protection upon completion of the substantial evidence record.

Background

The City of Lathrop intends on making an APF towards an Urban Level of Flood Protection for the Stage 1 River Island levee system on Stewart Tract in San Joaquin County, California. The Stage 1 River Island levee system is located entirely within RD 2062 and is composed of the following levee segments:

- **Perimeter Levee** – The Perimeter Levee is part of the San Joaquin River left bank levee between the northwestern branch of the Union Pacific Railroad (UPRR) and the junction with Old River. It is approximately 12,500 feet long. The Perimeter Levee was greatly enlarged (widened) in recent years by constructing levee fill adjacent to and landward of the existing levee. This configuration resulted in levee crowns much wider than common levee sections. Levee crowns along the Perimeter Levee range from a minimum width of about 70 feet to over 300 feet in width, as compared to a nominal 20-foot-width generally required for levees meeting an Urban Level of Flood Protection. Moreover, the added adjacent levee fill is composed of compacted clay, which is a much better levee material for seepage control and erosion resistance than most existing levee materials in the State-Federal Project levee system.
- **Cross Levee** – The Cross Levee is the segment of the Stage 1 ring levee that parallels the northwestern UPRR embankment. It is approximately 6,000 feet long and has a minimum levee crown width of about 50 feet. It is normally a dry-land levee that provides flood protection only if certain portions of either the San Joaquin River, Old River, or Paradise Cut levees fail and flood Stewart Tract. Stewart Tract was flooded in 1997 as a result of a levee failure along Paradise Cut.
- **Interior Levee** – The Interior Levee is the segment of the Stage 1 ring levee on the west side of the Stage 1 project area and runs between the Cross Levee and the Perimeter Levee. The Interior Levee joins the Perimeter Levee near the junction of the San Joaquin River with Old River. It is approximately 10,000 feet long and has a minimum levee crown width of about 40 feet. It is also a normally dry-land levee that provides flood protection only if certain portions of either the San Joaquin River, Old River, or Paradise Cut levees fail and flood Stewart Tract.

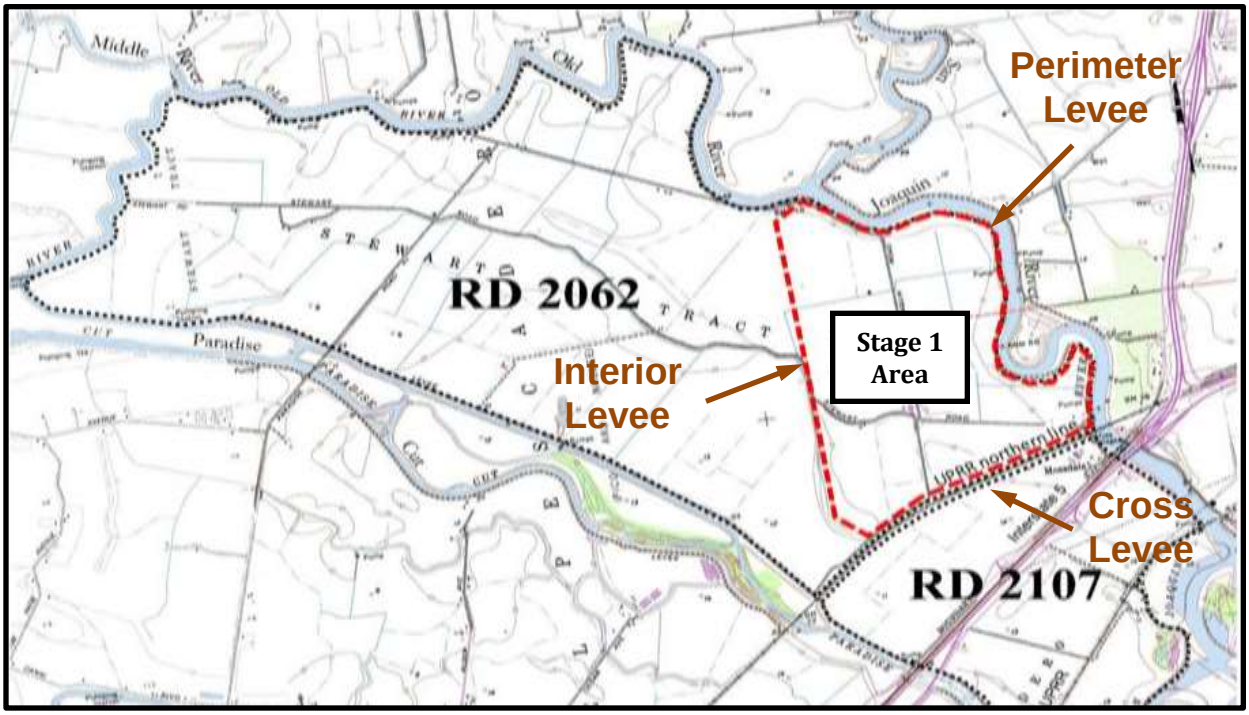

Figure 1: River Islands at Lathrop Stage 1 Project (adapted from MBK, 2016)

Senate Bill 5, enacted in 2007, requires cities and counties within the Sacramento-San Joaquin Valley to make a finding related to the Urban Level of Flood Protection criteria before approving certain land-use decisions within a flood basin. The finding can be either a finding that the levee system **provides** an Urban Level of Flood Protection, or a finding that **adequate progress** is being made towards providing an Urban Level of Flood Protection. In this case, the IPE is being asked to review an Engineer's Report for the River Islands Stage 1 levee system in support of an APF. The technical criteria associated with an Urban Level of Flood Protection and what is required for substantial evidence in the record to support an APF are contained in the following two documents:

1. Urban Levee Design Criteria (ULDC) – published by the Department of Water Resources (DWR) in May 2012, this document provides the engineering criteria and guidance for the design, evaluation, operation, and maintenance of levees and floodwalls that provide a 200-year Urban Level of Flood Protection. It outlines 20 technical areas associated with levee integrity and the evaluations needed to assure an Urban Level of Flood Protection:

   - Section 7.1 - Design Water Surface Elevation
   - Section 7.2 - Minimum Top of Levee
   - Section 7.3 - Soil Sampling, Testing, and Logging
   - Section 7.4 - Slope Stability for Intermittently Loaded Levees
   - Section 7.5 - Underseepage for Intermittently Loaded Levees
   - Section 7.6 - Frequently Loaded Levees
   - Section 7.7 - Seismic Vulnerability
   - Section 7.8 - Levee Geometry
   - Section 7.9 - Interfaces and Transitions
   - Section 7.10 - Erosion
   - Section 7.11 - Right-of-Way
   - Section 7.12 - Encroachments
   - Section 7.13 - Penetrations
   - Section 7.14 - Floodwalls, Retaining Walls, and Closure Structures
   - Section 7.15 - Animal Burrows
   - Section 7.16 - Levee Vegetation
   - Section 7.17 - Wind Setup and Wave Runup
   - Section 7.18 - Security
   - Section 7.19 - Sea Level Rise
   - Section 7.20 - Emergency Actions

2. Urban Level of Flood Protection (ULOP) Criteria – published in November 2013 by DWR, this document describes the procedures for making findings, including the processes for having substantial evidence in the record to make an APF.

   To support an APF, the ULOP Criteria includes the following requirements:

*"**EVD-3**: Substantial evidence in the record to support a finding related to an urban level of flood protection based on adequate progress on the construction of a flood protection system shall include the following, at a minimum:*

- *A report prepared by a Professional Civil Engineer registered in California to document the data and analyses for demonstrating the property, development project, or subdivision will have an urban level of flood protection at the time when the flood protection system is completed.*
- *A report by an Independent Panel of Experts on the review of the report prepared by the Professional Civil Engineer.*
- *A response by the Professional Civil Engineer to the comments from the Independent Panel of Experts."*

The ULOP EVD-3 Criteria has other requirements as well, but the subject of this report by the IPE pertains to the second bullet outlined above. Under Section 3.0, Other Considerations, the ULOP Criteria also states:

"The report prepared by a Professional Civil Engineer registered in California should provide the following information as evidence that an urban level of flood protection exists or will exist for the area under consideration:

- *A list of the flood management facilities utilized in providing an urban level of flood protection, including, but not limited to, SPFC facilities.*
- *The location of the flood management facilities utilized in providing an urban level of flood protection.*
- *The entities that operate and maintain the flood management facilities utilized in providing an urban level of flood protection.*
- *A list of, and consideration of, reports, evaluations, inspections, and performance history of the flood management facilities utilized in providing an urban level of flood protection since the previous finding, if any, was made.*
- *The response to the Independent Panel of Experts."*

Also under Section 3.0, Other Considerations, the ULOP Criteria states:

"The report by an Independent Panel of Experts should consider the assertions made in the Professional Civil Engineer's report and determine whether:

- *An urban level of flood protection from the identified sources of flooding exists or will exist for the area under consideration, or*
- *The subject flood management facilities meet the Urban Levee Design Criteria (DWR, 2012).*

If the panel does not concur with the assertions made in the Professional Civil Engineer's report, the report by the Independent Panel of Experts should state the reason(s) for not concurring."

Engineer's Report Prepared by MBK Engineers

The IPE has reviewed two drafts of the Engineer's Report prepared by MBK Engineers. The first draft reviewed by the IPE was dated November 2015. The IPE had several comments and questions regarding the report. As a result, MBK Engineers substantially revised the report to address IPE comments and submitted a revised draft labeled *Final* and dated March 2016. The *March 2016 Final* revision addressed many of the IPE comments, but there remain several IPE comments that require further clarification and/or information and there are also new comments added by the IPE that require resolution. In addition to the main Engineer's Report, there were more than a dozen Appendices to the report that addressed specific topics or questions previously raised by the IPE (Appendices A through P). The IPE has completed several reviews to different drafts of both the main Engineer's Report and to different drafts of the appendices. The IPE comments, the River Islands Team responses to IPE comments, IPE backcheck reviews, and closures of IPE comments are contained in the tables attached to this report (see Attachment 1).

As stated at the beginning of this IPE report, it was originally planned that a full finding that a 200-year Urban Level of Flood Protection currently exists would have been made for the Stage 1 Levee System. The Engineer's Report and its appendices were written to make such a finding following the *EVD-1* process as outlined in ULOP Criteria document. However, many of the comments provided by the IPE on various portions of the Engineer's Report and its appendices require further resolution and documentation. As this resolution and documentation is not yet complete, the IPE concludes that substantial evidence in the record to support a finding of Urban Level of Flood Protection does not yet exist. As a result, the River Islands Team is now pursuing an APF following the *EVD-3* process in accordance with ULOP criteria. Per the June 1, 2016 letter to the IPE from MBK Engineers, the IPE has been asked to evaluate the Engineer's Report and supporting appendices for an APF rather than for a finding that an Urban Level of Flood protection currently exists.

Composition of the IPE

The ULOP Criteria requires an IPE review of the Engineer's Report when flood management facilities and procedures are relied upon to provide an Urban Level of Flood Protection. As described in ULOP Criteria EVD-5, the ULOP Criteria requires a panel of at least three experts with different expertise, including at least one with expertise in hydrology and hydraulics, and at least two with expertise in design and construction of flood management facilities relevant to those under review, in this case, levee systems protecting urbanized areas. This IPE is comprised of Mr. Raymond Costa and Dr. Leslie F. Harder, both of whom have expertise in the design and construction of levees and other flood management facilities, and Dr. David T. Williams who has expertise in hydrology and hydraulics. Copies of the resumes for the three IPE members are attached to this report (see Attachment 2).

IPE Review of the Engineer's Report

The IPE makes the following observations with regard to the *March 2016 Final* version of the Engineer's Report prepared by MBK Engineers and to the supporting appendices prepared by the MBK Engineers and other members of the River Islands Team in meeting the requirements for an APF for an Urban Level of Flood Protection:

1. The Engineer's Report has been prepared under the direction of a licensed Civil Engineer in the State of California; Mr. Richard G. Reinhardt, who has signed and stamped the document.

2. The Engineer's Report has prepared a complete list of the flood management facilities, namely the Perimeter, Cross, and Interior Levee systems, together with the associated evaluations that will be utilized to demonstrate that they will provide an Urban Level of Flood Protection. The Engineer's Report is organized to have the descriptions and conditions of the levee systems summarized in the main report with more detailed information provided in various appendices.

3. The Engineer's Report identifies in text and in plates the locations of the flood protection facilities as well as levee stationing.

4. The Engineer's Report identifies the local maintaining agencies that operate and maintain the flood management facilities that will be utilized in providing an Urban Level of Flood Protection, including Reclamation District 2062 and Reclamation District 2107.

5. The Engineer's Report contains a large reference list of reports, evaluations, inspections, and performance history documents related to the flood management facilities. These reports were discussed and considered in the Engineer's Report.

6. The Engineer's Report and its supporting appendices demonstrate a clear understanding of the requirements of DWR's ULDC and what is needed for the River Islands Stage 1 levee systems to meet these requirements.

7. MBK Engineers and other members of the River Islands Team provided detailed responses to the review comments submitted by the IPE (see Attachment 1) and made substantial changes, clarifications, and improvements to the Engineer's Report and the supporting appendices to address IPE review comments. However, there are some comments that require additional resolution and documentation as well as new comments that require resolution and response. The IPE comments and the current status of substantial evidence in the record to support an Urban Level of Flood Protection can be summarized into three main groups:

   A. **ULDC Requirements Fully Addressed and Documented** – These are ULDC requirements that the River Islands Team has fully addressed and where there is substantial evidence in the record to demonstrate that these particular ULDC requirements for an Urban Level of Flood Protection have been met (ULDC Requirements 7.2, 7.3, 7.6, 7.7, 7.8, 7.9, 7.12, 7.13, 7.14 7.16, and 7.17). The IPE has closed out all substantial IPE comments on these requirements in the relevant comment/review spreadsheets and concurs that these ULDC requirements have been met and that there is substantial evidence in the record to support this conclusion. However, it should be noted that for

some of these criteria, there may be some instances where minor, non-safety related IPE comments recommending clarifications or additions be made to the documents remain open.

B. **ULDC Requirements Fully Addressed but only Partially Documented** – These are ULDC requirements for which the River Islands Team has provided information indicating that the levee system meets ULDC requirements, but where documentation and substantial evidence in the record is currently incomplete (ULDC Requirements 7.1, 7.11, 7.15, 7.18,, 7.19, and 7.20). However, the IPE believes that additional documentation can be developed by the River Islands Team and added to provide substantial evidence in the record to show that these ULDC requirements have been met.

C. **ULDC Requirements Partially Addressed and Partially Documented** – These are ULDC requirements for which the River Islands Team has provided significant documentation demonstrating that the levee system generally meets the ULDC requirements. However, there are specific aspects of the Stage 1 system that introduce uncommon potential failure modes that require further analysis and documentation to meet the ULDC requirements. These uncommon potential failure modes are as follows:

i) There are several large man-made lakes recently created and/or under construction within the Stage 1 area. These lakes are in some cases only a few hundred feet away from the levee embankments. Further, they have never been exposed to seepage loading during a high water flood event. The potential for high underseepage pressures and gradients to induce internal erosion (piping) and instability of the exposed lake slopes is still being evaluated by the River Islands Team. This affects the requirements in ULDC 7.4 Slope Stability and ULDC 7.5 Underseepage. Additional documentation or actions are required to meet these ULDC criteria.

ii) Near the northwestern corner of the Stage 1 area of River Islands, the Interior Levee joins the Perimeter Levee near the confluence of San Joaquin River and Old River. In this area, the Interior Levee is inland of and roughly parallel to the Old River/San Joaquin River Levee for approximately 1,100 feet. The distance between the two levees ranges from about 550 feet at the western end of this subreach to zero where they meet. The potential failure mode of concern here is if the unimproved Old River/San Joaquin River Levee in this area fails and the resulting scour flows then damages or erodes the inner Interior Levee that the Stage 1 area relies on for flood protection. The potential for failure of the Old River/San Joaquin River Levee in this subreach and the potential for significant scour erosion damage to the Interior Levee are being evaluated by the River Islands Team. This affects the requirements in ULDC 7.10 Erosion. Additional documentation or actions are required to meet this ULDC criterion.

iii) Along the southeastern side of the Stage 1 area of River Islands, the Cross Levee was constructed landward of the western alignment of the UPRR embankment. The Cross Levee provides vital flood protection in case of a levee failure along either the San Joaquin River, Old River, or Paradise Cut. The waterside toe of the Cross Levee is only about 120 feet away from the toe of the UPRR embankment. During

the 1997 flooding of Stewart Tract, the UPRR embankment temporarily retained flood waters created after a levee failure at Paradise Cut. The UPRR embankment then developed through seepage distress at several locations and eventually failed, leading to inundation of Stewart Tract. The potential failure mode of concern here would be if the unimproved UPRR railroad again develops through seepage distress and fails in a location opposite the Cross Levee, and the resulting scour flows then damages or erodes the inner Cross Levee. The potential for failure of the UPRR embankment in this subreach and the potential for significant scour erosion damage to the Cross Levee are being evaluated by the River Islands Team. This affects the requirements in ULDC 7.10 Erosion. Additional documentation is required to meet this ULDC criterion

A summary status of the documentation for the 20 ULDC criteria and IPE reviews is shown in Table 1.

Table 1: Summary Status of ULDC Requirement Documentation and IPE Reviews for River Islands Stage 1 Levee System

ULDC Criterion No.	Subject	Most Recent River Island Team Documentation	Most Recent IPE Review	IPE Conclusion/Status
7.1	Design Water Surface Elevation	Engineer's Report pp. 7-8 (March 2016)	Minor additional documentation requested (April 12, 2016)	Fully addressed and documented
		Appendix C: Hydraulic Analysis (March 2016)	All comments closed (April 18, 2016)	
		Appendix L: EXCEPTION to ULDC Emergency Actions (March 2016)	Substantial additional documentation requested (April 18, 2016)	Fully addressed, partially documented. EXCEPTION Required
7.2	Minimum Top of Levee	Engineer's Report pp. 8-9 (March 2016)	All comments closed (April 18, 2016)	Fully addressed and documented
		Appendix D: MTOL Compliance Evaluation (March 2016)	All comments closed (April 18, 2016)	
		Appendix K: Wind Wave Analysis (March 13, 2015)	All comments closed (January 16, 2016)	
7.3	Soil Sampling, Testing, and Logging	Engineer's Report pp. 9 -11 (March 2016)	All comments closed (April 12, 2016) and through email (April 23, 2016)	Fully addressed and documented
		Appendix E: Geotechnical Data Report (March 16, 2016)	All comments closed (April 18, 2016)	
		Appendix M: Levee Inspection Trench Observation Summary (April 21, 2016)	All comments closed (April 27, 2016)	

Table 1: Summary Status of ULDC Requirement Documentation and IPE Reviews for River Islands Stage 1 Levee System (continued)

ULDC Criterion No.	Subject	Most Recent River Island Team Documentation	Most Recent IPE Review	IPE Conclusion/Status
7.4	Slope Stability for Intermittently Loaded Levees	Engineer's Report pp. 11-13 (March 2016)	Several comments open/additional documentation requested (April 12, 2016)	Fully addressed, partially documented
		Appendix F: Geotechnical ULDC Evaluation – Levees (March 18, 2016)	Several comments open/additional documentation requested (April 12, 2016)	Fully addressed, partially documented
		Appendix N: Internal Lake Slope Stability Technical Memorandum (June 1, 2016)	Currently under IPE review	Partially addressed, partially documented
		Appendix O: Pedestrian Bridge Slope Stability Technical Memorandum (April 26, 2016)	Minor additional documentation requested (pending June 9, 2016)	Fully addressed and documented
7.5	Underseepage for Intermittently Loaded Levees	Engineer's Report pp. 13--15 (March 2016)	All comments closed (April 18, 2016)	Fully addressed and documented
		Appendix F: Geotechnical ULDC Evaluation – Levees (March 18, 2016)	Several comments open/additional documentation requested (April 12, 2016)	Fully addressed, partially documented
		Appendix N: Internal Lake Slope Stability Technical Memorandum (June 1, 2016)	Currently under IPE review	Partially addressed, partially documented
7.6	Frequently Loaded Levees	Engineer's Report pp. 15-16 (March 2016)	All comments closed. (April 12, 2016)	Fully addressed and documented
		Appendix G: Levee Loading Evaluation (March 2016)	All comments closed (April 18, 2016)	
7.7	Seismic Vulnerability	Engineer's Report pp. 16-17 (March 2016)	Minor additional documentation requested (April 18, 2016)	Fully addressed and documented
		Appendix F: Geotechnical ULDC Evaluation – Levees (March 2016)	Minor additional documentation requested (April 18, 2016)	
7.8	Levee Geometry	Engineer's Report pp.17-18 (March 2016)	All comments closed (April 12, 2016) and through email	Fully addressed and documented
7.9	Interfaces and Transitions	Engineer's Report pp. 18-19 (March 2016)	All comments closed. (April 12, 2016)	Fully addressed and documented
7.10	Erosion	Engineer's Report pp. 19--20 (March 2016)	Minor additional documentation requested (April 18, 2016)	Fully addressed and documented
		Appendix H: Erosion Evaluation (May 2016, but dated August 10, 2015)	Several comments open/additional documentation requested (June 8, 2016)	Fully addressed, partially documented
		Appendix P: Breach Potential Evaluation (March 29, 2016) – Northwestern Interior and Southeastern Cross Levee scour impacts	Several comments open/additional documentation requested (provided verbally May 2016)	Partially addressed, partially documented

Table 1: Summary Status of ULDC Requirement Documentation and IPE Reviews for River Islands Stage 1 Levee System (continued)

ULDC Criterion No.	Subject	Most Recent River Island Team Documentation	Most Recent IPE Review	IPE Conclusion/Status
7.11	Right-of-Way	Engineer's Report pp. 20-22 (March 2016)	All comments closed (April 12, 2016) EXCEPTION documentation requested in April 23, 2016 email	Fully addressed, partially documented. EXCEPTION Required
7.12	Encroachments	Engineer's Report p. 22 (March 2016)	All comments closed April 12, 2016)	Fully addressed and documented
		Appendix I: Encroachment and Penetration Evaluation (March 2016)	All comments closed. (April 12, 2016)	
7.13	Penetrations	Engineer's Report p. 22-24 (March 2016)	Minor additional documentation requested (April 18, 2016)	Fully addressed and documented
		Appendix I: Encroachment and Penetration Evaluation (March 2016)	All comments closed. (April 12, 2016)	
7.14	Floodwalls, Retaining Walls, and Closure Structures	Engineer's Report p. 24 (March 2016)	All comments closed (April 12, 2016)	Fully addressed and documented
7.15	Animal Burrows	Engineer's Report p. 24 (March 2016)	Several comments open/additional documentation related to Rodent Abatement Program (April 18, 2016)	Fully addressed, partially documented
7.16	Vegetation Evaluation	Engineer's Report pp. 24-25 (March 2016)	All comments closed (April 12, 2016)	Fully addressed and documented
		Appendix J: Vegetation Evaluation (March 2016)	All comments closed (April 18, 2016)	
7.17	Wind Setup and Wave Runup	Engineer's Report pp. 25-26 (March 2016)	All comments closed. (April 12, 2016)	Fully addressed and documented
		Appendix K: Wind Wave Analysis (March 13, 2015)	All comments closed (January 16, 2016)	
7.18	Security	Engineer's Report pp. 26-27 (March 2016)	Minor additional documentation requested (April 18, 2016)	Fully addressed and documented
		Security Plan (June 5, 2016)	Previously submitted version had several comments by IPE. Currently under review by IPE	Fully addressed, partially documented

Table 1: Summary Status of ULDC Requirement Documentation and IPE Reviews for River Islands Stage 1 Levee System (continued)

ULDC Criterion No.	Subject	Most Recent River Island Team Documentation	Most Recent IPE Review	IPE Conclusion/Status
7.19	Sea Level Rise	Engineer's Report pp. 27-28 (March 2016)	Several comments open/additional documentation requested (April 12, 2016)	Fully addressed, partially documented.
		Appendix C: Hydraulic Analysis (March 2016)	All comments closed (April 18, 2016)	Full addressed and documented
7.20	Emergency Actions and Flood Safety Plans	Engineer's Report p. 28-29 (March 2016)	IPE has not reviewed EAP or Flood Safety Plans (April 12, 2016)	Fully addressed, partially documented

Conclusion of the IPE

The IPE has reviewed the *March 2016 Engineer's Report* and the Engineer's Certification and concurs that there is substantial evidence in the record demonstrating that the River Islands Stage 1 levee system will provide an Urban Level of Flood Protection upon completion of the evaluations and additional documentation that will be added as substantial evidence to the record.

Respectfully submitted,

RIVER ISLANDS IPE TEAM MEMBERS

Mr. Raymond Costa, PE, GE

Dr. Leslie F. Harder, Jr., PE, GE

Dr. David T. Williams, PE, PH, CFM, DWRE

Attachments:
1) Excel Spreadsheet with IPE Comments, Responses from MBK, and IPE Backchecks
2) Resumes for members of the Independent Panel of Experts
3) Letter from Ric Reinhardt, MBK Engineers, dated June 1, 2016

Attachment 1:

Excel Spreadsheet with IPE Comments, Responses by MBK Engineers, and IPE Backchecks

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
14	ULDC 7.4	There is some discussion of the RDD stability factor of safety applicable to this project (fos 1.1 vs 1.2). Verify this text is consistent with the approach used in the ULDC geotechnical evaluation report.	The rapid drawdown criteria has been updated to reflect sustained water surface elevations. The criteria for the Cross and Interior Levees has been changed to FS = 1.1, and the criteria of the Perimeter Levee has been updated to FS = 1.2.	Response accepted, comment closed In the second paragraph of the revised language, please clarify that the ULDC requires a minimum factor of safety **between 1.0 and** 1.2 for rapid drawdown. Current version only states 1.2. Also, the revised language presents the results of Creep ratio and seepage severity determinations, but does not state what are acceptable limits to meet criteria. Please add this information. In the revised language, the text states that the slope of the embankment over which the through seepage is exiting was considered, but this is not discussed further. Should also note that with a minimum fines content and PI, embankments are not cohesionless and this affects through seepage.
30	UDC 7.7	Present 200-year PGA used in the analyses and describe that this represents a relatively low level of earthquake shaking. Consider comparing 10-year WSE + 3 feet elevations to deformed levee elevation.	The PGA is provided in eh GER. The following language was added to the ER: "The Peak Ground Acceleration utilized for the seismic stability analysis, both for the pseudostatic stability analysis and the post liquefaction stability analysis, represents the peak ground motions associated with the 200-year return period earthquake. This level of shaking is consistent with the guidance established by the ULDC, though it does represent a relatively low level of shaking." The deformed levee geometry was compared to the 10-year WSE + 3 feet, which is the elevation specified by the ULDC for which a levee must be repaired to within 8 weeks following a 200-year seismic event. This evaluation is included in Appendix B of the Stage 1 ULDC Evaluation (ENGEO, 2016	Please state that the peak ground acceleration used in the seismic evaluations was 0.208g and is associated with a Magnitude 6.8 event. Also, do you mean Appendix F instead of Appendix B? The deformed geometries should be compared there.
31	UDC 7.7	The calculated vertical seismic deformations for the Perimeter levee should be stated.	Document revised to include a table with estimated seismic deformation.	Table with estimated seismic deformations not included in this document.
36	ULDC 7.8	Levee Crown Widths: 1. Provide ranges of crown widths. 2. The 40-foot crown width listed in the text for the Perimeter Levee is likely the minimum width - correct? Could add that the width of the Perimeter Levee crown is generally more than 70? feet in width. 3. The 40-foot crown width listed in the text for the Interior Levee is misleading as it is commonly only 27 feet wide according to the geotechnical report. 4. The 50-foot crown width listed in the text for the Cross Levee is misleading as it is commonly only 35 feet wide according to the geotechnical report.	Text revised and added to clearly indicate crown widths and slopes. Figures were not included, however, references to the as-builts have been included (previously were not).	The text states that the Interior and Cross Levees have crown widths of 40 and 50 feet and are thus oversized, but Appendix F states that they can be only 27 and 35 feet. These inconsistencies are not addressed.

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
40	ULDC 7.10	In stating that the potential for wind-generated waves due to the long fetch on the Interior Levee is mitigated by the width of the levee and by the vegetation cover - please describe what the vegetation cover is and again describe the range in widths of the levee crown.	The width of the interior levee is uniform, with a levee crown width of 40 feet. The typical vegetated cover on the interior levee is primarily annual grasses, and ruderal weeds.	See previous comment about Interior Levee reported to vary from 40 feet to 27 feet in width.
22	ULDC 7.5	The results shown in the table for the Perimeter Levee need some explanation as it looks like the gradients calculated exceed criteria. Please add distance from the inscribed levee toe and note that the allowable gradients are based on this distance. Could also consider listing the range in gradients calculated.	Summary table for seepage analysis results were updated for each levee. Perimeter Levee table was modified to include the distance to the inscribed levee toe, and to include the exit gradient criteria at the location analyzed.	Response accepted, comment closed Consider specifically stating that for each location and table, the calculated exit gradients meet ULDC criteria.
15	ULDC 7.4	Provide values and basis for the amount of drawdown used for RDD analyses.	Rapid drawdown elevations for the Perimeter Levee were used from the ULDC Evaluation of Reclamation District 17, on the opposite side of the San Joaquin River. These values are based on the one-month drop in river stage following the peak of the 1997 flood event.	+K13 Please put this information into the report.
59	ULDC 7.7, Perimeter levee	First paragraph. Should state the 1.1 and 1.3 fos were computed using the 200-year seismic analysis. Some may not know "pseudostatic" implies this.	Document revised to state that the ground motions used for the factor of safety are the 200-year return period seismic analysis for the Perimeter Levee, Interior Levee and Cross Levee.	Appendix F states that the pseudostatic analyses used only <u>half</u> of the PGA (0.1g) in the analyses. In addition, the post-earthquake slope stability analysis used no seismic coefficient. Please rewrite.
21	ULDC 7.5	In the first paragraph, add ULDC criterion for maximum allowable average exit gradient of 0.8 at a distance of 150 feet from the levee toe for the DWSE, and to interpolate between 0.5 at the levee toe and 0.8 at a distance of 150 feet for allowable average exit gradients at intermediate distances. This will help introduce the content for the discussion of the inscribed levee toe later. Also, please reference the "inscribed" levee toe as opposed to the actual levee toe for the oversized levee sections.	Section revised to include the "ditch and depression" criteria within the section introduction. The "landside levee toe" was changed to the "inscribed landside toe" when referencing the methodology used for the Perimeter Levee.	Response accepted, comment closed Please change "*most critical location for underseepage analysis* " to "*most critical location* ***<u>s</u>*** *for underseepage analysis* "
49	ULDC 7.16	For the two groupings of large trees and the small tree at a third site on the Perimeter Levee - what are the widths of the Perimeter Levee at these locations? It may be that the widths are large enough to meet the intent of a planting berm which is allowed by the USACE and thus could meet USACE criteria as well as ULDC criteria for vegetation. The ULDC Vegetation Management Zone does <u>not</u> include most of the waterside slope. When the text states that there are no trees within the vegetation management zone on the Interior and Cross levees, does it mean that there might be trees on the lower waterside slope, or that there are no trees at all? - these are not the same thing - please clarify. If there are no trees at all on the Interior and Cross levees, it would seem that these levees also meet USACE criteria for woody vegetation as well as ULDC.	The vegetation documentation has been updated to reflect the comments and corrections made by the IPE. The vegetation component of the Engineers Report has been updated. There are no trees within the ULDC Vegetation Management Zone. The levees can be characterized as either having a planting berm, or long waterside slope.	Response accepted, comment closed Please add in the introduction that trees within the vegetation management zone that are allowed to remain because they do not pose an unacceptable threat still have to be trimmed and thinned for access and visibility. Please clarify that no woody vegetation of any kind exists in the vegetation management zones for the Interior and Cross Levees.
53	ULDC 7.20	The IPE had comments associated with the relatively undefined measures associated with the ability to quickly complete the relief cuts. Have these been addressed?	Please refer to comments and responses for the Relief Cut TM.	Response accepted, comment closed Please also add that in addition to flood safety patrols, levees will be inspected for damage after an earthquake.
1	Certification, Page v	Describe process for other engineering team members (e.g. ENGEO for Geotechnical) to make additional certifications related to their specific tasks and expertise	Document was revised to describe certifications by criterion. (6/1/16 -Text added as last sentence of second pragraph.)	Previous certification pages (Pages v and vi) not in current version - IPE not provided new version and did not see where the certifications by others shown?
2	Limits and Conditions of the Certification, Page v	Include need for periodic reviews of the operations and mantenance of the flood management facilities at intervals not less than 5 years (see Page 3-6 of ULOP).	Document was revised to include the need for periodic reviews every five years as required by ULOP Criteria. (6/1/16 - Edit was made to first sentence under header)	Did not see where periodic reviews were discussed.

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
5	ULDC 7.1	It would be appropriate to mention here the DWSE for the Interior and Cross levees are dependent on a ULDC exception involving a relief cut of the RD 2062 levee.	A sentence to both the Interior and Cross Levee sections has been added to indicate that the DWSE relies on relief cuts.	Response did not address comment. Please reference ULDC Exception for Relief Cut and where this is found Please clarify what is meant by the effects of potential sea level rise were also considered. Was sea level rise incorporated into the analysis and do the results reflect this?
11	ULDC 7.3	Consideration should be given to stating that while the specific guidance for the number and spacing of borings was not met, the number of explorations met the general intent with more than 15 explorations per mile along the levee alignment. Would also emphasize more that the new levees meet current criteria for levee material and compaction and that the QC construction data provide more information for a better levee than almost any of the legacy levees in the SPFC. Could also add that the design team examined the soils exposed in the inspection trenches of both the Interior and the Cross Levees during their construction to obtain additional information and to extend the depths of the trenches where appropriate. Depending upon these considerations, is there a plan to make this one of the EXCEPTIONS?	The section has been updated to state that the number of explorations meet the general intent of more than 15 explorations per levee mile. Discussion of the levee material included in ULDC Section 7.3. Referenced the trench observations letter that was provided as part of the response to comments package with respect to observations made during the trench inspection. At this time, the intent is to not make the conformance to ULDC Section 7.3 an exception.	**An Exception should be provided**. The reasoning and justification to support an Exception has been prepared. Since the text in this report states that the explorations **do not meet** the specific guidelines of the Corps, it would seem that an Exception is the appropriate vehicle to document this.
41	ULDC 7.10	This section seems to be an appropriate place to address the potential for scour erosion and impacts to the Interior Levee that might be induced by a failure of the existing Old River Levee at the northeast corner of the Stage 1 levee system - this hasn't been addressed yet.	A standalone memo, to be appended to the ER is being finalized.	When will this memo be available and what is its title? Also, there is no mention of this memo in the text.
42	ULDC 7.11	It is not clear that the CVFPB Zone A and Zone B actually provides 65 feet beyond the toe of the Perimeter Levee as indicated in text. Please provide a figure to show this. If it doesn't provide 20 feet beyond the toe of the levee, an EXCEPTION might be needed here. Part of the discussion involves the highly oversized nature of the levee, at least in places, which is not really described here in this section. A couple of figures would help a lot. This isn't a real problem, but the discussion and justifications need to be accurate.	Zone A and B do not provide a 65ft easement area landward of the toe. The 65ft easement area begins at the centerline of the Project levee and extends landward a minimum of 65ft. Per the CVFPB permits, this includes a 10 foot half-crown width, 2:1 landside slope, and minimum 10 ft "access area" that is buried. The text has been revised. No figure was added; figures are included in the permits referenced, and included in a separate tab for easy access.	Text states that there is only a 10-foot-wide easement landward of the levee at the Interior and Cross Levees. Since this does not meet criteria, **an Exception is needed** here. As stated earlier, these levees are reported to not be oversized in some places.
47	ULDC 7.13	Please provide the levee crown widths at the locations of the penetrations in the Levees. Please provide a brief description of the backfill (e.g. CLSM) for all of the levee penetrations. While the penetrations in the Cross Levee may have met Title 23 when they were installed, do they meet current ULDC criteria? Have hazard assessments or video inspections been performed for the pressurized pipelines?... Please state.	Widths of the levee at penetrations have been added to the TM. The levee crown widths are: Perimeter Levee Pumpstation: 150 feet Interior Levee 16" Recycled Water Lines (2): 40 feet Cross Levee (25 penetrations): 50 feet The levee backfill used for the penetrations was the spec material for the levee. Material was compacted to the same standards as the levee fill. TM revised to reflect this. Pipes through the Cross Levee installed during the 2012 Stage 1 Access Project were installed to meet City of Lathrop standards for backfill of pipes, as well as Title 23 requirements. There is documentation that the pressure lines through the levee were tested and approved prior to approval. All other pressure pipes through the Phase 1 levees will have updated inspections/tests performed by May 2016, or prior to the ULOP Finding.	Please add the requested information to this Engineer's Report. Also note minor typo in section on Cross Levee: 2102 should probably be 2012.
48	ULDC 7.15	IPE reserves the right to review this section after receipt of the Rodent Abatement Program reference.	The District Rodent Control and Repair program has been developed and is awaiting adoption by the RD Board, anticipated in early April 2016. The Program documentation will be completed and included as part of the District's O&M documentation.	Comment remains open

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
50	ULDC 7.17	In general, what is meant in this section that the levees meet ULDC 7.17? Does it mean that freeboard is met? Please clarify what criteria is being met. It is not clear what is meant in the text that the Interior Levee meets the ULDC 7.17 requirements when the levee does not meet MTOL in certain locations due to wind and wave, and needs an EXCEPTION. This should be clarified. Also, the presentation of the numbers in Table 8 don't provide any meaning without a reference to freeboard or some sort of other criteria.	The text was clarified to indicate that the wind-wave analysis performed for each levee was done so in accordance with ULDC. The discussion of freeboard in found in the MTOL section.	The text states that the only location that had the wind setup plus 2 percent exceedance runup greater than the minimum required freeboard of 3 feet was at Analysis Point 6. Actually, Table 12 shows that all of the analysis points range from 4.14 to 5.55 feet, making all of them exceed 3 feet. Please correct.
52	ULDC 7.19	The Hydraulic Analysis TM indicates that the effects of sea level rise were incorporated into the hydraulic analyses used for the evaluations of the levees - true? If so, that would mean the addition of 5.5 feet of additional stage for the downstream boundary stages for the San Joaquin and related tributaries. If this is true, it was left out of the text in this section. So, if true, please add this to the text instead of just stating the differences with and without sea level rise.	Section was revised to indicate that the effects of SLR were considered by increasing stages at the hydraulic model downstream boundaries, which are located far enough into the Delta to be primarily tidally driven, by the sea level rise projection.	The text states that sea level rise was considered. However, it is not clear that the DWSE and HTOL levels incorporate sea level rise, or whether this was a parametric study to determine the magnitude of the effects and since the effects are small, were not considered further. Please clarify.
54	ULDC 7.20	The RD 2062 Emergency Operations Plan has not been submitted to IPE for review.	The District EOP was recently updated and adopted in December 2015 by the RD pursuant to AB 156. The County adopted the EOP (which is a component of the Flood Safety Plan) in February 2016. The EOP is not a publically distributed document but is available for viewing.	Response did not address the fact that the IPE has not reviewed the EOP.
63	ULDC 7.17, Table 8	This table is meaningless since it just gives water depths. How can you use these numbers to determine they are ok? Should include the freeboard.	ULDC 7.17 requires that wind wave analysis be conducted and provides guidance on methodologies. The supporting TM documents this analysis. The table in the ER provides the combined setup and runup that is applied for determining the MTOL, which is discussed in the MTOL section.	Table should show Top of levee, DWSE, wind setup plus R2, added together and compared to top of levee.
64	ULDC 7.18	Does the RD plan to do rehearsals of the plan?	The Security Plan is an ongoing action.	Response does not address the comments.
66	ULDC 7.20	Will the plan be rehearsed periodically?	The District has engaged with both San Joaquin County Office of Emergency Services and City of Lathrop. The plan is to have regularly scheduled exercises.	Should be specified in the EAP.
69	Limits and Conditions of this Certification, Items 1 - 5	How and who will determine it is not adequately operated and maintained as well as all the other conditions?	The Engineer ultimately.	Should be specified in the Certification
70	Certification Statement	Should the City of Lathrop be included with RD 2062?	City, RD and River Islands are listed.	Unable to verify as Certification Statement was not provided.
71	Certification Statement	Should have Richard instead of Ric since that is what in on the seal.	Changed. Note the Engineer's Certification has been removed from the report to a standalone letter.	Unable to verify as Certification Statement was not provided.
51	ULDC 7.17	The stationing location of the Interior levee Site Numbers should be provided.	Document revised to include the approximate levee stationing for each Site Number.	Response accepted, comment closed
3	Perimeter Levee, Page 3	The text states that there is no visual or functional difference between the original San Joaquin River Project levee and the non-project levee and fill between them. However, it is my understanding that the official Project levee is only a portion of this joined embankment, and that building restrictions apply to the Project levee	Document was revised to clarify that despite the presence of two levee embankments, they appear as one.	Response accepted, comment closed
4	ULDC 7.1	Briefly explain here why adjustments for climate change, updated hydrology, and updated hydraulic models were not made in this document.	The report was modified to note that the noted adjustments are optional and therefore were not applied to the values presented in the report. As indicated in the main report, the TM includes the details. These details include indicating why these items were not applied.	Response accepted, comment closed
6	ULDC 7.1	Please add the 500-year WSE and the HTOL DWSE for the three levees as the HTOL is a design water surface elevation as well, and the 500-year WSE was used to help compute the HTOL values for the different levees. Also provide a brief description of the HTOL and how it was derived.	The HTOL and description were added to the report. It was also noted that in all cases the HTOL was equal to the 500-year WSE.	Response accepted, comment closed
7	ULDC 7.2	Update this section, as necessary, based on IPE comments to the draft technical memorandum	Section was reviewed and revised per comments received on the MTOL TM. Specifically, section was revised to reflect that an exception is not needed.	Response accepted, comment closed

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
8	ULDC 7.2	The MTOL technical memorandum provides the calculated overtopping discharge rate for the wind/wave conditions. It appears this discharge rate is below the allowable range included in ULDC. Under this condition, the IPE would expect this condition to be within design criteria and not require an EXCEPTION. The Design Team should review this condition and if the discharge rate is below the allowable rate, this should be documented as meeting ULDC and no EXCEPTION would be	The overtopping rate is below the allowable range. Documents have been revised to remove the need for an exception.	Response accepted, comment closed
9	ULDC 7.2	For the slightly deficient MTOL for the Interior Levee, it might be worth noting that the Interior Levee is wider than standard Project levees (Isn't it 27 to 35 feet minimum width versus 20 feet at the crest? If so, doesn't this represent a 35 to 75% wider levee even at the narrowest locations?)	Document revised to describe the embankment at the location of the allowable overtopping.	Response accepted, comment closed
10	ULDC 7.3	The IPE has already commented separately on the ENGEO ULDC geotechnical evaluation report with respect to the inadequacy of information for the independent confirmation by this IPE	Noted. See ENGEO's responses to comments provided on the Geotechnical Evaluation.	Response accepted, comment closed
12	ULDC 7.4	Mention that slope stability analyses were carried out at locations where seepage/underseepage were considered to be most critical and thus likely represent the most critical for slope stability as well.	Document was revised to discuss the correlation between stability issues with high seepage gradients.	Response accepted, comment closed
13	ULDC 7.4	There should be some mention in this section with respect to the wide and extremely wide levees along the various reaches.	Document was revised to include discussion of wide and extremely wide levees.	Response accepted, comment closed
16	ULDC 7.4	Provide stability analyses results for the new bike/pedestrian overcrossing constructed upon the Perimeter levee.	The stability analysis results are included under separate cover: ENGEO; Pedestrian Bridge Slope Stability Analysis Technical Memorandum, River Islands - Phase 1, Lathrop, California, March 17, 2016; Project No. 5044.000.003.	Response accepted, comment closed
17	ULDC 7.4	Per ULDC format, provide through seepage assessment within this section.	Document revised to include Though Seepage considerations, criteria, and analysis results.	Response accepted, comment closed
18	ULDC 7.4	Suggest revising the three summary tables showing slope stability factors of safety by adding a column showing the minimum allowable (e.g. 1.4 for steady-state seepage) and merging the two calculated lowest and highest factors of safety columns into one to show the range (e.g. 1.4 - 4.6 for the Perimeter Levee). Also, you are showing results only to the nearest tenth (e.g. 1.2). Hopefully, there aren't any results that you rounded up to meet criteria (e.g. 1.15 is shown as 1.2) - consider showing the results to nearest hundredth (e.g. 1.22) - especially since you are showing the results for exit gradients to the nearest hundredth.	Summary table for slope stability analysis results (Table 4) was updated. The results for both the stability and seepage analyses are reported to two significant digits in general conformance with the criteria established in the ULDC.	Response accepted, comment closed
19	ULDC 7.5	In discussing the numbers of analyses made for the three levees, note that the analysis locations were selected because they represented the most critical locations for underseepage along each levee (e.g. thinnest blankets, highest levee/head), based on the results of the geotechnical investigations. All other sites would be expected to calculate lower gradients and higher factors of safety.	Section was revised to indicate that the cross sections were selected at the locations with the most critical subsurface conditions. Section now reads: "Analysis locations were selected based on the most critical underseepage conditions identified from our subsurface explorations, laboratory testing, and surface topography. Locations with thin blanket conditions, high head differentials between the waterside head and the landside toe, and interbedded layers of high permeability material were primarily selected as the most critical location for underseepage analysis. Other locations within any particular reach are expected to yield lower exit gradient and higher factors of safety."	Response accepted, comment closed
20	ULDC 7.5	Delete any references to allowable underseepage criteria at the toe of seepage berms as there are none present on this project. Wording should match that contained in the ULDC geotechnical evaluation report.	Section revised to omit mentions of berms.	Response accepted, comment closed
23	ULDC 7.5	Replace "critical exit gradient" with "average exit gradient"	Document was revised to "average exit gradients"	Response accepted, comment closed
24	ULDC 7.5	A calculated average exit gradient of 0.63 for the Cross levee does not meet ULDC for the HTOL WSE.	The cross section at this location (Cross Levee STA 25+90) originally utilized the rough finished grades, which included the lowered street excavation at approximately elevation 14. This condition did not reflect the finished grade of the roadway. The model was updated to include the finished grade condition at the selected station. The location is currently at the approximate finished pad elevation.	Response accepted, comment closed

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
25	ULDC 7.5	Discuss how 3D effects were considered/analyzed at levee corners and with multiple water surfaces.	Document was revised to include discussion of three dimensional effects and analysis.	Response accepted, comment closed
26	ULDC 7.5	Briefly discuss that for analyses of Interior and Cross Levee sections near the Perimeter Levee, that multiple water surfaces for both the San Joaquin/Old River and the flooded interior 2107 were analyzed. In addition, sensitivity analyses were also performed for potential failures of the older levee system beyond the Perimeter Levee and its impact of inducing higher excess seepage pressures into the aquifers beneath these levees.	Document was revised to include discussion of multiple water surface elevations.	Response accepted, comment closed
27	ULDC 7.5	This portion of the report should note the presence of the interior lakes and their effects on underseepage. In most instances, the presence of the lakes act as relief elements for excess underseepage flows and pressures and end up reducing the calculated gradients. In most circumstances, this is a benefit and extra robustness that is not accounted for in the underseepage calculations that are presented. However, the benefits have been estimated and can be noted. On the other hand, when the lakes are close to the levee, seepage gradients exiting the slopes into the lakes have to be evaluated for the potential for internal erosion as well. These issues should be documented in Appendix F.	Document was revised to include a discussion of the landside lakes and their effect on underseepage and internal stability. This condition has been evaluated and the results presented under separate cover: ENGEO; Internal Lake Stability Technical Memorandum; River Islands - Phase 1, Lathrop, California, March 15 2016; Project No. 5044.410.001.	Response accepted, comment closed
28	ULDC 7.6	There was an IPE comment on the draft technical memorandum which described the potential "skew" of data due to the recent years of drought. IPE recommended to potentially use frequently loaded levee criteria for at least the Perimeter levee in order to increase redundancy, resiliency, or robustness	Please refer to comments and revisions on the Levee Loading TM. As per the ULDC definition, an intermittently loaded levee is one "that does not experience a water surface elevation of one foot or higher above the elevation of the levee toe at least once a day for more than 36 days per year on average." If the Phase 1 levee had been in place during the 94 year history of RD 2062 it would have experienced water twice, with the total number of days much less than "35 days per year on average. Furthermore, the duration of the ULOP Finding is for 20 years. There's no intention to deauthorize, decommission, or physical remove the Paradise Cut or SJR levee system during this time frame. Therefore, it is most accurate to use the actual data per ULDC which indicates that the Cross and Interior Levees are intermittently loaded as described in the document. However, the recommendation to assign the levee as "frequently loaded" will be considered during future levee phases	Response accepted, comment closed
29	ULDC 7.7	Change "*immediate* action plan" to "emergency action plan" in several places	"immediate action plan has been replaced with post-earthquake remediation plan"	Response accepted, comment closed
32	ULDC 7.8	No need for bypass levee geometry criteria to be stated.	Reference removed from text.	Response accepted, comment closed
33	ULDC 7.8	What specific seepage criteria do not need to meet ULDC for wide levees?	Text removed from section.	Response accepted, comment closed
34	ULDC 7.8	Where are the levee geometries summarized and documented to meet ULDC criteria?	Text revised to clearly include crown widths and slopes.	Response accepted, comment closed
35	ULDC 7.8	It is not clear, but it appears that when you state that side slope gradients for the levees do not meet the maximum allowable for standard levees in all places - you are <u>not</u> referring to seepage gradients, but that the slopes are <u>steeper</u> than the ULDC standard 3H:1V/2H:1V slopes - correct? If so, this needs to be made clearer. However, if true, we don't understand that if the levee crown widths are more than 20 feet and the slopes are all 2H:1V landside and 3H:1V waterside - why don't they meet criteria? In addition, please provide the actual slopes that don't meet criteria (e.g. 2.6:1?). Can you show a figure for the smallest/steepest section to demonstrate that the ULDC template fits within all of the actual levee sections as per ULDC 7.8.1 that is referenced?	Confusing text removed. Text revised and added to clearly indicate crown widths and slopes. Figures were not included, however, references to the as-builts have been included (previously were not).	Response accepted, comment closed
37	ULDC 7.8	The patrol road lengths do not match the levee lengths contained in section Description of Flood Management Facilities	Patrol road lengths removed as irrelevant. A patrol road is present on the crown for all three levees. Reference to as-builts added.	Response accepted, comment closed

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
38	ULDC 7.9	There is a potential for a varied hydraulic loading condition at the intersection of the Perimeter and Interior levees and the Perimeter and Cross levees. This condition was modeled by ENGEO in the ULDC geotechnical evaluation report. A discussion of this should be included in this section.	Document revised to include discussion of varied hydraulic loading conditions at the Interior-Perimeter Levee intersection and at the Perimeter-Cross Levee intersection.	Response accepted, comment closed
39	ULDC 7.9	There is existing erosion protection (revetment) along a portion of the Perimeter levee. Comment on the transition of the bank treatment from the revetted to the unrevetted portions of the reach.	A sentence indicating a transition between revetment and non-revetment on waterside slopes/berms has been added.	Response accepted, comment closed
43	ULDC 7.11	The Interior Levee with a crown width of only 27 feet in many places is not really oversized by a lot. Part of the reason for an easement is for access and visibility during flood events. Please provide a description of the easement widths beyond the levee toes.	Description of easements has been improved for all levees.	Response accepted, comment closed
44	ULDC 7.11	This section will need to be updated based on the final wording of the proposed grading ordinance.	Intent of grading ordinance is unchanged. However, should grading ordinance change, or effect statements in ER, ER or Engineer's Cert will address this.	Response accepted, comment closed
45	ULDC 7.11	Provide the width of the easement for the Interior levee	Description of easements has been improved for all levees.	Response accepted, comment closed
46	ULDC 7.12	A bike/pedestrian overcrossing embankment has recently been constructed along a portion of the Perimeter levee. Verify this embankment does not present an unacceptable encroachment.	The Pedestrian overcrossing is part of the Bradshaw's Crossing encroachment and the River Islands Parkway. This encroachment abuts the Perimeter levee alignment. This section of Perimeter Levee is elevated above the entire system to provide a smooth transition to the higher elevation of the bridge deck at the abutment (Approximately 42.3 feet). This embankment does not present an unacceptable encroachment.	Response accepted, comment closed Please add statement that there are no other encroachments, permitted or unpermitted in the Perimeter levee.
55	ULDC 7.1	Specify date of the LSJR Model	The report was modified to include the date of the hydraulic model.	Response accepted, comment closed
56	ULDC 7.2, Interior levee, para 2	Is the exception made or being requested?	Neither; per review and comment by the IPE, an exception is no longer proposed.	Response accepted, comment closed
57	ULDC 7.4	Shouldn't the following be cited in this section? ENGEO, 2015c. River Islands Phase 1A Geotechnical Data Report, River Islands, Lathrop, California. Project No. 5044.410.001. October 8.	References have been removed from the individual sections.	Response accepted, comment closed
58	ULDC 7.6	First paragraph. Should be once a day instead of once a date.	Corrected.	Response accepted, comment closed
60	ULDC 7.12, Perimeter levee	First paragraph. Should state that the east bound road encroachment is a non-penetrating one. Should also mention that the riprap under the bridge is a slight encroachment into the flow but not a high hazard.	The language has been updated to reflect the IPE comment. The two piers in the river are also considered to not be a high hazard with respect to the flow in the river.	Response accepted, comment closed
61	ULDC 7.12, General	This section says there are "no encroachments that <u>penetrate</u> or are adjacent to the ... levee" except for the Perimeter levee. However, in the following Section 7.13, it states there are penetrations. Please reword to prevent confusion.	The language has been updated to reflect the IPE comment.	Response accepted, comment closed
62	ULDC 7.16, Perimeter levee	Should state that the low hazard is mainly because the levee is much wider than required.	The language has been updated to reflect that there is no woody vegetation within the vegetation management zone.	Response accepted, comment closed
65	ULDC 7.19	Should state that Table 9 is sea level rise at the ocean, not at the project location. Also state the where the sea level rise was applied to get to the effects at the project location	Section was revised to indicate that the effects of SLR were considered by increasing stages at the hydraulic model downstream boundaries, which are located far enough into the Delta to be primarily tidally driven, by the sea level rise projection.	Response accepted, comment closed
67	Independent Expert Review and Responses	What is meant by the note to include a list of the conerns/comments of the IPE and the responses? Is there a plan to provide all of the comments, responses, backchecks, and close-out of the comments in an attachment or appendix? Will there be any outstanding comments that the IPE needs to comment on as discussed in ULOP?	This was deleted.	Response accepted, comment closed
68	Independent Expert Review and Responses	Please correctly refer to IPE member Dr. Les Harder	Corrected.	Response accepted, comment closed

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	REFERENCE		EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERT'S COMMENT (April 2016)	ENGINEER'S RESPONSE (May 2016)
	Page	Section						
1	2	1	Should give a quick background of the River Islands project so the reader can grasp the importance of this analysis.	A few sentences were added to indicate the intent to make a ULOP finding. This document will be appendized to a main report which discusses the broader context for the ULOP.	Close this comment			
2	4	3	Who developed the model?	Text revised. The model was originally developed by David Ford Consulting Engineers in 1996. The model was provided to MBK Engineers in 1999, and MBK has been modifying and refining the model since then.	Close this comment			
3	4	3	Did the CVFD and COE "approve" the model? The documentation of these uses should be in the references and cited here.	The CVFPB and COE have not provided any formal approval of model, but have reviewed the model and have accepted the analysis performed by the model. References will be added.	did not see anything in the document stating that CVFPB or COE have accepted the model.	References to model applications reviewed by CVFPB and USACE are included 2nd paragraph of Section 2 on Page 4 of 8/12/15 version of TM (App. C of draft Engineers Report). Additional discussion regarding review by NHC for CVFPB will be added.	Close this comment	
4	4	3	The most recent version (5.0 may come out soon) will be used for finalization?	This would be dependent on the timing of the release of HEC-RAS 5.0. If 5.0 is released prior to finalization of the Engineer's Report, then a check will be made to see if 5.0 results in any significant differences, at which time it will be decided whether or not the analysis needs to be redone.	Close this comment			
5	5	3	Is the redline the model cross section locations? Tom Paine Slough is not included – if so, why not?	Yes, the red lines represent the reaches in the model that are represented with cross sections. Tom Paine slough is not hydraulically connected to the river system due to a gate structure at its downstream end where it meets Sugar Cut and by the San Joaquin River levee system at its upstream end, and is therefore not included in the hydraulic model as a reach. Tom Paine Slough will be removed from Figure 3 to avoid this potential confusion.	we believe that the Slough should still be in there but a statement saying it is hydraulically not connected to the system because of the gate structure	This is stated in 3rd paragraph of Section 2 on Page 4 of 8/12/15 version of TM (App. C of draft Engineers Report). With further research determined that there is no gate structure, but rather siphons that supply water to the slough. Figure 3 will be modified to include call out of Tom Paine Slough siphons.	Close this comment	
6	6	3	Should have a date associated with the model since it could be updated and then the new one becomes the current version – maybe use the date of this documentation when it is finalized	Agreed. Date added.	Close this comment			
7	6	3	This is not in the references	Reference added	Close this comment			
8	6	3	What event was used for confirmation/verification?	The February 1998 event was used for confirmation/verification. The text was revised to clarify this.	Close this comment			
9	6	3	All these deficiencies were not in the April 2006 flood?	Correct, there were no levee breaches or gage failures during the 2006 event.	Should be stated in the document	This is stated in 2nd paragraph of Section 2.2 on Page 6 of 8/12/15 version of TM (App. C of draft Engineers Report)	Close this comment	
10	6	3	What frequency can be associated with the 1997 and 2006 floods so we can make a proper comparison?	Frequencies added to report.	Close this comment			
11	6	3	Isn't this document the documentation?	No, this document presents some calibration analysis results, but does not include detailed documentation and discussion of the calibration. At this time, detailed documentation of the most recent model calibration analysis had not been prepared.	Should specifically state that another document with more details will be produced later	Document will be modified to remove reference to future documentation, and additional information on the calibration will be added to TM.	Close this comment	
12	6	3	But it says the current model was verified, not calibrated, using the 1998 flood	See response to comment no. 8.	Close this comment			
13	6	3	This section discusses the process of the calibration/verification but there is no discussion of the results. Will there be such a discussion in later documentation? Looking at the 2006 flood calibration model results and the HW marks, there are differences of over 3 feet – see Figure A-1.	See response to comment no. 11. A detailed calibration report was prepared in January 2006; subsequent to that report the model has been further refined and re-calibrated with the April 2006 flood event. The intent is to update the calibration report in the near future.	Close this comment			
14	6	4	not in references	Reference added	Close this comment			
15	6	4	not in references	Reference added	Close this comment			
16	7	4	How does the COE values for the 200 and 500 year Qs compare to what is in Table 1?	Comp study 200-yr and 500-yr peak flows at latitude of Vernalis are 144,400 cfs and 224,000 cfs, respectively.	We think it would be informational to show the COE Comp values in comparison to what is being used and more detail on an explanation of why the difference	Comp Study hydrology values are included in Table 2 on page 8. Determining the reason for the difference would require a detailed review of methodologies and procedures used for development of each hydrology.	Close this comment	
17	7	5	Please explain why the COE approached was not selected	The FEMA approach is the most straightforward approach, and, to our understanding, generally produces more conservative results.	Should state this	Reason for selecting FEMA approach added to TM.	Close this comment	
18	9	5.1	How does this compare to the 500 year flood? Is it always lower than the 500 year elevations?	The 500 year flood water surface elevation is lower than the 200 year flood water surface elevation plus 3 feet at all urban levees.	Should state this	The 500-yr wse is not pertinent to this section of TM. This section describes treatment of urban levees in the hydraulic model and the ULDC specifically states that they are to be assumed to be no lower than the 200-yr wse plus 3 feet and makes no mention of the 500-yr wse.	Close this comment	
19	9	5.2	How was the model modified?	The model was modified by adjusting lateral structures in the hydraulic model that represent levees to reflect the ULDC required minimum top of levee.	close this comment			

20	9	5.3	What are the heights of the piers (bed to the highest low chord) in comparison to the 5 foot depth? Show the bridges in the schematic/map? Any basis for using 5 feet? Was this assumption made for the 10 year event?	Height Varies. Locations of bridges have been included in a figure. Analysis was revised to reflect USACE guidance.	Close this comment			
21	12	5.5	Does CVFCD and DWR agree with this approach?	Neither DWR nor USACE have issued guidance for incorporating climate change. Additionally, the ULOP finding is for 20 years. We would not anticipate climate change to significantly affect flood frequencies during the period of finding.	Close this comment			
22	13	5.8	need to be in references	Added to references	Close this comment			
23	14	5.9	Should state that these conditions are evaluated using the unsteady mode of RAS. Ponded areas are modeled as storage areas?	Report will be revised to note analysis was in unsteady mode. Yes, ponded areas are modeled as storage areas.	Close this comment			
24	14	5.9.1	For these breaches, is it assumed that it erodes down to the adjacent non-leveed elevations? Jones Tract levee breaches resulted in erosion significantly below the adjacent elevations. Why 500 feet width? Was there a sensitivity analysis done on this?	Natural ground elevation was assumed for breach invert. 500 feet width was based on review of historical breaches that occurred in the jan. 1997 flood event. At this time no sensitivity analysis has been done for levee breach size.	Should do a sensitivity analysis of erosion depth of the breach. Jones Tract has erosion down to 25 - 50 feet below the ambient elevations	A sensitivity analysis was made with the hydraulic model in which the inverts of the San Joaquin River breaches into Stewart Tract were lowered 10 feet (the amount of lowering is limited by the minimum elevation in the receiving floodplain storage area). The effect on the computed maximum stage in RD 2062 was +0.01 feet.	Should state in the text that a sensitivity analysis was performed and results as stated. Can close this comment after this addition to report.	This language was included in section 4.91.1.
25	15	5.9.2	See comments for condition 1.	See response to comment no. 24	See response to 24	see #24		
26	16	5.9.3	See comments for condition 1.	See response to comment no. 24	See response to 24	see #24		
27	16	5.10	When will this be available/documented and who is doing is it?	MBK serves as the District Engineer for the RD and will be preparing a relief cut action plan for inclusion in the District's operations manual and flood safety plan/emergency procedures document. This be available as part of the ULOP effort.	Should state this	Emergency Operations Plans have been prepared for RD 2062 and RD 2107 and have been added to the TM as references.	Close this comment	
28	16	5.10	What happens if the relief cuts are not made?	The effect of the relief cuts can be seen in Table 9. The computed 200-yr peak water surface elevation in RD 2062 is 22.4 feet (NAVD88) without relief cuts and 20.2 feet (NAVD88) with relief cuts.	Close this comment			
29	17	5.10	How is the cut to be done and what are the triggers to do it?	MBK serves as the District Engineer for the RD and will be preparing a relief cut action plan for inclusion in the District's operations manual and flood safety plan/emergency procedures document. The triggers for the cuts will be outlined in the document.	See response to 27	Reference to the Emergency Operations Plans, which include the relief cut specifics, has been added to the TM.	Close this comment	
30	17	5.10	This was done using RAS's levee breach option? If so, should add the other parameters.	Additional breach parameters are noted in report.	Close this comment			
31	19	6	Debris on bridge is mandatory?	Yes; added to bullet list.	Close this comment			
32	19	6	Do the assumptions of sea level rise and no debris on bridges affect the answers significantly? These assumption may affect the movement of water through the storage areas and the controlling scenarios.	The sea level rise scenario was simulated both with and without debris on bridges. The final water surface elevation was the higher of the two.	Close this comment			
33	20	6.2	See comments for section 6.1.	See response to comment no. 32	Close this comment			
34	22	6.3	See comments for section 6.1.	See response to comment no. 32	Close this comment			
35	22	7	O'Dell top of levee is not referenced or mentioned other than in the plots.	This TM is documenting the determination of the hydraulic parameters (DWSE, MTOL, and HTOL), not making a determination of ULDC compliance for MTOL which is being accomplished in a separate technical document.	If O'Dell info is being shown in the document, it should be referenced	All references to O'Dell have been removed from the TM.	Close this comment	
36	28	9	Sounds reasonable but should check with the COE, CVFCD, and DWR.	River Islands met with DWR in February 2014 and this was discussed. While DWR does not provide formal opinions related to the technical adequacy for ULOP findings, they did indicate that the approach was reasonable.	Close this comment			
37	28	9	Does this include superelevation? I assume that the since table 11 shows the runup was always less than 3 feet, the plus 3 is the greatest. This should be stated. The below table should have another column that shows the WSE plus 3 feet and say this column is the elevation that levee needs to be restored to.	No. Superelevation effects will be added. The 10-year water surface elevation section and table will be revised as requested.	Close this comment			
38	General		It should be documented that the Hydraulics evaluation depends on the relief cut being made as described in the Relief Cut technical memorandum. (Be advised this technical memorandum has comments by the IPE concerning the sequence/feasibility of the forced breach plan).		Not addressed			

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT	ENGINEER'S RESPONSE	BACKCHECK COMMENT (January 2016)	BACKCHECK RESPONSE (March 2016)	EXPERT'S FINAL COMMENT (April 2016)
1	MTOL Compliance Evaluation TM, Appendix D	Does this assessment consider the relief cuts are made as contained in the Relief Cut Memo you also forwarded to us?	The MTOL evaluation is based on a DWSE that does include the relief cuts. The relief cuts are discussed in detail in the Hydraulics memo. The relief cut memo is limited to the reliance on floodwaters to expand the cut.	Response accepted, comment closed		
2	MTOL Compliance Evaluation TM, Appendix D	ULDC describes exceptions in the case of it is "prohibitively expensive" to raise the levee to the MTOL elevation. Has the owner considered the cost of just adding additional baserock to the levee crown (which can be salvaged for future use when the levee is removed) for this reach?	The cost to add the additional 0.7 feet for approximately 700 feet would be between $15,000 and $25,000. This portion of levee will be degraded in 2016 as part of future River Islands levee work.	Response accepted, comment closed		
3	MTOL Compliance Evaluation TM, Appendix D	There is a difference in calculated MTOL stage of about 1.3 ft from about Station 33+00 to 44+00 (1,100 ft apart). is there a potential for a calculation error at Station 33+00?	ENGEO indicates that the adjusted wind speed (see Table 2 in the Wind Wave Analysis) for point 6 is 66.25 mph compared to 45.72 mph for point 5, in addition to the differences in elevations at the levee toe and top of levee at those locations, result in a 1.41-ft difference in the wave runup plus setup.	Response accepted, comment closed		
4	MTOL Compliance Evaluation TM, Appendix D	How does the calculated overtopping rate of 0.0036 cfs/ft compare to the "allowable" in USACE documents?	The ENGEO wind wave analysis memo discusses the overtopping rate. USACE guidance allows overtopping, typically within the range of 0.01 cfs/ft to 0.1 cfs/ft,.	This value is within ULDC guidelines. Suggest documenting this in the report and not applying for an EXCEPTION for this condition.	Memo and Engineer's report has been revised to remove exception and clarify within ULDC.	Response accepted, comment closed
5	MTOL Compliance Evaluation TM, Appendix D	It should be documented whether the "top of levee" profile is a centerline measurement or crown shoulder (both allowed by ULDC). additionally, the document should describe whether the crown surfacing was used in the top of levee profile assessment.	The top of levee profile uses the waterside hinge point, plus 6 inches for the AB. (see section 3).	Response accepted, comment closed		
6	MTOL Compliance Evaluation TM, Appendix D	In Figure 5, it should read "Cross Levee" along the right hand portion of the figure.	The figure has been updated.	Response accepted, comment closed		

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (November 2015)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
1	2.2	"observed seepage" is described in the text. Is it known if it was either through seepage, underseepage, or both? If unknown, so state.	Text updated to read, "In addition, based on the Reclamation District's observations during high-water flood events, seepage has been observed within the limits of the existing Old River levee in the vicinity of Station 270+00 and 313+00 as shown on Figure 5. It is unknown if the observed historical seepage was underseepage or through seepage"	Response accepted, comment closed
2	2.2	Not able to find referenced "observed seepage" in Figure 3 along the existing Old River levee	Figure 3 updated to be more clear. Historical seepage was observed near the confluence of Old River and the San Joaquin River.	Response accepted, comment closed
3	2.2	Should note that Interior and Cross levees have never been "hydraulically" loaded	Text updated to read..."It should be noted that the Interior and Cross levee embankments bordering the Phase I portion of the River Islands Project have not encountered a high-water event from flooding."	Response accepted, comment closed
4	3.2	Text refers to (as well as other locations in the report) "observation trench" excavations. Generally, this excavation is referred to as an "inspection trench" and has typical dimensions for depth, width, and sidewall inclinations. Was there anything different about the trench for this project that it cannot be referred to with the standard designation of "inspection trench"?	Text updated to refer to the trench as an "inspection trench"	Response accepted, comment closed
5	4.1	It should be noted that dewatering was performed to enable the excavations of the man-made lakes to depths of 30 to 40 feet below original grade.	Text updated to read, "Temporary construction dewatering wells were installed to temporarily lower the groundwater in the vicinity of the lakes in order to excavate them using traditional excavating equipment (e.g. scrapers and excavators). The dewatering wells were abandoned following completion of lake construction."	Response accepted, comment closed
6	4.3	There is no description as to how all boreholes were abandoned (ie, grouted). There is no description as to how the test pits were backfilled (ie, compacted in lifts). There is no description as to whether casing was used for mud rotary drilling through existing levee embankments.	Section 4.2.1. was updated to read, "Backfilling of explorations performed by Kleinfelder were backfilled with cement grout in accordance with the County of San Joaquin pubic health requirements. Information regarding the backfill of explorations performed by Neil O Anderson and Roger Foott and Associates was not provided in published documents. In addition, information regarding casing of explorations through existing levee embankments was not provided." Section 4.2.2 was updated to read, "Backfilling of ENGEO boring and CPT explorations consisted of cement grout in accordance with the San Joaquin County Public Health Requirements. Test pits were generally backfilled using cuttings from the excavation with moderate compactive effort." Section 4.3.3 regarding mud-rotary drilling was updated to read, "Explorations using this method were cased for levee crown explorations. A steel pipe was used to bypass the embankment soils to limit internal eroding of embankment materials during drilling."	Response accepted, comment closed

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (November 2015)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
7	4.6	Are all piezometers (for this and previous studies) still active? If not, how were they abandoned?	Text updated to read, "All monitoring wells within Stage 1 were either presumed destroyed prior to ENGEO's involvement on the project or have been abandoned and backfilled with cement grout in accordance with the County of San Joaquin Pubic Health Requirements."	Response accepted, comment closed
8	4.6	What type of piezometers were used that required data logging equipment?	Data logging equipment was not required. Text updated to read, "A HOBO® U20 Water Level Logger (pressure transducer) was deployed in each well to record continuous groundwater level data." It should be noted however that there are currently no piezometers/monitoring wells located within the limits of Stage 1. Levee-specific piezometers will be installed as part of the ULDC evaluation for Stage 1.	Response accepted, comment closed
9	5.0	The text states explorations were used "within approximately 500 feet of the centerline of the crown". If both landside and waterside of the crown, so state.	Text updated to read, "...within approximately 500 feet of the waterside and landside of the levee centerline."	Response accepted, comment closed
10	7.1	"near surface soils" within the observation trenches are referred to. Be more specific as to the location of "near surface" (ie, sidewalls, trench bottom, etc).	Text updated to read, "In general, the soils along the sidewall and bottom of the inspection trenches were characterized as relatively consistent over large areas and did not contain highly variable deposits of permeable lenses that intersected the levee alignment." For additional information pertaining to the Inspection Trench please see the Levee Inspection Trench Observation Summary Letter dated February 3, 2016.	Response accepted, comment closed
11	7.1	Provide more detail concerning the subdrain which was installed (ie, purpose, discharge location, surrounding filter/drain material, perforation opening size, etc). Is there a maintenance plan for this drain in the O&M manual?	The subdrain pipe is planned to be abandoned prior to receipt of the 200-year finding. Text updated to read, "To minimize the risk of internal erosion within the levee embankment, the subdrain pipe was surrounded by 2- to 3-feet of Caltrans Class 2 Permeable Material. The subdrain pipe is planned to be abandoned in place in general accordance with the Title 23 abandonment methods."	Response accepted, comment closed
12	7.1	The text describes soil samples were taken every 500 feet during fill placement. Is that per lift or for the entire embankment?	Text updated to read, "Soil samples were taken approximately every 500 lineal feet at various vertical lifts throughout the subexcavation and embankment ..."	Response accepted, comment closed
13	7.2	See comment above for "near surface soils".	See response to Comment 10 above for Section 7.1	Response accepted, comment closed
14	7.2	See comment above for the subdrain.	See response to Comment 11 above for Section 7.1.	Response accepted, comment closed
15	7.2	See comment above for soil samples taken every 500 feet.	See Response to Comment 12 above for Section 7.1.	Response accepted, comment closed
16	Figure 1	Should state what the colored (blue and orange) lines designate. Blue is Stewart Tract and Orange is project levee location?	Please see updated Figure 1	Response accepted, comment closed
17	Figure 3	What is the light blue area in the upper portion of Figure 3?	Please see updated Figure 3	Response accepted, comment closed
18	1.3 Perimeter levee	The 15 feet levee height is consistent along the entire levee? Also same comment for Cross and Interior levees.	Text updated for the Perimeter Levee to read, "...approximately 13 to 16 feet in height from the landside toe." for the Interior and Cross Levees to read..."approximately 10 to 15 feet in height from the landside toe."	Response accepted, comment closed
19	1.3 and Figure 3	Old River is part of the levee location description but it is not shown in Figure 3	Please see updated Figure 3	Response accepted, comment closed
20	2.1.2	Were the companies cited in the references contacted to see if they conducted other relevant studies in the area?	Yes. The companies cited in the references had been previously contacted during ENGEO's baseline geotechnical study in 2002. All subsequent relevant geotechnical work has been performed by ENGEO.	Response accepted, comment closed
21	2.2	First paragraph states the original design was to about the 50-year flood. Was this based upon what was said in the report? Since this report was about 50 years ago, this info may be outdated.	This statement has been removed from the text.	Response accepted, comment closed

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (November 2015)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)
22	2.2	This paragraph is the first time RD 2062 is mentioned. Should state the relationship of RD 2062 in relation to the project location.	Text added to Section 1.2 reads, "The River Islands project is flood-protected by levees maintained by Reclamation District No. 2062 (RD 2062), including on the west bank of the San Joaquin River, the South bank of Old River, and the North bank of Paradise Cut."	Response accepted, comment closed
23	3.1	Should reference the statements in the first paragraph.	The statements in the first paragraph are general regional geology and no reference was used.	Response accepted, comment closed
24	4.6	What did the monitoring wells do? Hydraulic connections? High or low? Any permeability values extracted? Etc?	Text updated to read, "Monitoring well data was generally used to determine seasonal high groundwater levels as well as to measure seasonal and annual fluctuations in groundwater levels and to observe groundwater gradients across the site. Additionally, the City of Lathrop routinely collects water quality samples from some of the wells under their Waste Discharge Requirements and Master Recycling Permit Order R5-2006-0094." No pumping tests have been performed and therefore no subsequent data from the wells is available for hydraulic connections, permeability values, etc.	Response accepted, comment closed
25	5.0	How can the "passage of time may result in altered subsurface conditions"? Are you talking about geologic time or that the passage of time may result in new explorations and thus the interpretations may change?	Text updated to read, "The passage of geologic time may result in altered subsurface conditions."	Response accepted, comment closed
26	6.0	It states that tests were made on select samples. What criteria were used to determine which samples were to be tested? Every nth one? Visual? Distance interval?	Text updated to read, "Selection of samples to be tested was based on visual classification and engineering judgment to determine the physical properties of the various strata relevant to the purpose of the exploration."	Response accepted, comment closed
27	Figure No. 8	A) Typical Subexcavation Cross Section B detail does not show an inspection trench. However, Plan and Profile figures in the main report show an inspection trench was excavated and backfilled. Explain this discrepancy. B) The waterside and landside should be shown on Cross Sections A and B.	In some of the areas where DDC was performed the subdrain trench (at the location shown in Cross Section B on Figure 8) doubled as the inspection trench and was excavated to meet the minimum inspection trench dimensions. This is an as-built condition, not reflected on the design drawings. See revised Figure 8 with waterside and landside callouts.	Response accepted, comment closed
28	Figure No. 9	The Typical Subexcavation detail shows an excavation depth of 5 feet. This does not match the excavation depth shown on the Plan and Profile figures for the Perimeter levee. Explain this discrepancy.	The inspection trench was excavated during the construction of the Ring Levee and met the minimum requirements for depth and width. The excavation shown on Figure 9 was a keyway and was not intended to meet Inspection Trench minimum dimensions. The Plan and Profile show the Inspection trench that was excavated during Ring Levee construction.	Response accepted, comment closed
29	General	Was there any geophysical surveys performed? If so, where are the results?	No relevant geophysical work was performed for the Stage 1 ULDC evaluation.	Response accepted, comment closed

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (November 2015)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S RESPONSE (June 2016)
1	1.1	The description of what SB5 requires is not quite correct	Section 1.1 revised as noted.	Response accepted, comment closed+E4	
2	1.1	A few things: 1. Cite DWR ULDC (2012) document 2. Reference date of ULOP document and that it is a draft. 3. The engineers and agencies don't make a "finding", the development agencies do before approving new development. The role of the engineers here is to provide supporting evidence into the record to support the finding.	See revised section 1.1. 1. Short citation in text (DWR, 2012) and long citation included in References section: Department of Water Resources, Flood Safe California, Urban Levee Design Criteria, May 2012. 2. Reference date of ULOP included (November 2013). Unlike the April 2012 version, the Nov 2013 version does not indicate this is a draft report. 3.Section now reads. "We used ULDC criteria to develop the documentation needed to allow the City of Lathrop developing agencies to make a "Finding" on behalf of the City of Lathrop that an Urban Level of Flood Protection exists within the area that approximately follows the limits of the subject RD 2062 levee system."	Response accepted, comment closed	
3	1.1	Where is "through seepage" analyzed? Where is "levee geometry" analyzed? Should state that this report and scope does not address: - settlement - freeboard - penetrations - encroachments - vegetation - O&M - emergency response - erosion - real estate requirements - etc... It would also be good to identify where these other items will be addressed	See revised section 1.1. Section now identifies additional geotechnical topics discussed in report and topics not covered in this report.	Response accepted, comment closed	
4	2.1	Reference where the information in Table 2.1-1 comes from. Also, please identify what the Classification of "A" means.	See revised section 2.1. Table now includes reference to USGS Fault Map database. California Building Code Classification column removed from Table	Response accepted, comment closed	
5	2.2	Clarify that "no known surface expression of active faults is believed to exist along the alignment" means across either the levee system or Stewart Tract in general. Based on this wording, is there a possibility of blind thrust faults here?	See revised section 2.2. Section now reads "no known surface expression of active faults is believed to exist along the levee alignment."	Response accepted, comment closed	
6	2.4	The ULDC requires that an overall estimate of levee damage during a 200-year earthquake be developed, and that an EAP to rapidly repair the levee to a 10-year geometry be in place. Where will the estimated level of earthquake damage be documented and where will the EAP be developed?	See revised section 2.4. Section now reads. "Our evaluation of seismic induced deformation is outlined in Section 5.5, and the reaches anticipated to experience seismic induced deformation and identified in Table 6.0-2. An Emergency Action Plan (EAP) will be prepared as part of the Operations and Maintenance Plan for Reclamation District 2062 ."	Response accepted, comment closed Consider adding in this section that no significant earthquake-induced deformations were indicated for the 200-year earthquake and that a 10-year levee cross section would be maintained for all of the levee reaches.	See revised section 2.4. Section now reads. "Our analyses indicated no significant seismic induced deformations therefore, a 10-year levee cross section should be maintained for all of the levee reaches."

7	3	The text states that long-term settlement will be evaluated - where is this done? Also, where will the potential for hydrocompaction be evaluated?	See revised section 3. Long term settlement is now addressed in Section 3.2	Response accepted, comment closed	
8	3.2	It is stated that consolidation settlement due to fill placement is not anticipated. The Draft Minimum Top of Levee Compliance technical memorandum levee crown elevation plots for the for the Interior and Cross levees show elevation differences up to about 1 foot. Were these levees built to a constant elevation and subsequent to construction experienced settlement? If so, this should be considered in the settlement evaluation.	A comparison of the Interior and Cross Levees between the MTOL Compliance and the original Grading Plans (T&O Report, ENGEO 2005) indicates that the current top of levee is at or above the elevation specified on the grading plan. We therefore do not consider consolidation settlement to be a significant issue. Furthermore, no additional fill is anticipated, so future consolidation settlement within the Stage 1 levee system is not anticipated.	The original comment was not addressed and it relates to whether the current top of levee elevation has varied (subsided) from the as-built condition. (Levees are generally constructd to a uniform top of levee elevation). If it has subsided, has the subsidence ceased and if not, will it effect the MTOL compliance?	Based on consolidation parameters interpreted from incremental consolidation tests provided in the Stage 1 ULDC GDR: Cv = 70 ft^2/year (approx. average of consol tests, neglecting some of the larger values) D= 25 feet (assuming the approximate thickest section of clay on the profile, no assumed lateral drainage paths, single direction drainage) t = 10.5 years (time since completion of levees/levee improvements) Then we get a time factor of T = 1.176, which is approximately equal to 95 % of the ultimate consolidation. If the variability observed in the top of levee is actually due to consolidation, then for all practical intents and purposes, consolidation is complete and will not affect the MTOL compliance. Furthermore, a comparison of the current top of levee (as seen in MBK's MOTL Compliance Evaluation) and the Stage 1 Grading Plans (ENGEO, 2005) indicate that the levees are currently above the design elevations specified on the grading plans. For instance, the grading plans indicate that the design crown elevation of the Interior Levee is 25 feet (NAVD88), which is lower than any location along the current alignment. This implies that not only were the levee built to a greater elevation than designed, they have not likely experienced any settlement.
9	3.2	Concur with comment above. Settlement information from the recently constructed Cross and Interior levees, together with the expanded fills along the Perimeter levees should be summarized here and used to support conclusions regarding future settlement.	See previous response.	See previous Non-concur	
10	4.0	The Project Datum for this report should be clearly provided	See revised Section 4.0. Section now reads. "The vertical datum utilized for the River Islands, Stage 1 Urban Levee Design Criteria evaluation is the North American Vertical datum 1988 (NAVD88). "	Response accepted, comment closed.	
11	4.0	Concur with comment above - note that MBK H&H reports use both 1929 datum (see Relief Cut TM) and 1988 datum (see MTOL TM). Clarify what datum is being used in this report, where the conversion comes from, and any adjustments from H&H analyses.	See revised section 4.0. Datum conversion was determined by the civil, O'Dell Engineering.	Response accepted, comment closed	
12	5.1	Can you list the 200-year and HTOL WSE for the various levee reaches here?	See revised section 5.0. Table 5.1-1 includes DWSE and HTOL elevations for each reach	Response accepted, comment closed	
13	5.3.2 (5.4.2)	Version 13 of the DWR Guidance Document is outdated. How does the analysis used compare to the final guidance document?	See revised section 5.3.2. Reference included for April 2015 (Final Draft) of URS Guidance Document. Boundary Conditions are consistent with 2015 Guidance Doc	Response accepted, comment closed.	

14	5.3.2 (5.4.2)	With respect to the 3rd bullet on Page 7, note that the use of constant head boundary condition on the waterside vertical face is conservative for dryland Cross and Interior levees that do not have a river channel. With respect to the 4th bullet on Page 7, clarify that the water pressures were set to the ground surface only at the vertical edge of the landside boundary of the model, not in between the boundaries. Also, clarify where the waterside edge of the model (center of river?) is for the two dryland Cross and Interior levees. Also, how is the UPRR embankment modeled in the analyses of the Cross Levee - particularly with respect to waterside boundary conditions?	Agree.	(1) For the first comment, perhaps this comment was not clear, but this comment was intended for the authors to note in the text that full DWSE head set at the waterside boundary to represent a charged aquifer is conservative - this appears not to have been done. (2) The clarification requested that the landside boundary condition only applied to the landside boundary <u>was</u> made. OK (3) Clarification of waterside edge of model not made. (4) Clarification regarding UPRR embankment modelling not made.	The original comment was not seen in full due to a copy paste error. 1) See revised section 5.4.2. Referenced bullet now reads "Dryland levees (Interior and Cross Levees) were modeled with a constant head boundary condition on the vertical face of the waterside in order evaluate a “charged” aquifer, as this is conservative for the dryland levees that do not have an adjacent river channel." 3) See revised Section 5.4.2. Added bullet that reads "The waterside boundary was set at 1,000 feet waterward of the centerline of the dryland levee." 4) See revised section 5.4.2. Added bullet that reads "The Union Pacific Railroad (UPRR) embankment to the south of the Cross Levee was modeled with typical engineered fill material parameters, and a continuous boundary condition equivalent to the flood elevation was applied to the surface of the embankment. Because the clay blanket is considered continuous underneath the railroad, the presence the embankment has little to no effect on the seepage conditions present at the Cross Levee."
15	5.3.2 (5.4.2)	The location of the waterside boundary for the dryland Interior and Cross levees does not appear to have been detailed here. Please provide this information.	See revised section 5.3.2. Section now reads. "The waterside boundary was set at 1,000 feet waterward of the centerline of the dryland levee."	Assume you mean revised Section 5.4.2, but did not see the 1,000 feet waterward limit in text.	See part 3 of Response to Backcheck Comment 14.
16	5.3.2 (5.4.2)	The description for the two scenarios for the northern portion of the Interior levee is unclear. How were these analyses performed? The 3D effects should elevate the seepage above a 2D analysis. Also, what is the assumption for 3D seepage at the 90-degree bend between the Cross and Interior levees?	Boundary condition figures were added to Appendix A to illustrate the different loading scenarios considered for the northern portion of the Interior Levee. See Figures A-8-B and A-8-C. Levee angle at the Interior and Cross Levee is assumed to be approximately 60 degrees (120 degree deflection angle), so a 30% surcharge is accounted for at this location.	Please add references to the figures and describe the 3D seepage adjustments here.	Figures are already referenced: "The boundary conditions for both loading scenarios are presented in Appendix A (Figures A-8-B and A-8-C)." See revised Section 5.4.2. Section now reads "Additionally, three-dimensional seepage effects were taken into consideration for this cross section, as described in Section 5.4.6."
17	5.3.3 (5.4.3)	It is not appropriate to refer to the localized gradient (no blanket layer present) as the same as the underseepage exit gradient (blanket layer present).	See revised section 5.3.3. Section now refers to average gradients and local gradients separately.	Response accepted, comment closed. (Response should refer to Section 5.4.3)	
18	5.3.3 (5.4.3)	A "quick condition" is only representative for a condition where the blanket layer soils are of no/low cohesion. For a cohesive blanket layer, an uplift condition would exist where the blanket layer would lift and crack and a blowout type failure could occur.	See revised section 5.3.3. Section now reads. "If the factor of safety against underseepage is less than 1.0, the calculation is indicative of an uplift condition when a blanket layer is present or a quick condition when no blanket condition is present."	Response accepted, comment closed. (Response should refer to Section 5.4.3)	
19	5.3.3 (5.4.3)	It should be established that the waterside slope used for the Perimeter levee is stable (non erodible during Project design life) and is completely contained within the levee embankment and streambank. The projection of the waterside levee slope in Figure 2 is undercut by portions of the submerged streambank.	See revised section 5.3.1. Section now reads "We generally consider this material to be non-erodible for the design life of the project." In addition, we have updated Figure 2 to show the Zone A and Zone B CVFPB easement construction to show the inscribed levee construction.	Response accepted, comment closed. With respect to Figure 2, suggest the following edits/clarifications: 1) Reclamation Board (actually The Reclamation Board) is now known as the Central Valley Flood Protection Board; 2. The San Joaquin River Levee, the Ring Levee, and the filled area between those two levees now comprise what is referred to as the Perimeter Levee; 3) Is the waterside crown hinge point the same location that is referenced in the Grading Ordinance?; and 4) label "Final Grading Elevation"	1. Reclamation Board changed to Central Valley Flood Protection Board. 2. Clarification added to Figure 2. 3. No, the intent of the waterside crown hinge point here is to neglect overly steep waterside slopes. The intent of the waterside crown hinge point is to have an eaily identifiable location to reference for someone not familiar with the nuances of the CVFPB. 4. "Final Grading Elevation" added to Figure 2.

20	5.3.3 (5.4.3)	With respect to an allowable exit gradient of 0.8 at and beyond 150 feet from the levee landside toe, in ULDC Section 7.5 there are other engineering judgment factors to be used at distances beyond 300 feet. This will be important to address for the existing ponds within the development.	See revised section 5.3.3. Section now reads. "The ULDC also specifies that an exit gradient above 0.8 may be acceptable beyond 300 feet from the levee toe, provided that a sensitivity analysis is performed to evaluate the susceptibility of the system to underseepage. The sensitivity analysis should consider the assumed boundary conditions, variation in the model seepage parameters, the presence of any subsurface conditions that may affect the ability to flood fight, such as highly permeable aquifer, and the comparison of the seepage results with existing empirical relationships, such as creep ratio."	Response accepted, comment closed. (Response should refer to Section 5.4.3)	
21	5.3.3 (5.4.3)	Refer to Figure 2 when describing where the inscribed landside toe is for the Perimeter levee. Should also re-label portions of the figure as it appears that the Perimeter levee is landward of the landside toe in Figure 2	See revised section 5.3.3 and Figure 2. Section now refers to Figure 2. Figure 2 has also been revised; the "Perimeter Levee" label had been updated to "Ring Levee".	The point here was to describe the inscribed landside toe from which distances would be measured to determine allowable exit gradients. Response did not address comment as Figure 2 does not show this. Please add a "dot" and label to show inscribed landside levee toe for determinations of allowable underseepage gradients. (Response should refer to Section 5.4.3)	Inscribed toe location has been added to Figure 2.
22	5.3.4 (5.4.4)	Please show typical cross sections of the different levees at this point with dimensions to illustrate various points, particularly with regard to through seepage and underseepage. You should also make the point that many of the levee sections represent oversized levees. Also, where will you be summarizing the different types of soils in the different levees?	The original figure showing typical levee cross sections is no longer applicable since mass grading in the summer of 2015. Typical levee properties, including crown width, blanket thickness, and head differential are shown on the Plan and Profile. Wide levees are discussed in Section 5.7.3. The levee materials are discussed intermittently in Section 5.2, Section 5.3.5 (seepage parameters), and Section 5.4.2 (strength parameters)	Even if the mass grading has changed some of the landside toe elevations, the levee slopes and crown widths should be about the same. Please update figure to show typical cross sections and where they apply.	At this stage of the evaluation, we do not think that providing a new figure with typical levee dimensions will bring any more clairty to our evaluation, or provide any insight that other figures have not already provided. A figure providing typical levee crown widths has been provided on each page of the Plan and Profile, typical levee crown widths and landside and waterside slopes for each reach are included in the cut sheets, and typical levee dimensions, material properties, and construction methods are discussed in detail throughout the text. The GDR and supplenmentary background documents that were provided to the IPE, whcih are all publicly available, all contain typical dimensions and properties as well. Therefore, we are disinclined to
23	5.3.4 (5.4.4)	Should refer to "progressive ***internal*** erosion"	See revised section 5.3.4. Section now reads. "This can cause localized instability, unraveling of the landside levee slope soils, and potentially progressive internal erosion of embankment soils causing levee failure."	Response accepted, comment closed. (Response should refer to Section 5.4.4)	
24	5.3.4 (5.4.4)	Section refers to "landside toe of slope". For the Perimeter levee, the landside toe of slope is a different designation location compared to the Interior and Cross levees. Should distinguish between the two conditions.	See revised section 5.3.4. Section now clarifies: "We should note that the landside toe of slope for the Perimeter Levee was identified as the toe of the embankment and not the inscribed toe of slope that was used for our underseepage analyses."	Did not see the revised language in Section 5.4.4 - response should refer to Section 5.4.4	Language is found in Section 5.4.4.3 and reads "For this purpose, we identified the landside toe of slope for the Perimeter Levee as the toe of the embankment and not the inscribed toe of slope that was used for our underseepage analyses."

25	5.3.4 (5.4.4)	Should also include consideration of seepage path length (through embankment) to hydraulic head (above the landside toe elevation) ratio in the determination of allowable through seepage condition. Sometimes referred to as a modified Creep Ratio method of analysis. The Duncan, et al. paper is now being referenced for evaluation of through seepage and should be considered here.	See revised section 5.3.4. Section now includes discussion of creep ratio, and a creep ratio criteria has been added to the design criteria.	While a discussion of Creep Ratio has been added regarding the use of Lane's Weighted Creep Ratio, the definition of the length of the Weighted Line of Creep, Lw, as shown in Exhibit 5.4.4.1-1 appears to be incorrect. According to Duncan et al. (2011), the horizontal length shown in this figure for Lw should be divided by 3, making the lengths and the creep ratios 3 times smaller. **This has implication to the results of these analyses if the factor of 3 reduction was not used in the calculations. When showing results from Lane's Weighted Creep Ratio, please show:** **1) Uncorrected levee width** **2) Weighted Line of Creep** **3) Gross Head Difference** **4) Lane's Weighted Creep Ratio** In addition, in order to justify a minimum creep ratio of 2.0 for medium clay, please provide ranges of fines content and PI values for levee embankment soil to justify values. Also note that seepage results presented in Table 6.0-1 are not normalized per foot of head and not compared to the 5 gpm/ft/day criteria adopted for Light Seepage in Section 5.4.4.2. Please present values in same units and show seepage flow criteria in a footnote. (Response should refer to Section 5.4.4)	Figure was intended to show the entry and exit points that the creep ratios were measured from (i.e. the breakout point instead of the landside toe). The numbers reported *did* take into consideration the reduced lengths in calculating L_W. Exhibit 5.4.4.1-1 revised for clarification. Also, a table with the lengths of the horizontal and vertical seepage paths, weighted line of creep, the gross hydraulic head and lane's creep ratio is presented in Section 6.0. See Table 6.0-3. Table 5.3.1-1 Added with ranges of PI, LL and #200 Tests from Stage 1 compliance testing. Table 6.0-1 was added to address comment number 91, the purpose of which was to address the total volume of seepage during a 200-year flood, with the intention of providing the owner with a volume of nuisance water for which to make provisions. Though our initial intuition suggested we provid "cubic feet per day" as a flow rate, we have udated the table to reflect "gallons per minute per foot of head per 100 feet of levee" for the property owner to discern a proper conveyance system. See revisions to table 6.0-1. Footnote also added. We should also note that these results are have already been presented in the results summary spreadsheets.
26	5.3.5 (5.4.5)	ULDC Section 7.3 refers to site specific hydraulic conductivity testing. Justify no site specific testing for this study.	See revised section 5.3.5. Section now discusses why no site-specific testing hydraulic conductivity testing was performed.	Discussion added, but additional information requested. ~~Response accepted, comment closed.~~ Again, would like to see summary of levee fill properties (ranges of relative compaction, fines content, and PI) presented early in the main text to justify relative impermeability of the material described as a sandy, lean clay.	See revised section 5.4.5 and Table 5.3.1-1. Section now reads "Levee fill was compacted to 90 percent relative compaction at a minimum of 3 percentage points over the optimum moisture content. Fill material consisted of soil material with a Plasticity Index of 8 or more, a Liquid Limit of less than 50, 20 percent or more passing a No. 200 sieve, and a maximum particle size of 3 inches. Details regarding material compliance testing results are provided in Table 5.3.1-1. "
27	5.3.5 (5.4.5)	The text explanation of anisotropy is reversed for horizontal and vertical.	See revised section 5.3.5. Section now reads. "The selected ratio of vertical conductivity to horizontal conductivity, or anisotropy ratio (Kv/Kh), is generally based on the values determined through model calibration and laboratory soil testing in relation to gradational and plasticity characterization."	Response accepted, comment closed. (Response should refer to Section 5.4.5)	

28	5.3.6 (5.4.6)	Justify why the approach used for evaluation of three dimensional seepage effects is considered conservative.	Revised section 5.3.6. Based on several analyses performed throughout the RD 17 Phase I, II and III projects, and the ULDC evaluation, we have found that this methodology is relatively accurate with respect to the results obtained through other processes. We therefore consider this process "appropriate" or "reasonable" instead of "conservative". Section now reads. "We recognize that this methodology is intended for screening level evaluations. However, based on similar analyses that we have performed for adjacent levee districts on the San Joaquin River, it is our opinion that this approach to three-dimensional effects is acceptable for our current design analyses."	The text should state what the "other processes" consist of. Additionally, the text should include a statement that the adjacent levee districts on the San Joaquin River are of a similar geologic/depositional environment as this study area. (Response should refer to Section 5.4.6)	A description of the "other" three dimensional evaluation added, and a qualification that these depositional environments are in fact similar has been added to the text. "Previous evaluations were performed for various assessments for Reclamation District 17, located on the east bank of the San Joaquin River, adjacent to River Islands. The previous method of evaluating three-dimensional effects was performed by developing an analytical section semi-perpendicular to the design critical section; the semi-perpendicular section crosses the levee upstream and downstream of the design critical section and extends to the center of the river at each end location. Boundary conditions were applied to the two-levee semi-perpendicular section in a similar manner as that stated in Section 5.4.2. Where a fine-grained blanket layer existed, the total head at the bottom of the blanket layer in the two-levee semi-perpendicular section analysis were compared to the total head at the bottom of the blanket layer in the critical section analysis where the two analyses intersect. While keeping the water surface elevation at the design level, the head (action) was increased in the critical section so that the resulting total head below the blanket layer equals the two-levee section at their intersection. The exit gradient was then checked. A separate procedure was developed for locations where no fine-grained layer existed, however, such an application would not have been applicable at any location within the Stage 1 levees of River Islands.
29	5.3.6 (5.4.6)	List locations where 3D adjustment to the gradient was used here and the magnitude of the adjustment.	See revised section 5.3.6. Information presented in Table 5.3.6-1.	Response accepted, comment closed. (Response should refer to Section 5.4.6)	
30	5.4.2 (5.5.2)	ULDC Section 7.3 recommends low confining stress strength testing be performed. Was this performed for this study?	See revised section 5.4.2. Section now reads. "Confining pressures for the triaxial testing of the blanket material were limited to low pressures, equivalent to approximately 5 to 10 feet of effective overburden stress."	Response accepted, comment closed.	
31	5.4.2 (5.5.2)	How did you correlate SPT blowcounts in fine-grained soils to shear strength parameters?	See revised section 5.4.2. Section now reads. "Soil strength parameters for fine-grained soils were selected and largely based on CPT correlations, strength testing for previous geotechnical investigations and laboratory soil testing."	Response accepted, comment closed. (Response should refer to Section 5.5.2)	
32	5.4.3 (5.5.3)	Change "failure plane" to "failure surface" - the potential sliding surfaces are not planes.	See revised section 5.4.3. Section now reads references "failure surface."	Response accepted, comment closed.	
33	Table 5.4.3-1 (Table 5.5.3-1)	Shouldn't the San Joaquin River be considered at flood stage for a long period prior to drawdown? (use FS>1.2)	See revised Table 5.4.3-1. Section now reads. "For this evaluation, a FS ≥ 1.2 is being utilized for Rapid Drawdown analyses along the Perimeter Levee, and a FS >1.1 along the Cross and Interior Levees, per USACE Guidance."	Response accepted, comment closed. (Response should refer to Section 5.5.2)	
34	Table 5.4.3-1 (Table 5.5.3-1)	Delete last two columns for Pseudostatic and Post Earthquake Minimum Acceptable Slope Stability Factors of Safety since you are not designing for earthquake loading.	See revised Table 5.4.3-1.	Response accepted, comment closed. (Response should refer to Section 5.5.3 and Table 5.5.3-1)	
35	Table 5.4.3-1 (Table 5.5.3-1)	Need to change minimum F.S. for RDD to 1.1 for Cross and Interior levees and to 1.2 for San Joaquin levees. USACE SPK is now requiring F.S. = 1.2 for Sacramento River levees where the river does not stay up as long as does the San Joaquin River. USACE SPK now considers F. S. = 1.0 only for very flashy small streams or creeks.	See revised Table 5.4.3-1.	Response accepted, comment closed. (Response should refer to Section 5.5.3 and Table 5.5.3-1)	
36	5.4.3.2 (5.5.3.2)	Should state "the embankment ***and foundation*** becomes fully saturated"	See revised section 5.4.3.2. Section now reads. "Rapid drawdown occurs when prolonged flood stage water levels saturate waterside embankment slope and foundation soils and then the water surface falls faster than the soil can drain."	Response accepted, comment closed. (Response should refer to Section 5.5.3.2)	
37	5.4.3.2 (5.5.3.2)	See comment above for RDD evaluation FS	See revised section 5.4.3.2. Removed discussion of water level duration and used conservative factor of safety for criteria.	Response accepted, comment closed. (Response should refer to Section 5.5.3.2)	

38	5.4.3.2 (5.5.3.2)	Please provide the amount and the rationale for the RDD analysis of the Perimeter levee. For the Cross and Interior levees, I think you mean that the amount of RDD is from the 200-year DSWE down to the ground surface elevation - if so, that seems reasonable.	Rapid drawdown elevations for the Perimeter Levee were used from the ULDC Evaluation of Reclamation District 17 on the opposite side of the San Joaquin River. These values are based on the one-month drop in river stage following the peak of the 1997 flood event. The cross and interior levees did not have historical drawdown elevations, so we assumed the drawdown would extend to the ground surface on the waterside of the levee.	Original comment asked for the amounts of drawdown (e.g. 10 feet) to be cited. Please provide typical numbers for each reach.	See Section 5.5.3.2. Table 5.5.3.2.-1 Typical Drawdown Amounts added. Reference to PBI's rapid drawdown evaluation added to references, rapid drawdown calculation added as Appendix E.
39	5.4.3.3 (5.5.3.3)	Text states the "average annual high water river stage" was evaluated. How does this compare to the "average summer water surface elevation" and the "average winter water surface elevation" referred to in Section 5.4.4?	See revised section 5.4.3.3. The water surface used was the higher of the average summer and average winter water surface elevations. Section now reads "we interpolated the average summer and the average winter river stage between two gage DWR gage stations on the San Joaquin River."	Response accepted, comment closed. (Response should refer to Section 5.5.3.3)	
40	5.4.4 (5.5.4)	For seismic stability analyses, it is common to use drained shear strengths for cohesionless materials (with generated pore pressures if appropriate), residual shear strengths for liquefied materials, and undrained shear strengths for saturated cohesive soils. However, no undrained shear strengths appear to have been used, or at least shown in the sheets in Appendix A. It is recommended that the strengths assumed for seismic stability be listed for the different soils be shown in the model development sheets in Appendix A.	Total strength parameters (φ and C) are being utilized for seismic analyses. Total strength parameters are included in the Cross Section and Material Parameters figure of each figure set.	Response did not address comment. It is not clear what is being used for non-saturated materials for seismic loading - should use effective strengths. Figure sets in Appendix A also show <u>both</u> effective and undrained shear strengths for each material, so it is not clear what is being used in the analysis.	See revised figures in Appendix A. Materials are labeled as "undrained" when undrained strengths are being used in ananlysis.
41	Table 5.6-1 (Table 5.7-1)	State "less than 100 feet ***wide*** "	See revised Table 5.6-1. Section now reads. "... 100 feet wide."	This minor comment was not addressed. (Response should refer to Table 5.8-1)	See revised Table 5.8-1. Section now reads. "... 100 feet wide."
42	Table 5.6-1 (Table 5.7-1)	Section 5.4.3.2 referred to water surface drawdown elevations provided to the City of Lathrop. Is this the same as the drawdown water elevation provided by PBI?	Yes.	Please provide full reference that is consistent with previous descriptions.	Reference to report by PBI has been added to references section, rapid drawdown summary attached as Appendix E
43	Table 5.6-1 (Table 5.7-1)	The criteria for Through Seepage is unclear - note that you would expect seepage to daylight on the landside slopes of most normal sized homogenous levees	See revised Table 5.6-1. Section now reads. Breakout height considered for an erodible material. Also, additional through seepage criteria added to section.	Criterion worded backwards - what you want is that the phreatic water surface <u>does not</u> exit onto the landside levee slope above the landside levee toe in an erodible material - please fix. (Response should refer to Table 5.8-1).	See revised Table 5.8-1. Through seepage criteria now reads "Phreatic water surface does not exit onto the landside levee slope above the landside levee toe in an erodible material or exits onto non-erodible material."
44	Table 5.6-1 (Table 5.8-1)	For Underseepage, use exit gradient of less than 0.8 at a distance of 150 feet for DWSE. For slope stability, use F.S. = 1.1 and 1.2 for RDD per earlier comment. The reference to the PBI RDD water surface only pertains to the Perimeter levee, it is down to the ground surface for the other dryland levees. Also, change "failure planes" to "failure surfaces" Also, this table is for the 200-year DWSE - where are the criteria for the HTOL summarized?	See revised Table 5.6-1. Section now reads. "Exit Gradient ≤ 0.8 at 150 feet from Levee Landside Toe"	Gradient comment addressed, but PBI RDD water surface not addressed. Please address comment and provide full reference. (Response should refer to Table 5.8-1)	The comment was not seen in full due to a copy paste error. 1. Comment addressed in Response to Comments. 2. See revised Table 5.8-1. Section now reads "Drawdown water surface elevations further described in Section 5.5.3.2." As described in the Referenced Section, drawdown water elevations for Cross and Interior Levee were chosen to be ground surface. Calculation Summary provided in Appendix E 3. "Failure planes" changed to "failure surfaces" in Table 5.8-1.
45	5.7 (5.9)	Please list in this section the locations (stations) where analyses were carried out.	See revised section 5.9. Sections are provided in Table 5.9-1.	Response accepted, comment closed.	
46	5.7.2 (5.9.2)	There should not be a negative gradient or the statement of "no positive y-gradient" - just state that the gradient is zero. Same comment to Page 8.	See revised section 5.9.2. "no positive gradient" changed to "exit gradient equals zero."	Response accepted, comment closed. (Could clarify that this pertains to underseepage vertical gradients across the blanket)	Suggestion incorporated, text revised to: "... we reported an exit gradient of zero across the blanket layer."
47	5.7.2 (5.9.2)	Please describe the characteristics of the different levee fills. This information could also be added to the cross sections requested previously.	See revised section 5.2.1 (Levee Geometry), 5.3.5 (Hydraulic Conductivity) and 5.4.2 (Soil Strength Parameters). Sections modified to include discussion of the various levee materials.	Requested cross sections and summary (ranges and average) of embankment fill materials (relative compaction, fines content, and PI) not provided.	See revised Section 5.3.1 and Table 5.3.1-1 for material compliance testing results, including range of results, average of results, and standard deviation of results.
48	5.7.2 (5.9.2)	The localized gradient and the average underseepage exit gradient should not both be referred to as the exit gradient	See revised section 5.9.2. Section now refers to wither the average gradient or the local gradient.	Response accepted, comment closed.	

49	5.7.2 (5.9.2)	Critical locations for determining exit gradients could also exist beyond 150 feet from the landside levee toe.	See revised section 5.9.2. Section now reads. "The critical locations to determine exit gradients are typically the landside toe of the levee, and any ditch, depression, or location with a thin confining blanket layer to the landside of the levee."	Response accepted, comment closed.	
50	5.7.2 (5.9.2)	Is it the ***occurrence*** or the ***location*** of calculated through seepage?	See revised section 5.9.2. Section now reads. "... the location of calculated through seepage."	Response accepted, comment closed.	
51	5.7.2 (5.9.2)	The approximate height of through seepage relative to the levee toe (as defined in the text) for the Perimeter levee is not appropriate.	See revised section 5.9.2. Section now reads. "...relative to the landside levee toe for the Cross and Interior Levees, and the landside fill slope for the Perimeter Levee."	Response accepted, comment closed.	
52	5.7.2 (5.9.2)	"***levee-spec fill*** " is not defined in the text	See revised section 5.9.2. "Levee-spec fill" was changed to "Levee Fill", which is defined in section 5.2.1.	Response accepted, comment closed.	
53	5.7.3 (5.9.3)	Some portions of the Perimeter levee would meet the ULDC Section 7.8.1 definition of a ***wide levee*** as contained in ULDC. There should be some reference to this condition in the text.	See revised section 5.9.3. Section now includes discussion of wide levees.	Response accepted, comment closed.	
54	6.0	Describe what "finished grades" means and the schedule for their completion. Concur with comment below that the conclusion should be that after additional material is placed landward of the existing Phase 1 levees, the levees will meet DWR ULDC Criteria with regard to through seepage, underseepage, and slope stability.	See revised section 6.0. Discussion of "finished grades" was removed from section. As of Fall 2015, mass grading of the Phase 1 Stage 1 area is complete.	Response accepted, comment closed.	
55	6.0	Clarify that Reaches 6 and 7 where earthquake-induced deformations are expected are along the Perimeter levee. Show typical 10-year geometries in comparison to existing levee geometries and potentially deformed geometries.	See revised section 6.0. Section now reads. "we anticipate that the post-earthquake reduction in soil strength may cause significant deformation within Reach 7 and within a portion of Reach 6 on the waterside of the Perimeter levee." Appendix B added to show deformed levee geometries with respect to 10-year WSE + 3 feet.	First comment addressed. However, cross sections not provided in Appendix B. Table in Appendix B should also include elevation of current crest and magnitude of deformation estimated.	See revised Appendix B. Figures now included, table now includes current crest elevation.
56	6.0	"should be adequate to resist the 200-year ***and HTOL*** water surface elevation***s*** "	See revised section 6.0. Section now reads. "Our analysis indicates that the current levee system is adequate to resist the 200-year and HTOL water surface elevations specified by the ULDC.	Response accepted, comment closed.	
57	Figure No. 2	See comment above for Section 5.3.3	See revised Figure 2.	Response accepted, comment closed. (with suggested figure edits/additions)	
58	5.7 and Reach by Reach Summary	**Major Comment**: The state of practice for levee evaluations in the Central Valley is to prepare a written section for each reach summarizing: a) Heights and geometries of levee within reach b) Generalized levee embankment characteristics d) Generalized foundation characteristics e) Past performance f) Levee construction and modification history g) Penetrations or other appurtenant facilities h) Natural, physical, and land-use constraints i) Reasoning/rationale for selection of critical section j) Justification for modeling of soil layers and not using certain explorations or layering that appear to be more critical To be sure, much of this is covered in the summary sheets for each reach, but additional justification for some of these items is incomplete, particularly documentation on the critical sites and the layering selected. Recommend adding written sections in the report covering these issues in addition to the summary sheets.	See individual Reach by Reach Summaries for revisions.	Our previous recommendation was to have written sections be added to the report to discuss each reach. The discussion would involve the characteristics of the reach and the reasoning why the locations selected for modelling were selected. In addition, several reaches have multiple model locations and discussing why these different locations were selected and the assumptions made is important. Yes, the summary tables provide some of this information, but not in sufficient detail. Also among the missing items is a discussion of the analysis results for each section and how they compare to required ULDC criteria. The summary tables present results, but do not discuss how they meet meet criteria. The report should discuss each reach and how the evaluations demonstrate that seepage, underseepage, and stability criteria are met. It isn't enough to simply state that they meet criteria and to look at the summary tables without more discussion. Recommend adding written sections for all 10 of the reaches and provide requested discussion.	General geometric characteristics of each reach are provided on the Reach Summary and a discussion on analytical section selection is provided in Section 5.3. ULDC performance criteria, and the analytical methodologies used to determine compliance with the criteria, are discussed at length in the respective sections of the report and presented in graphical form within the various Appendices. As such, further reach-by-reach discussions of these items in the Conclusions Section of the report is not considered necessary.

59	Reach by Reach summary sheets	General Comments for each reach write up: 1) Stating "Meets ULDC criteria is redundant. 2) Underseepage is typically presented as one word. 3) There is no "criteria" in ULDC for seismic performance. 4) Levee embankment needs to meet through seepage criteria for HTOL WSE. 5) It is not understood what "anticipated cut/fill" refers to in Reach Description. 6) The type(s) of Levee Prism Soils should be described. 7) Correct the spelling of toe (not "tow"). 8) It is a little confusing to state "No through seepage". There is through seepage in every Reach. 9) The text describes the location of "toe of levee" as designated for the Perimeter levee. The summary tables for the Perimeter levee do not use this same designation.	See individual Reach by Reach summaries for revisions. 1. This is meant to quickly portray whether the reach meets criteria or not. 2. Agreed, revision made. 3. Revised to "F. S. > 1.0" 4. HTOL through seepage results added to cut sheets. 5. Mass grading is complete, cut/fill section removed 6. Levee Prism Soils discussed in Section x.x 7. Spelling corrected. 8. Revised to "Through Seepage Issue? Yes or No" where issue indicates breakout height above levee toe. 9. Summary tables for Perimeter levees revised to have results at Toe of Berm	(only for Comment No. 9) The use of the term "berm" is not used through out this report. Suggest other wording such as Toe of Embankment Slope or equivalent. Remainder of responses are accepted and the comments are closed.	The summary tables were revised to say "Toe of Fill"
60	Appendix A	For the seepage analyses shown in Appendix A, we have previously asked to have the waterside edge of the results shown to the waterside boundary so that we could better evaluate how the waterside boundary conditions and seepage through the waterside blanket affects seepage pressures beneath and landward of the levee. This does not appear to have been done as the waterside boundary for the dryland levees was explained to us to be about 500 feet waterward of the levee. However, only the seepage results for the first 100 feet or so waterward of the levee are shown in the figures in Appendix A. These results should be shown in the figures in Appendix A.	Boundary Condition figure added to each of the figure sets in Appendix A.	Boundary conditions have been added, but what was requested in the IPE comment was to show the results of the analyses shown to the waterside boundary. Waterside results not shown. Please add.	Revised figures in Appendix A now include the total head conditions to the waterside boundary.
61	Appendix A	General comments for each cross section: 1) it would be helpful to include the Reach designation in the title block. 2) The landside toe elevation is shown on the Plan and Profile sheets. There is no way to confirm that line with the information submitted. Are there as built grading plans available that the reviewers can confirm this elevation? 3) There are several locations where there are surficial sand deposits shown on the Plan and Profile sheets. In most cases, they appear to be cutoff by the excavation/backfilling of the inspection trench. However, at least as shown on the drawings, it does not appear all of the permeable material would have been removed by this process (ie, Station 88+00 along the Perimeter levee). There should be documentation that the project geotechnical engineer and geologist mapped/observed the inspection trench and no permeable materials were present along the alignment. 4) It does not appear any of the seepage analyses that may have been performed including any lake features have been included. It is ok to not rely upon those features as seepage relief devices but there should be some analysis that indicates the ponds are of sufficient distance from the levee that they do not present a piping hazard. 5) Where is the location of the idealized profile shown on the Plan and Profile figures? Centerline of the levee? Minimum blanket layer condition either beneath the levee, at the levee toe, or in the field? 6) In some cases, the theoretical levee template shown on the cross sections does not appear to have the correct crest width dimension (20 feet). 7) All of the unit weights of the materials are 120 pcf. It would see that there would be a variation in this unit weight for the various soil types/in situ conditions.	See individual seepage analyses for revisions. 1) Reach designation added to Title Blocks 2) An as-built grading plan for Stage 1A has been published by O'Dell Engineering (O'Dell Engineering; Grading Plans, Village B, Village C, and Village I; River Islands Phase 1A; July, 18, 2014; Project No. 25500). The remainder of Stage 1 is in progress. 3) A letter addressing the cutoff trench observations from the project engineer and geologist has been included in the response to comments package. 4) Additional seepage analyses were performed to evaluate the piping potential associated with the lakes. See the technical memorandum regarding this issue. 5) The profile represents the interpreted surface below the centerline of the levee. 6) Figures have been corrected where the theoretical levee crown width was less than 20 feet. 7) We considered variations in unit weights based on material type and laboratory testing. However, the average unit weights for each material type was generally close to 120 pcf, and the affect of the varied unit weights on the results of our analysis was negligible. We therefore consider 120 pcf to be appropriate for this evaluation.	(only for Comment No. 2). IPE cannot complete the independent review if grading of Stage 1 that might effect analysis results is still in progress). Will the TM regarding seepage analyses of the lakes be incorporated in this Appendix? If not, then where? Note that the IPE had many comments/questions on the Lake Stability TM that still need to be addressed.	To clarify, the grading is complete for Stage 1, however, the as-built topography has not yet been produced for Stage 1. Furthermore, Grading Ordinance has been established so that the Levee District will have the ability to regulate further grading such that the levees are not adversely affected. Significant grading is not anticipated. It is our understanding that the Internal Lake Slope Stability Technical Memorandum will be published separately.
62	All Reaches	Show slope inclination (e.g. 3:1) on all models	See individual seepage analyses for revisions.	Landside slopes shown, but not waterside slopes. Please add waterside slopes.	See revised figures in Appendix A with waterside slopes.
63	All Reaches	It is good to show the ruler and the exit gradient criteria as a function of distance from the inscribed landside levee toe.	Agreed.	Comment closed.	

64	Reach 1	Following previous general comment, there is no accompanying text to explain why the cross section was selected for analyses. And no discussion of why other locations were not selected. For instance, at Station 48+00 there is a surficial silty sand deposit. Examination of this area would indicate it was cutoff by excavation/backfilling of the inspection trench. This should be documented.	A brief description regarding the reasoning for selecting particular cross sections has been included in the cut sheets.	See previous Non-concur	General geometric characteristics of each reach are provided on the Reach Summary and a discussion on analytical section selection is provided in Section 5.3. ULDC perfromance criteria, and the analytical methodologies used to determine compliance with the criteria, are discussed at length in the respective sections of the report and presented in graphical form within the various Appendices. As such, further reach-by-reach discussions of these items in the Conclusions Section of the report is not considered necessary.
65	Reach 1	Figure 8 in the Data Report indicates the presence of a toe drain at the landside toe of the levee. How was this modeled in the seepage and stability analyses? It would seem to be of potential benefit for potentially localized lowering of the phreatic surface. Additionally, what are the details of the drain (ie, filter type/gradation, type of pipe, pipe diameter, perforation opening size, surrounding drainrock, slope, discharge location, capacity to carry estimated seepage quantity flow rates)? Confirm the type of pipe used is sufficient to support the overlying backfill/embankment loading. The O&M manual should include provisions for monitoring the discharge during high water events as well as action plans for neutralizing the system should sediment be observed in the drainage discharge. Same comment to other applicable reaches.	See revised section 5.2. Details of the toe drain within the ring levee are discussed in Section 5.2.2. To minimize the risk of internal erosion within the levee embankment, the subdrain pipe was surrounded by 2- to 3-feet of Caltrans Class 2 Permeable Material. The subdrain pipe is planned to be abandoned in place in general accordance with the Title 23 abandonment methods. We therefore have not modeled the toe drain and will not rely on its presence.	ENGEO provided information in emails/conference calls regarding disposition of drain, but this is not reflected in the text. Our recollection is that the toe drain would be removed, not just the ends grouted. However, this is not reflected in the text. Note that this is discussed in Section 5.3.3, not Section 5.2.2.	See revised section 5.3.3. Section now reads "Due to the inability to detect internal erosion of the levee into the toe drain during a flood event, the toe drain will be abandoned in strict accordance with the Title 23 abandonment methods. Controlled Low Strength Material (CLSM) will be used to completely grout the toe drain pipelines, thus removing the ability of the drain to transfer fines away from the subsurface soils. We therefore did not consider the presence of the toe drain in our seepage and stability analyses."
66	Reach 1	Figure 8 in the Data Report indicates the crest can range from 40 to 50 feet in width (which is at odds with the Station 45+00 summary sheet which states that the crown width ranges between 59 and 62 feet), and that the landside slope can vary from 2:1 to 3:1. If so, how does the Station 45+00 model address this - shouldn't it represent the most critical geometry in the reach? This should be documented. Same comment to other applicable reaches.	Reach summaries have been revised. The maximum dimension occurs adjacent to an approach fill, and the minimum dimension has been adjusted on the Reach Summary.	Response accepted, comment closed	
67	Reach 1	Probably the most important item in underseepage evaluations is the thickness of the top stratum or blanket layer and the corresponding elevation of the bottom of the blanket. In the underseepage calculations for the Station 45+00 model, the bottom of the blanket is set at about Elevation +9 feet. This appears to be consistent with the top+C64 of the SM layer shown in Figure A-1-A for the plot of the stick-log for Borehole T1-B2. However, the Plan and Profile sheet indicates the top of the SM layer in Borehole T1-B2 is actually around Elevation +12 feet, which would be much more critical+C64. This discrepancy needs to be resolved. In addition, there should be documentation as to why the more shallow SM layers in Borehole B-14 were discounted - at face value, they would be considered to be more critical. Additional documentation is needed. Another point is that the surficial SM layer shown in the profile near Station 45+00 appears inconsistent with the majority of the geotechnical information displayed in the borehole stick-logs and CPT	Comment noted. The subsurface profile is an idealized stratigraphic representation of the subsurface conditions beneath the levee alignment. Once generated the profile was used to assist with selection of the individual reaches and the critical cross sections within each reach. Individual cross sections utilized subsurface explorations within the vicinity of the critical cross section identified in the subsurface profile. Some explorations (e.g. B-14) were reviewed and considered unreliable when compared to newer explorations such as CPTs or borings with more frequent sampling intervals and lab testing to confirm the soil descriptions. The SM layer identified in T1-B2 is a thin discontinuous lense. Based on the additional explorations in the vicinity the bottom of clay blanket is consistently at or below an elevation of +9 feet. The shallow sand layer shown near station 45+00 was observed in CPT 3-CPT33 (relatively close to the centerline) and was therefore included in the idealized profile.	Where will this reasoning and information be documented? This information should be documented in the individual reach discussions recommended above. Please individual reach discussions in the text and add this type of documentation for the models in each reach.	As described in Section 5.3, the idealized analytical models developed for this evaluation are based on considerable engineering and geologic judgement and are intended to be reasonable representations of actual conditions and anticipated performance. A full description of all judgemental decisions used in developing each analytcal section would too exhastive to be of significant use. Section 6.0 presents the conclusions of our analyses as discussed at length in the respective sections of the report and presented in graphical form within the various Appendices. As such, further reach-by-reach discussions of these items in the Conclusions Sections of the report is not considered necessary.
68	Reach 1	It is understood that River Islands does not want to use the landside lakes as part of its flood control project, but it would be very useful to cite that the gradients are even less when the landside lakes are incorporated into the model for Reach 1. A short paragraph describing how the lakes were incorporated into the model, including the water surfaces/boundary conditions, and the resulting reduction in gradients would be informative and support resiliency and robustness of the project. Same comment to other applicable reaches.	Section 5.2.4 and Section 5.3.3.1 were added to discuss the presence of the lakes and their effects on the analysis results.	See previous comments on evaluations of landside lake seepage. Response acceptable, close comment. (Response should refer to Section 5.3.4 and 5.4.3.1)	

69	Reach 1	Near the eastern edge of Reach 1 where the levee is close to the San Joaquin River, shouldn't the critical seepage loading come from the much higher San Joaquin River stage than from the interior flood inundation level of Elevation 20.5 feet? Isn't the San Joaquin River stage here is about Elevation 28.6 feet?	We evaluated this condition at the nearest low point within Reach 1 to the San Joaquin River, located near Station 65+00 on the cross levee. The elevation in that location is approximately 17 ft, and the bottom of the blanket is at approximately +4 ft, based on adjacent explorations. We used the total head from Sta. 150+00 at approximately 600 feet from the levee crown to estimate the exit gradient at this location. For the 200-year, H = 22.34 feet, and for HTOL, H = 23.15 feet. This yielded an average exit gradient of i = 0.41 for the 200-year condition, and i = 0.47 for the HTOL condition.	Response acceptable, close comment.	
70	Reach 2	The analysis section for the Station 16+00 model indicates that the ground surface at the levee toe is 15.9 feet, but the Plan and Profile Sheet indicates that it is less than 15 feet - please resolve and correct this discrepancy.	Fill line on the plan and profile has been revised. However, we should note that in several instances, the landside grades are variable relative to the levee toe. Locations where this occurs are represented on the reach summaries and figures by the "Field" exit gradients.	Response acceptable, close comment.	
71	Reach 2	At Station 25+90 CPT 6A indicates a thinner blanket layer condition than shown in the cross section. At Station 16+00, CPT 6-CPT7 appears to have a continuous layer of silty sand beneath the blanket layer. Suggest deleting Layer 2 as shown beneath the inspection trench.	CPT-23 was performed beneath the crown near Station 25+90 and is considered more reliable than CPT 6A and is also more consistent with the surrounding explorations. Therefore our model reflects our interpretation of the subsurface conditions at this location. At Station 16+00, 6-CPT7 is located approximately 600 feet from the crown. CPTs closer to the crown indicate a thicker blanket layer. Therefore the sand layer beneath the blanket at 6-CPT7 is not considered to be continuous.	Response accepted, comment closed. These assumptions and rationales should be included in the discussions in the individual reach sections recommended for the report.	
72	Reach 3	Note that the letters for some of the CPT soundings near Station 80+00 have been reversed in the Plan versus Profile sheets in Plate 1B (e.g. A2-C2 versus C2-A2 - made it difficult to find them).	Noted.	Noting it does not address whether you will fix these typographical errors.	Nomenclature consistency will be considered for future phases, but we currently feel that this change will not add significant value or clarity to the Plan and Profile.
73	Reach 3	For the Station 89+25 Model, the bottom of the blanket is modeled at Elevation 1.5 feet, but several explorations show sandy materials up to at least Elevation 7 or 8 feet (e.g. CPT C3, CPT-4, CPT-5, CPT C4-A4, CPT A-C8, et) - this should be resolved and the model likely revised.	Cross Section added at Station 80+00 to account for thinner blanket conditions. Bottom of blanket is at approximately +6.5 feet NAVD88 under levee.	It was good to add an extra model to address a thinner blanket. However, this model includes an extra wide fill for the Interior Levee - basically adding 70 feet to the crest width. This creates new questions regarding the purpose of the extra engineered fill, why was it added, what are its extents, and how does this relate to the evaluation? Are there areas where the wide levee is not present, but the thinner blanket is? Please clarify. Note that the addition of this new model and analyses should be included in the discussions in the individual reach sections recommended for the report.	The thin blanket is only located within a short segment of the reach, as shown on the profile portion of the Plan and Profile. Also shown on the plan portion of the Plan and Profile is the extent of the widened levee prism, between Station 50+00 and Station 85+00. The purpose of the fill is for a future roadway that will travel along the top of the levee, which was widened to accomodate a higher volume of traffic. As shown in the plan and profile, the extent of the thin blanket condition extends somewhere between Station 80+00 and Station 85+00. There is therefore no location where a thin blanket condition exists that there is not fill. Furthermore, though the analysis does not consider the presence of the lakes, we do note that this location is directly adjacent to Lake 3 within a highly permeable aquifer, which will only further reduce the seepage pressures acting at the toe of the fill.
74	Reach 3	A proposed lake is shown near Station 80+00 that appears to be only about 250 feet from the levee. This distance seems too short and should likely be expanded to at least 500 feet unless detailed analyses show very high factors of safety and low gradients for potential seepage/internal erosion distress. Even at a distance of 500 feet, the seepage analyses for these lakes should be carried out and a robust factor of safety demonstrated.	Cross section added at Station 80+00 to account for Lake 3 seepage effects. See Technical Memorandum addressing this concern.	Response accepted, comment closed. Note that IPE have several comments and concerns about TM that evaluated landside lakes.	

75	Reach 3	For the Station 89+25 model, the breakout height for the DWSE is 1.5 feet and for the HTOL it is 2.5 feet, but the summary sheet states that this is No or N/A. What do these results indicate? It also seems inconsistent with some of the other summary sheets which show break-out heights. How is through seepage addressed in these analyses? There is also a comment that through seepage does not need to be addressed for the HTOL - actually, it needs to be. Same comments for other similar analyses/models.	HTOL breakout heights identified on the respective seepage graphics.	Response does not address issues in the comments. Please provide responses. Among them, please explain how a through seepage breakout height meets criteria. If it is because the levee is composed of clay, this is not discussed in the summary tables - another reason to have individual sections in the report discussing each reach.	See revised Table 5.8-1. Through seepage criteria now reads "Phreatic water surface does not exit onto the landside levee slope above the landside levee toe in an erodible material or exits onto non-erodible material." Therefore, the section at 89+25 does not fail the breakout height through seepage criteria on account that the material is non-erodible.
76	Reach 4	Explorations B-15, B-14, 6-CPT24, and B-29 indicate a consistent relatively thin blanket layer condition. The alignment of these explorations generally follows the trace of former stream channels on historic documents as well as near the contact of two geomorphic units shown on the Geomorphology map. Confirm there is not a thinner blanket layer condition beneath the levee due to a previous infilled channel near Station 44+00. Analysis for Station 18+00 is unclear. (Designated blanket layer thickness on seepage model diagram is not correct). It is not understood why B-38 has been discounted. Boring log does not match stick log shown on Plan and Profile figure	Based on our review of the geomorphology and subsurface data and our understanding of the site history in this area, we do not believe this channel was infilled with coarse-grained material or that it would be specifically indicative of a thinner blanket condition. We assume you mean B-48 given that B-38 is located several thousand feet from this location. The log for Boring B-48 in the GDR is the correct representation of the subsurface. The stick log in the profile is a typo and has been corrected, however, the subsurface stratigraphy presented is accurate.	Response accepted, comment closed.	
77	Reach 4	A proposed lake is shown near Station 31+00 that appears to be only about 250 feet from the levee. This distance seems to short and should likely be expanded to at least 500 feet unless detailed analyses show very high factors of safety and low gradients for potential seepage/internal erosion distress. Even at a distance of 500 feet, the seepage analyses for these lakes should be carried out and a robust factor of safety demonstrated.	Additional seepage analyses were performed to evaluate the potential for piping into the lakes. See Technical Memorandum addressing this concern.	Response accepted, comment closed. Note that IPE have several comments and concerns about TM that evaluated landside lakes.	Noted. Lake TM and subsequent comments are addressed separately.
78	Reach 4	The calculation arrows for the Station 18+00 analysis for underseepage at the toe extend down to Elevation -7 feet - they should only extend down to Elevation 0 feet. Reinforce other comment that top of aquifer/bottom of the blanket is commonly around Elevation +7 to +10 feet	Calculation arrows adjusted to the correct depth.	Response accepted, comment closed.	
79	Reach 4	It is not clear how the different water surfaces are considered in the analyses for the Station 18+00 cross section. For example, the analysis for the 200-year Interior levee DWSE yields a higher pore pressure (21.0 ft) at the landside toe than the DWSE (20.5 ft) - how is this arrived at? How is the pore pressure of 21.7 ft determined for the San Joaquin River DWSE?	A boundary conditions figure has been added to the figure sets to include the hydraulic loading assumptions made for each analysis. For the DWSE, we included a hydraulic load in the San Joaquin River adjacent to the reach. See Section 5.3.2 for the assumed loading conditions on Reach 4.	It was previously requested to show seepage results all of the way to the waterside boundary - these results would have helped answer the question.	Seepage figures revised to show total head graphics all the way to the river (Figure A-8-B and A-8-C). As demonstrated in the seepage figures, the presence of water on the interior of the federal levee causes a reduction in pore pressures at the landside to of the Interior Levee. As far as how we measured the pore pressure of 21.7 feet for the SJR DWSE (Scenario 1 in the figures and text), SEEP/W was utilized to calculate the total head at a node at the bottom of the blanket below the landside toe.
80	Reach 5	Need to show entire levee cross section (and gradient criteria ruler) extended out to center of San Joaquin River to illustrate river loading and wide levee section	Figure adjusted to show entire levee cross section and gradient criteria.	Response accepted, comment closed.	
81	Reach 6	In the Station 46+00 model, bottom of blanket is set at Elevation +1.2 feet, but 6-CPT-20, B32, CPT-71, and 6-CPT17 indicate that this could be as high as Elevation +4 to +10 feet. This should be resolved and the model revised.	Cross section added at Station 52+50 to evaluate the location with the thinnest blanket condition in Reach 6.	It was good to add an extra model to address a thinner blanket. However, this levee section is also very wide - are there narrower sections in this subreach that might have a thinner blanket? Note that the addition of this new model and analyses should be included in the discussions in the individual reach sections recommended for the report.	The narrowest levee prism is already represented at Station 46+00. Hypothetically, if we assume the worst parts of both locations (levee width from 46+00 and seepage pressures and blanket thickness from 52+50), our avgerage exit gradient would be approximately: i_avg = (24.6 - 19.0)/(19.0-8.9) = 0.55, and the exit gradient criteria would still be approximately 0.69. Naturally, as the prism gets wider, more seepage pressure is dissipated and the criteria increases, so any location within this reach will be below the hypothetical exit gradient and have a larger exit gradient criteria.

82	Reach 7	Even at a distance of 500 feet, the seepage analyses for these lakes should be carried out and a robust factor of safety demonstrated.	Additional seepage analyses were performed to evaluate the potential for piping into the lakes. See Technical Memorandum addressing this concern.	Response accepted, comment closed. Note that IPE have several comments and concerns about TM that evaluated landside lakes.	Comments regarding the interior lake memorandum are addressed separately.
83	Reach 8	The diagonal boundary line between the SM layers near the landside toe has no apparent justification in the Station 76+00 model. This changes the bottom of the blanket layer from about Elevation +10 feet to Elevation +6.5 feet - recommend using horizontal boundary line from landside to centerline of old levee at Elevation +10 feet. Also, the ruler to define acceptable gradient appears to be off about 10 feet based on incorrect inscribed levee template that assumes levee crest width of only 10 feet or so.	Bottom of blanket layer changed to elevation 10.5 feet for cross section at 76+00, as per 6-HA2. See revised cross section in Appendix A, Figure A-13-A. Ruler adjusted for 20 foot crown.	Response accepted, comment closed.	
84	Reach 8	Hand auger 6-HA2 is not shown on the Plan and Profile figure. Recommend extending the top of Layer 3 horizontally waterward under the levee toe.	6-HA2 added to the Plan & Profile. Layer 3 extended waterward beyond the levee toe. See revised cross section in Appendix A, Figure A-13-A.	Response accepted, comment closed.	
85	Reach 8	(Figure A-12-B incorrectly refers to the cross section at Station 76+00). At Station 81+00, the HTOL average seepage gradient increases by more than 20% above the DWSE. Review the adequacy of meeting criteria for this condition with a thick underlying aquifer.	Figure updated with correct station. Station 81+00 was modified to include the raised grades in Reach 8, which was omitted in the original model (See Appendix Figures A-14-C and A-14-D for revised exit gradients). The updated model still resulted in an increase of greater than 20% between the DWSE and the HTOL. In addition, we modeled the WSE at the physical top of levee (PTOL), and found the exit gradient of i = 0.49, which we consider to be acceptable for 200-year level of protection.	Response accepted, comment closed.	
86	Reach 9	The shallow SM layer (Layer 3) is shown to be cutoff by the inspection trench backfill. According to the Plan and Profile sheet at Station 88+00, this layer is not shown to be cutoff. Verify there are no end around seepage effects at Station 92+50 from this potential permeable layer that may not have been cutoff.	The shallow SM layer was sufficiently cutoff by the inspection trench. As previously stated, the subsurface profile is an idealized stratigraphic representation of the subsurface conditions beneath the levee alignment and displays the general depth of the Inspection trench. Please refer to the "Levee Inspection Trench Observation Summary" letter dated February 3, 2016.	Response accepted, comment closed. (Note the date of this letter may change based on comments by IPE and potential revision).	
87	Reach 10	For the Station 136+00 model, both Borings B-53 and B-54 show very thin blanket layers that are not modeled near the levee - only starting 220 feet beyond the levee. This should be revised to show the bottom of the blanket layer at about Elevation +15/+17 feet for the majority of the entire cross section. Also, need to show landside portion of the model and gradients calculated beyond wide levee. Further, need to show 3D calculation for gradients in this area even if levee is very wide.	See revised cross section in Appendix A. Clay identified in CPT-67 has been disregarded, and thin blanket condition identified in B-53 modeled. Bottom of blanket layer modeled at elevation +16 feet. Figures adjusted to show locations where a positive exit gradient identified. 3D effects applied to analysis, see Appendix A or Table 5.4.6-1.	3D effects do not appear to have been applied to the 0.19 2D analysis results. Please review and correct - check that 3D corrections have been properly applied to all analyses as appropriate. Also, it appears that you are basing the layering on B-54 in the figure rather than B-53.	3D effects added for seepage results, see revised figures in Appendix A and summary table in section 6.16. We should note that the first location where a positive exit gradient is measured is at a distance of approximately 1,655 feet from the levee crown, so it is not likely that the 30% surcharge is applicable for this case. However, applying a 30% surcharge is conservative, so we still considered the 3D effects at this cross section. Agreed, response to comment should state "B-54". Both B-54 and B-53 were considered in the interpretation of the cross section. However, B-54 has a thinner blanket condition, with only 2 feet of blanket rather than approximately 5 feet. We should note that for B-53, the surficial material was logged as a "sandy silt", even though the symbol presents silty sand. This inconsistency has been discussed previously
88	Reach 10	For the Station 150+00 model, the bottom of the blanket is extended to about Elevation -3 feet for most of the cross section (except for a slightly shallower thin, discontinuous SM layer). However boreholes indicate the bottom of the blanket ends around Elevation +5 feet. This model should be reviewed and modified. Also, show landside portion of the model and gradients calculated beyond wide levee.	We reviewed and revised the cross section. The lower clay blanket identified in K-B-1, 3-B4, CPT-63, B-55, 6-CPT-12, B-56, B-13 and CPT-16 was neglected for conservancy. The bottom of the clay blanket now ranges between approximately +3 feet and +8 feet. Figures adjusted to show location where a positive gradient was measured, landside of the crown.	Response accepted, comment closed.	
89	Reach 10	At Stations 136+00 and 150+00 extend the seepage model landward to show the seepage conditions at the toe of the embankment fills. Review Plan and Profile sheet stratigraphy shown between Stations 147+00 and 156+00. Permeable layer (SM) may not be depicted correctly.	Analysis figures revised to show locations where positive exit gradients occur.	Response accepted, comment closed.	

90	General	Section 1.1 describes an evaluation was performed for ULDC Section 7.3 Soil Sampling, Testing and Logging. There is no discussion of this in the report with respect to whether the intent of ULDC was achieved in this study.	A section was added to discuss ULDC Section 7.3 (Soil Sampling, Testing and Logging). See revised Section 5.2.	There is no statement made in Section 5.2 concerning whether the intent of ULDC was achieved for the laboratory testing performed.	Section 5.2 revised, "Laboratory testing for Stage 1 is discussed in the Geotechnical Data Report (ENGEO, 2016), and consisted of unit weight and moisture content, Atterberg limits, grain size distributions, incremental load consolidation, unconfined compressive strength, unconsolidated-undrained triaxial compressive strength, miniature vane shear, hydraulic conductivity, and expansion index testing. Based on the guidance established by the ULDC, the laboratory testing performed for Stage 1 is in general conformance with Section 7.3 of the ULDC."
91	General	There should be a discussion included with respect to the amount of seepage anticipated during flood stages. The owner should make provisions to collect/control this seepage.	See revised 5.4.3 and Table 6.0-1. An estimate of nuisance water flow rate is provided in Section 6.0.	Response accepted, comment closed. Suggest using same units in Table 6.0-1 as used in Table 5.4.4.2-1. Additionally, suggest providing a range of anticipated seepage values. The highest underseepage rate per cross section (about 1 cfs/day) - assume this is per foot of levee - is about 0.005 gpm/ft of levee. This seems low.	Per comment 25, the "Anticipated Seepage Volume during Flood Event" table has been revised from flowrate units of "cubic feet per day" to "gallons per minute per foot of head per 100 feet of levee" to provide the owner with a seepage flowrate to make provisions to collect/control seepage.
92	TABLE 2.1-1	What is the source of this table?	See revised Table 2.1-1 with source. Table now includes reference to USGS Fault Map database.	Response accepted, comment closed.	
93	TABLE 2.1-1	Define "characteristic magnitute" that is in the table somewhere in the text.	See revised Table 2.1-1. USGS defines that parameter as the "Moment Magnitude"	The Moment Magnitude is just the scale. Please clarify if this is the characteristic magnitude, the MCE, or something else, and describe what this is in the text.	Table revised to "maximum earthquake magnitude". Defintion added to text: "The USGS estimates the maximum magnitude along a fault by using the mapped surface geology and recorded earthquake location and depth distributions to obtain fault length or area. Using the fault dimensions and, in some cases, estimates of where earthquake ruptures may initiate and terminate (segmentation models), the maximum or characteristic magnitudes are calculated from relationships that are dependent on fault length or area (for example, Ellsworth, 2003; and Hanks and Bakun, 2002)."
94	2.4	The last sentence of the last paragraphs says "Provided that a sufficient plan can be prepared and implemented, mitigation of potential liquefaction and lateral spreading impacts, prior to the occurrence of a design level earthquake, is not required." Has a sufficient plan been designed or will there be one planned?	The emergency action plan (EAP) will be prepared as part of the Operations and Maintenance package, prepared by MBK.	Response accepted, comment closed. Note Non-concur responses related to need for IPE to verify elements of O&M and EAP plans.	
95	5.1	The MBK report should be cited properly since there are many MBK reports in the area. Also, the MBK report is not in the references.	See revised section 5.1 with source. Section now includes a reference to MBK's technical memorandum.	Response accepted, comment closed.	
96	5.3.1 (5.4.1)	This may be trivial, but shouldn't seep/w be SEEP/W? Also later for SLOPE/W.	Software has been updated to SEEP/W and SLOPE/W	Response accepted, comment closed.	
97	5.3.6 (5.4.6)	Which cross sections were the 10 to 30 percent added (increased) to the exit gradient and how did you decide on what increase? Would be nice to see a table of the cross sections, the initial exit gradient, the percent increase, the final one used, and the reason for the value used. We know the info is imbedded in Appendix A.	See revised section 5.3.6. Three dimensional seepage effects provided in Table 5.3.6-1.	Response accepted, comment closed.	
98	5.4.3.2 (5.5.3.2)	This section states "For the Perimeter Levee we utilized water surface drawdown elevations that have been provided to the City of Lathrop as part of a separate hydraulic study for the San Joaquin River." Can you properly cite this study?	Citation added for Reclamation District 17 ULDC Evaluation (ENGEO) and Lathrop/Manteca 200-year Hydraulics Report (PBI).	Do not see the citation in 5.5.3.2	
99	5.4.4 (5.5.4)	Youd et al. and the other cited papers in this section are not in the references.	See revised References section.	Response accepted, comment closed.	
100	TABLE 6.0-1 (TABLE 6.0-2)	Should show the 10-year WSEL, the deformed top of levee elevation, and show that difference to see how close they are - for both segments.	See updated Appendix B to address post-earthquake levee deformation relative to 10-year WSE + 3 feet.	Cross sections not provided in Appendix B	See revised Appendix B with cross ssections.
101	General	Many papers and reports cited are not in the reference section.	See revised References section.	Response accepted, comment closed. Consider renumbering the page numbers of the References so that they follow the numbers of the main text rather than starting from 1.	

102	General			It would have been better to have a version of this document that was marked up with "track changes" from the previous draft reviewed by the IPE as several new report sections, tables, and analysis sections have been added together with changes in the text.	Agree. Further revisions will be tracked for review.
103	5.3.3			It is not clear what the status is of the toe drain. The text states the toe drain "will be abandoned" then goes on to state "high strength grout was used to plug the drain". If the drains were abandoned, there should be more specific details provided as to whether the abandonment meets Title 23 requirements, etc.	See revised section 5.3.3. Section now reads "Due to the inability to detect internal erosion of the levee into the toe drain during a flood event, the toe drain will be abandoned in strict accordance with the Title 23 abandonment methods. Controlled Low Strength Material (CLSM) will be used to completely grout the toe drain pipelines, thus removing the ability of the drain to transfer fines away from the subsurface soils. We therefore did not consider the presence of the toe drain in our seepage and stability analyses."
104	Table 5.4.3.1-1			Since the previous draft of Appendix F, Table 5.4.3.1-1 has been added to illustrate the effects of the landside lakes on underseepage gradients. **<u>New Comments</u>:** **1) For three of the cases, the reduction in exit gradient is show as 100% - does the exit gradient really go down to zero?** **2) Please include the actual exit gradient values for the without- and with-lake conditions so that we can see the actual changes, along with the percent reductions.** **3) In a footnote to the table or listed in the text, state what the water surface elevation in the lakes was assumed as (Elevation 5 feet?)**	1) Yes. In these cases, the phreatic water surface is drawn down such that the total head at the bottom of the blanket layer is less than the total head at the ground surface. 2) See revised Table 5.4.3.1-1. Table now includes exit gradient at toe with and without lake. 3) See revised Section 5.4.3.1. Now reads "...a constant head boundary condition was set within the excavation to the lake's maintained water surface elevation of the 5 feet"`
105	New Section 5.7			Since the previous draft, a new Section 5.7 has been added to Appendix F to address interfaces and transitions (ULDC 7.9). Since there are no features such as seepage berms or cutoff walls associated with the levee system, this section addressed the intersection of the Perimeter and Cross Levees and focused on underseepage gradients at a location in this intersection. <u>New Comments for New Section</u>: 1. There is also an intersection between the Interior Levee and the Perimeter Levee that is not discussed - but should be. 2. In addition to evaluating underseepage at this location, through seepage should also be looked at carefully at both junctions with the Perimeter Levee. 3. However, in addition to the seepage/underseepage calculations, a review of the dimensions and intersection details for the two levee junctions should be shown, together with details of how the newer construction was benched into the older fill. The evaluation for this ULDC requirement should address these issues and state why these interfaces are not of concern for a 200-year DWSE.	1. As stated in the text (Paragraph 2 of the Section 5.7), "The cross section at the Perimeter Levee and Interior Levee intersection was extended to include the influence of the San Joaquin River, in addition to the DWSE and HTOL conditions behind the Interior Levee." The cross section at Interior Levee 18+00 was specifically selected to evaluate the interface conditions, most importantly the hydraulic loading conditions, for the Interior Levee and Perimeter Levee intersection. The results of these evaluations are presented in Figures A-8-A through A-8-J. 2. Through seepage conditions addressed for the Cross Levee/Perimeter Levee intersection, see Table 5.7-2 and revised Section 5.7. Discussion added for Interior Levee/Perimeter Levee intersection, but no new analysis conducted with respect to through seepage. 3. The Cross Levee and Ring Levee (the interior portion of the Perimeter Levee) were built at the same time, as one continuous levee. Therefore the Cross Levee was not benched into the Perimeter Levee, and there is no transition in materials. As far as benching into older fill, the fill between the Ring Levee and the original Perimeter Levee was performed in the same manner within the vicinity of the Cross and Interior Levee as it was with every other portion of the Perimeter Levee. The cut slope of the original Perimeter Levee was excavated at approximately 3/4:1 and was benched in 2-foot intervals. This information has already been provided in Section 7.3 of the

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' FINAL COMMENT (April 2016)
1	Background and Purpose	Suggest additional discussion related to the Cross and Interior levees. While currently inland/dry levees, they might be inundated by levee breaches on either the San Joaquin River or Paradise Cut. In the case of a breach that is not repaired, these levees would become loaded corresponding with stages in the adjacent waterways at the breach locations. We believe that this should be noted and that it is assumed that any breach would be repaired to restore the levees to a "dry land levee" condition.	The purpose of the subject Technical Memorandum (TM) is to determine if the project levees are intermittently loaded or frequently loaded, as per ULDC definition. The TM will be revised to include the following information in the determination for the Cross and Interior Levees. In order for the Cross and Interior Levees to experience water on them, RD 2062 would need to be inundated, which will only occur as the result of a failure of a State/Federal Project levee. Historically this has occurred twice since the formation of RD 2062 in 1922, in 1950 and 1997. Based upon this infrequent loading, the Cross and Interior Levees meet the ULDC definition of intermittently loaded.	The IPE agrees with the Design Team's response to our initial comment. We believe it useful to also verify and document the loading status of the San Joaquin River or Paradise Cut levees that would need to fail in order for the Interior and Cross levees to retain floodwater. That is, if the San Joaquin River and Paradise Cut levees are considered intermittently loaded levees it would follow that the Interior and Cross levees should also be considered intermittently loaded levees. The IPE believes that these are all intermittently loaded levees, but recommends that this fact be fully documented. This issue with regards to the Perimeter levee along the San Joaquin River seems to have been appropriately documented by the Design Team between approximately RM 53.4 and RM 55.9, as shown in the TM, but not further upstream on the San Joaquin River or on Paradise Cut where levee breaches might inundate the Cross and Interior levees. The remaining consideration is whether there is a high probability that earthquake damage to the Cross and Interior levees could be repaired in time to prevent a levee breach caused by flood waters. The Cross and Interior levees will almost certainly be dry and not retaining water at the time of any earthquake. However, if they are damaged by an earthquake due to foundation liquefaction or other strength losses, they may not be able to adequately hold back water released by a levee failure on either the San Joaquin River or Paradise Cut. Unless detailed seismic evaluations are planned for these levees, it seems appropriate that their loading status be further documented to put the issue completely at rest. In addition, you should also state clearly in Section 8: Conclusions, that the Cross and Interior Levees have been determined to be Intermittently Loaded Levees - right now, only the Perimeter Levee is mentioned in this section.	The loading condition for the Interior and Cross Levees is not related to the loading condition of levees that protect them. As per the ULDC definition, an intermittently loaded levee is one "that does not experience a water surface elevation of one foot or higher above the elevation of the levee toe at least once a day for more than 36 days per year on average." As noted in the response and in the TM, if the Phase 1 levee had been in place during the 94 year history of RD 2062 it would have experienced water twice, with the total number of days much less than "36 days per year on average." This loading condition is not going to change during the 20 year duration of the ULOP Finding because for that to happen the State-Federal Project Levees protecting Stewart Tract would need to be deauthorized, decommissioned, or physically removed, and there is no intention of any of these occurring during this time frame. ENGEO performed a seismic vulnerability analysis and determined that post-seismic deformation is not anticipated to be significant. Loading of the Interior and Cross levees is clearly stated to be Intermittently in the revised memo. Section 8 of the TM has been modified as recommended.	Response accepted, comment closed
2	General			The IPE appreciates the detailed breakdown of the loading frequency of the Perimeter levee. Of interest in the 31 years of record is that 19 of those years (61% of the time) the water did not rise at least 1 foot above the landside toe elevation even one day per year. Of the remaining 12 years of record, 8 times the water rose at least 1 foot above the landside toe for more than 36 days (8/31=26%). And for 4 of those years (4/31=13%) the water level was more than 1 foot above the landside toe for more than 100 days per year. Note the last 10 years of record include the period of prolonged drought experienced by the southern San Joaquin Valley. The point is that if this analysis was made 10 years ago, the results would show that the levee is definitely frequently loaded. Based on this information it is reasonable to conclude that the Perimeter levee meets the definition of an intermittently loaded levee. However, it is also close (32 days avg vs 36 days criterion) to being classified as a frequently loaded levee. This marginal result is not really surprising as most levees in the Central Delta are considered to be frequently loaded levees, and while Stewart Tract is above sea level, it is located at the fringe of the Central Delta. As one moves out from the Central Delta, there will be a point where the levee system just meets criteria for an intermittently loaded levee, and Stewart Tract appears to be close to that spot. Further, the use of the very lowest elevation of the landside toe at RM 54.8 represents a conservative selection in the evaluation. Nevertheless, it may be prudent for redundancy, robustness, and resiliency for any remedial work that needs to be done to address seepage and slope stability issues that consideration be given for those levee improvements to be designed to meet the measures, assumptions, and factors of safety associated with frequently loaded levees instead of intermittently loaded levees – at least for low spots downstream of RM 54.8. It is not recommended that these levees be improved to meet seismic stability criteria.	Comment is noted, particularly the recommendation for future work to consider a frequent loading condition for robustness, resiliency, and redundancy.	Response accepted, comment closed

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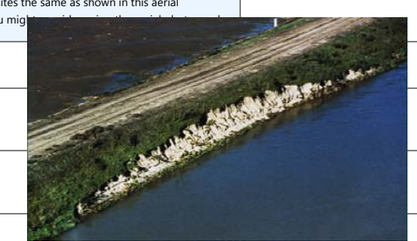
No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (June 2016)	ENGINEER'S RESPONSE (June 2016)
1	Page 1, Sect. 1. Background and Purpose, page para 1, (impact levee integrity)	It should be clear this is a levee safety assessment and not an assessment of how floods may impact improvements such as houses, docks, etc that may be constructed in the future along this reach	The technical assessments being prepared as part of the ULOP Substantial Evidence Record are intended to demonstrate complaince with ULDC and are not intended to support adequecy determination of any future development action. This comment will be addressed in the Engineer's Report as an overarching comment for all of the techncial appendices to ensure this is clear.	Response accepted. Comment closed.			
2	Page 1, Sect. 1. Background and Purpose, page para 1, (during flood events)	It should be clarified whether this is for a single flood event or cumulative flood events over a period of X years (length of the finding?)	This evaluation is for a single 200-year DWSE. Text revised.	Response accepted. Comment closed. (Note the date of this revised document for Appendix H still shows August 10, 2015 - it should be updated to represent the date of the current version)			
3	Page 1, Sect. 2 Process, #2 (to the waterside levee slope)	Should also include the waterside streambank or berm	Language for the sreambank has been included, where requested	Response accepted. Comment closed.			
4	Page 2, Sect. 2 Process, #4 (of the levees)	And streambanks	Language for the sreambank has been included, where requested	Response accepted. Comment closed.			
5	Page 2, Sect. 2 Process, #5 (on the levees)	And streambanks	Language for the sreambank has been included, where requested	Response accepted. Comment closed.			
6	Page 3, Sect. Historical Assessment, page para 2, (fps)	1.7 – 2.2 fps.	The correction noted has been made in the final memo	Non-Concur. Numbers and table reference is out of date. The numbers appear to have been revised to 1.5 - 2.3 fps, and they are now in Table 2 as a new Table 1 has been added. Tables and references now appear to be out of order.	Updated to meet current table references, moved text to be in line with tables.	Response accepted. Comment closed. (Note typo in text on Page 6: 15 feet per second should be 1.5 feet per second).	
7	Page 3, Sect. Historical Assessment, page para 2, (extent)	Need to evaluate wind-wave and erosion potential on these two levees, particularly on Interior Levee. I would expect that this is not a problem due to the wide levee, the compacted levee materials, and the short duration of the inundation. Nevertheless, this should be evaluated and documented.	Wind-wave was determined to cause erosion impacts that would require attention if RD 2062 flooded. Memo updated with discussion throughout.	Response accepted. Comment closed.			
8	Page 3, Sect. Historical Assessment, page para 4, (61)	Is this on the exterior of the Perimeter Levee, or on the inside area due to wave wash erosion of the flooded levee?	Exterior of the Perimeter levee.	Non-Concur. The locations in this place in the text and in the Photo labels are in Levee Miles whereas other places in the text and in the figures show River Miles or Stationing. Need some sort of reference to either River Mile or Stationing to know where these locations are, or change all of the labels to RM or Stationing.	RM and LM now included	Text/Figure references and labels are still incomplete/inconsistent. Several issues remain: 1. Photos 1 and 2 are not referred to in the text or discussed. 2. Titles for Photos 1 and 2 refer to Levee Mile 1.19 - levee miles are not shown in plan views to see where these are and are not given additional labels such as stationing or River Mile which are used in the text. 3. It is not clear whether the damage shown in Photos 1 and 2 for Levee Mile 1.19 are associated with locations discussed in the text. Is Levee Mile 1.19 equialent to RM 54.4? 54.8? Also, is the damage at any of these sites the same as shown in this aerial photograph taken in 1997? If so, you mig 	
9	Page 3, Sect. Historical Assessment, page para 4, (1998)	Indicate the type of repair performed at the two sites in 1997 and 1998.	The type of repairs have been included in the final technical memo.	Response accepted. Comment closed.			
10	Page 3, Sect. Historical Assessment, page para 4, (no noticeable changes.)	Have the sites been exposed to conditions comparable to the 1997 event since they were repaired?	Table was included in memo to relate 1997 event to other significant events in time.	Response accepted. Comment closed.			
11	Page 3, Sect. Historical Assessment, page para 4, (a minor repair performed)	Regarding the 2013 repair, what was the cause of the erosion that needed it to be repaired?	Cause of the erosion is unknown; likely due to boat wake or 2006 flood damage. Repair performed by District with Excavator and imported quarry stone	Response accepted. Comment closed.			
12	Page 3, Sect. Historical Assessment, page para 5, (has been avail since 2007)	What about before 2007?	Text revised to clarify that reports documenting assessments were not prepared prior to 2006.	Response accepted. Comment closed.			
13	Page 3, Sect. Historical Assessment, page para 5, (one (1) listing of a site that was repaired)	Regarding the 2013 repair, What kind of repair? Who made the repair	Repair performed by District with Excavator and imported quarry stone	Response accepted. Comment closed.			
14	Page 3, Sect. Historical Assessment, page para 6, (two scour sites on the waterside??? From the 1997 flood event)	Provide table of significant events since the 1997 flood and compare the 1997 flood.	Table included in updated technical memo	Response accepted. Comment closed.			

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15	Page 4, Sect. Hydraulic Analysis, page para 1 (MBK performed hydraulic analysis)	What hydraulic model was used?	HEC-RAS details and hydrology information included in memo	Response accepted. Comment closed.			
16	Page 4, Sect. Hydraulic Analysis, page para 2 (@The table below lists the left bank and channel velocities for the 200-Year DWSE along the San Joaquin River.)	Were the bank velocities averaged over the entire left overbank area or were they determined using the flow distribution option? Also, there are significant bends that could increase the average velocity against the levee – any adjustments made for this?	Average bank velocities were used. Outside Bend calculations performed for 2 primary river bend locations, quantifying conservative velocities. Text revised.	Response accepted. Comment closed.			
17	Page 4, Sect. Hydraulic Analysis, page para 2 (@Velocities along the Perimeter Llevee and riverbank are about a third three times slower than of the velocities in the main channel.)	How do these velocities compare to past performance? In other words, in the areas that have had previous erosion would these velocities (along with the soil types present) indicate erosion would have occurred?	The velocities during the 200-year DWSE and 1997 event have been compared in the final memo	Non-Concur. For the locations where repairs were needed following the 1997 flood, what were the model scour velocities and how do they compare to the maximum values determined? Also, for the two locations located on outside of the bends - how did they perform in 1997? Please describe what the performance was at these bends and the reasons for that performance.	References of 1997 erosion sites were included and compared with 200-year using velocities based on modeling information. Made reference to performance of outside bends in 1997. Since there was no damage we had to assume some factors which may have attributed to the performance along these sections.	Table 3 shows that the superelevation velocities exceed the allowable except for vegetated and rock slopes. What is on the bank at these locations? No mention of this and no mention of how this will be handled if the allowable is exceeded during the 200-year flood. Further, new text states states that the mid-upper waterside slope will be subject to high velocities which will be prone to erosion. What should the reader take from these statements? Also, no mention that one of the previous erosion areas at RM 54.8 is at the tail end of one of the two outside bends. In addition, the locations modeled in Tables 2 and 3 do not show the results for the two serious and one minor erosion sites, which were identified in the text as at RM 54.4, 54.8, and also 54.14. Are the values listed in the text L11for the two serious erosion sites based on interpolation? Should superelevation have been added to the RM 54.8 site as was done for the RM54.9-55.2 reach in Table 3? Additional discussion is needed.	
18	Page 4, Sect. Geometric Criteria Assessment, page para 1(@131)	Should compare to DWR ULDC geometry standards.	ULDC geometry has been included in the evaluation	Non-Concur. The text and titles of Figures 3 and 4 reference ULDC geometry criteria, but actually Title 23 geometry is shown and labeled. Should also describe in the text that 20-foot-wide levee crown is at MTOL, not necessarily the actual crown. Also, text states that locations for cross sections are monitor site locations are shown in Figure 5. but "monitor" was not really discussed. Please describe what "monitor" means and why these sites were chosen. Note: previous informational tables in previous draft have been removed from the figures - consider adding them back in. Finally, what is meant by "This is the only location along the Perimeter levee that required additional evaluation based on the site visit?" Earlier discussion referred to two sites, but it was not clear why these two sites were selected - which site is being referred to here, and what was the additional evaluation made as a result of the site visit?	Both figures were updated to include the corrected MTOL elevations of 29' and 29.2' respectively, along with the minimum ULDC geometry requirement with the 3:1 slopes and 20' crown at MTOL Document updated to define monitor of the site and why it was chosen. It is the only site that does not have rip rap bank protection along the lower waterside berm and slope. Site was selected due to the discernable visual difference of the waterside slope conditions. The additional evaluation made at this site was to overlay the actual cross section with the minimum ULDC geometry	Test remains fairly muddled about monitor site or sites, where they are, why they were chosen, and what to do about them. Assuming we read this correctly, please clarify the following: 1. Text sometimes refers to 1 monitor site or two monitor sites. Figure 5 shows only 1 monitor site between about RM 53.5 to 53.8. Table 8 indicates either 2 or 3 sites, depending upon how to read the table (Monitor Sites RM 53.5-53.75 and 53.58-53.89 overlap each other). 2. Recommend combining two monitor sites at northern site to make one monitor site from RM 53.5 to 53.9. Clarify that this should be a monitor site based on being an outside bend and high calculated scour velocities (from Table 3) and the lack of vegetation scour protection (from site visit). 3. Make RM 54.9-55.2 a monitor site based on being on an outside bend and high scour velocities (from Table 3). 4. Add 3 more monitor sites (RM 54.36-54.42, 54.77 -54.84, and 54.14). These are based on past erosion scour and previous repairs. Monitoring should be done to ensure that previous repairs are holding. Recommend that levee geometry cross sections also should be added for these three sites as well as for RM 54.9-55.2. Right now, the two cross sections presented are only from the northern RM 53.5-53.9 monitor site. 5. Show all 5 monitoring sites in Figure 5. 6. Clarify that levees in their existing conditions meet ULDC erosion requirements, notably because of extremely wide Perimeter levees. However, additional risk reduction measures that should be done include a) improvement vegetation and slope protection at RM 53.5-53.9 and RM 54.9-55.2, b) Stockpiling of flood-fight materials per Page 14 - should be included in O&M manual. These measures would not be required for a current finding. Note that new text on Page 8 still lists geometry criteria as from Title 23 - this should be corrected to ULDC criteria, and it should be clarified that the geometry criteria is for new levees as 3:1 slopes are used in the figures.	
19	Page 4, Sect. Geometric Criteria Assessment, page para 2 (@The entire levee reach is oversized)	Be more specific with respect to "oversized"; "well beyond", and generally, dimensions.	Text revised to be more specific. Cross-section from Geotechnical Engineering Report under development by ENGEO will be included in the final version.	Response accepted. Comment closed.			
20	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@standard)	Figure 3 states that the waterside levee slope at this location does **not** meet ULDC Criteria.	Figure was incorrect and has now been corrected. The levee meets criteria.	Response accepted. Comment closed.			
21	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@requires)	Required by whom? An agency?	Text revised for clarity.	Response accepted. Comment closed.			
22	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@have vegetation)	Constantly? What is the levee district practice for vegetation management? Include photos. How much vegetation and what type?	Comment addressed in updated technical memo. Language has been changed to clarify vegetated cover.	Response accepted. Comment closed.			
23	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@slope)	What kind of vegetation? Grass? Mowed? Complete or sparse coverage?	Ruderal weeds and grasses. Typically sprayed, occasionally cleared or mowed. Sparse coverage on SJR, more continuous coverage on Interior and cross levee. Text revised.	Response accepted. Comment closed.			
24	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@Figures 3 and 4)	The figures should extend to show the bottom of the channel. The template should be adjusted to be contained within the embankment/streambank	Comment addressed, figures updated in technical memo	Non-concur. Text states that Cross and Interior levees have minimum crest widths of 40 feet, but Geotechnical Evaluation states that crown widths are as low as 35 feet for the Cross Levee and 27 feet for the Interior Levee.	Geotechnical Evaluation updated to reflect current information. No need to change text in erosion report	Response accepted. Comment closed.	

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25	Page 4, Sect. Geometric Criteria Assessment, page para 3 (@6)	This sentence belongs with the discussion on the Perimeter Levee rather than with the Cross and Interior Levees.	Sentence referencing figures moved to previous paragraph.	Response accepted. Comment closed.			
26	Page 7, Sect. Geotechnical Assessment, page para 1 (@The Perimeter levee material along the waterside of the levee)	What about the streambank?	Language has been included to consider the streambank as well in the final memo.	Response accepted. Comment closed.			
27	Page 7, Sect. Geotechnical Assessment, page para 2 (@Type 1 levee fill material)	What is Type 1 levee fill material?	Text revised.	Response accepted. Comment closed.			
28	Page 7, Sect. Geotechnical Assessment, page para 2 (@Type 1 levee fill material)	Cite minimum and typical fines contents and plasticity test results.	Details from ENGEO report has been included detailing material used.	Non-concur. The text states that there was a minimum fines content of 20 percent, but Table 6 indicates that the material is predominantly ML or CL - this means that the fines content is at least 50%. Recommend adding a row in the table listing average fines content. Also, for the LL and PI values shown, the classification would be CL, not ML.	Minimum fines of at least 20% required. Table updated to include average test results which is 74.6% passing, classification is CL.	Response accepted. Comment closed.	
29	Page 7, Sect. Geotechnical Assessment, page para 3 (@Table 2)	cite reference	Reference Cited in updated technical memo	Response accepted. Comment closed.			
30	Page 7, Sect. Geotechnical Assessment, page para Table (@2)	Based on the results and the presence of sandy soils in the levee and riverbank, and past performance, should expect a limited amount of erosion. Need to address how this limited amount of erosion is not a problem due to the rebuilt and wide levee section.	Text has been revised to discuss soil types and slope protection. See Geotechnical section and Summary section.	Response accepted. Comment closed.			
31	Page 7, Sect. Geotechnical Assessment, page para Table (@less than 5%)	less than 5% what?	Table has been reformatted to show remaining language in cell	Response accepted. Comment closed.			
32	Page 7, Sect. Geotechnical Assessment, page para 4 (@sparse vegetated cover)	What kind? grasses? Trees?	Vegetation type has been defined in the final memo	Response accepted. Comment closed.			
33	Page 7, Sect. Geotechnical Assessment, page para 4 (@based on maximum permissible velocities shown in the hydraulic analysis)	This analysis needs to be redone for increased velocities at bends. Would like a table that shows the location,, the overbank velocity, the adjusted overbank velocity, the material of the levee slope and the max permissible velocity for the location.	Outside Bend calculations performed for 2 primary river bend locations, quantifying conservative velocities. Text in the Hydraulic Analysis section addresses comment	Non-concur. Locations where calculations were performed for outside bends not shown in figures.	Outside bend areas shown in figure	Response accecpted. Comment closed.	
34	Page 7, Sect. Geotechnical Assessment, page para 4 (@completely covered in vegetation along the waterside berm)	Clarify slope is not vegetated below the water line	Text revised.	Response accepted. Comment closed.			
35	Page 7, Sect. Geotechnical Assessment, page para 4 (@slope)	Clarity site location	Text revised.	Non-concur. Please clarify that the two cross sections in Figures 3 and 4 represent this non-reveted slope site. Also, is this the "monitor" site? If so, please clarify how or why this site was chosen. This should have been done earlier in the report as it was confusing in earlier sections. In addition, text on Page 15 refers to Photos 1-3, but these photographs are for other sites (Photo 3 is of the landside slope of the Cross Levee) - do you actually mean Photos 5 and 6? Also, note that Page 15 states that the site that lacked quarry stone bank protection was between RM 53.58 and RM 53.87, but other locations (e.g. Page 16) state that the site extends to RM 53.89.	Clarification associated with Previous comment 18 and has been updated in the Document. All references have been updated and corrections to the RM/LM have been made in the document.	See previous Backcheck comments. Not all of these comments have been addressed.	
36	Page 7, Sect. Geotechnical Assessment, page para 5 (@vegetation cover along the slopes that will help protect the slopes during a 200-Year DWSE flood event)	Protect the slopes from what? Wave action? The slopes should be compared to possible erosion due to wave action.	Wave Action, and potential damage caused by Wave action quantified, Interior Levee only. Text revised.	Non-concur. Text states that Cross and Interior Levees have 40-foot-wide crowns, but Geotechnical Evaluation indicates crown widths as low as 27 feet - please clarify and resolve discrepancy.	Geotechnical Evaluation updated to reflect current information. No need to change text in erosion report	Response accepted. Comment closed.	
37	Page 8, Sect. Site Visit, page para 1 (@survey)	Clarify that the survey was a visual survey	Text revised.	Response accepted. Comment closed.			

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38	Page 8, Section: Site Visit, page para 1 (@performed a general reconnaissance of the waterside levee slope and berm of the perimeter levee)	Clarify that is was not possible to observe conditions below the waterline	Text revised.	Response accepted. Comment closed.			
39	Page 8, Section: Site Visit, page para 1 (@cover)	Should expect at least limited erosion in this area during high water.	Yes, an improved description of the anticipated erosion has been provided.	Response accepted. Comment closed.			
40	Page 8, Section: Site Visit, page para 1 (@should be considered)	Clarify is improved vegetation management is being considered or required.	Text revised to indicated that improved vegetation management must be performed.	Non-concur. The text states that Table 6 (you probably mean Table 8 here) includes one proposed action, and later portions include multiple actions. However, Table 8 states potential action as only monitor. Recommend adding improved maintenance efforts including vegetation management and erosion control	References to the appropriate table have been made, and recommended additional language has been included to improve maintenance at the site.	Current draft remains muddled on this issue. See previous Backcheck comments.	
41	Page 8, Section: Site Visit, page para 1 (@figures 4)	Correct figure references.	References corrected.	Non-concur. As stated earlier, references on Page 15 to Photos 1-3 appear to be incorrect. Also, Page 17 refers to Table 6 when it appears you are referencing Table 8. Recommend reviewing all figure, photo, and table references and correcting incorrect references	references/ citations updated	Response accepted, Comment closed.	
42	Page 9, Sect. Site Visit, page para 1 (@ The cross sections show that erosion during a 200-Year DWSE will not critically damage the levee.)	Indicate what erosion would occur during 200-year event. What is critically? Any safety factor?	See revised text. Potential erosion damage was considered to be similar, if not greater than 1997 event. Not critical due to extremely wide levee design. Modeling to determine the factor of saftey was not conducted.	Response accepted. Comment closed.			
43	Page 9, Sect. Site Visit, page para 2 (@There is one encroachment on the Perimeter levee...)	The BOSC site visit indicated a perimeter fence, protruding pile foundations, and no revetment. The possibility of localized erosion within this area should be addressed.	Text revised to include discussion.	Response accepted. Comment closed.			
44	Page 9. Sect. Summary, page para 3 (@erosion)	What kind of erosion? Streamflow? Wind wave?	Comment language addressed with additional descriptions in final memo	Response accepted. Comment closed.			
45	Page 9. Sect. Summary, page para 3 (@during either a flood or normal flow)	Clarify if this is for one flood event or multiple flood events over the duration of the finding?	Single Flood event. Text revised.	Response accepted. Comment closed.			
46	Page 9. Sect. Summary, page para 3 (@complaint with ULDC7.10 for erosion)	ULDC 7.10 requires: 1. Assessment whether dispersive soils are present within the levee embankment. 2. At least a reference to where wind wave analyses are included.	Included evaluation to support ULDC requirement	Non-concur. See comment below with respect to presence of dispersive soils.	See comment response below.	See Backcheck comment below. Comment does not seem fully addressed.	
47	Page 9, Table 3 (@Continuous Rock protection along lower slope)	Should be stated that in all cases the condition/adequacy of the revetment below the waterline was not examined. Provide justification that it is appropriate	Additional text provided in Site Visit section to address comment.	Response accepted. Comment closed.			
48	Page 9, Table 3 (@improve)	What does "Improve" mean?	Word deleted. It was intended to indicate that the site should be monitored, and if monitoring indicated an issue, improved.	Response accepted. Comment closed.			
49	Page 9, Sect. Recommendations, page para 4 (@without the need for action)	Table 3 shows proposed actions. This is inconsistent with first sentence	Language in the recommendations has been changed in final memo. Action based on a long term maintenance need, not directly required to meet ULDC for erosion.	Response accepted. Comment closed.			
50	Page 9, Sect. Recommendations, page para 5 (@annual boat survey)	Clarify that in addition to annual surveys, surveys should also be performed after major flood events.	Text revised.	Response accepted. Comment closed.			
51	Page 10, Sect. Recommendations, page para 2 (@consider)	Consider? Or Implement?	Implement. Text revised.	Non-concur. Table 8 seems to recommend only monitor. Text on several pages, including Page 17 states "consider." Recommend further strengthening of text language and to make it consistent throughout the report	Language has been included, as recommended, to include additional maintenance of the monitor site, and the document has been updated to be consistent.	Recommendation for improved vegetation/slope protection/maintenance remains muddled. See previous Backcheck comment.	
52	Page 10, Sect. Recommendations, page para 2 (@slope)	What about adding rock to fill in scour area at base of slope?	Yes, text revised.	Response accepted. Comment closed.			
53	Page 10, Sect. Title (REFERENCES)	Should include ULDC; hydraulic report	Report included in the references	Response accepted. Comment closed.			
54	Page 12, Figure 6 (@levee)	Add stationing and River Mile rather than Levee Mile since the rest of the report used River Miles. Do you actually use this figure?	Figure is used to show monitor location. River miles included.	Response accepted. Comment closed.			
55	Email, dated 9/2/2014	Information in the report should be clarified in several places. Terms and descriptions are sometimes unclear or lacking detail.	Text has been revised for more clarity.	Response accepted. Comment closed.			

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56	Email, dated 9/2/2014	The Interior and Cross Levees should be evaluated for wave-wash erosion. The report states that they are subject to this, particularly the Interior Levee ("The Interior levee, during a 200-year DWSE would be subject to erosion caused by Large wind generated waves," see Page 3), but no evaluation is presented or documented. This is likely not a problem due to the following: Interior and Cross Levees are wide (minimum crown width of 40 feet) and can sustain wind-wave effects for a short period. Interior and Cross Levees are composed of compacted materials having minimum fines contents and plasticity, and therefore are more erosion resistant than most levees. Past interior erosion has been relatively limited during inundation – commonly less than 6 feet horizontally in a levee. Duration of inundation is relatively limited. Nevertheless this should be evaluated and documented.	Agreed. Text has been revised.	Response accepted. Comment closed.			
57	Email, dated 9/2/2014	There appears to be the potential for limited erosion of the sandy Perimeter Levee. The report appears to struggle with what to do about this. The evaluation should go in more detail to describe and document why this is not a problem: Wide levee. While outer portion of Perimeter levee is sandy, the central and landward portions are new, compacted materials with minimum fines contents and plasticity, so erosion should be contained. Past erosion problems have been limited in length and depth.	Text revised in geotechnical and summary sections.	Response accepted. Comment closed.			
58	Email, dated 9/2/2014	It seems the report is not definitive about repairing some of the erosion damage and vegetating the slopes of the Perimeter Levee. The report should be more definitive on this.	Text has been revised for more clarity. A site is being proposed for monitoring. Improved vegetation is called for.	Non-concur. Table 8 seems to recommend only monitor. Text on several pages, including Page 17 states "consider." Recommend further strengthening of text language and to make it consistent throughout the report.	Language has been included, as recommended, to include additional maintenance of the monitor site, and the document has been updated to be consistent.	Recommendation for improved vegetation/slope protection/maintenance remains muddled. See previous Backcheck comment.	
59	Revised text			Table 3 shows an allowable velocity of 6-7 fps for a vegetated condition. Table 5 indicates this allowable velocity is only valid for slopes less than 5%. Confirm the allowable velocities shown in Table 3 are valid for these steeper slopes.	Erosion is likely to occur at the outer bend areas above the flatter waterside berm where the 6-7 ft/s rate applies. The Maximum Permissiable Velocites do not apply for these steeper sloped locations. Sites will be monitored as shown in Table 8. Text revised to clarify.	Recommendation for bend areas, monitor areas, need for improved vegetation/slope protection/maintenance remains muddled. See previous Backcheck comment.	
60	Revised text			Include ENGEO GER reference	Geotech report updated, Reference included.	Response accepted, comment closed	
61	Revised text			Under Geotechnical assessment, provide the compaction standard used for the 90% relative compaction. (2 places)	ASTM D-1557 included in the section to revise text	Response accepted, comment closed	
62	Revised text			In Section 3 Summary, there is mention of dispersive soils present along the Perimeter Levee. Where is this documented in the GDR? Where are these materials located? How prevalent and how dispersive? Also, why is this not a problem for both erosion and seepage for any of the levee embankments?	Language in report has changed to reflect information provided in the 2016 GER performed by ENGEO. References updated. The reference is based on the evaluation given in Section 5.3.1 and based on information provided in Appendix A.	Reviewer could find no reference to the presence of dispersive soils in GER.	
63	Revised text			In Section Hydraulic analysis, the Table 3 shows velocities higher than the maximum permissible. What is going to be done about it?	These sites will be monitored and evaluated annually, or during and after each flood event to check condition and address any changes.	The text should acknowledge that the maximum velocity is exceeded and will be monitored annually. Will the erosion during the 200-year flood cause failure?	

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (APRIL 2016)
1	Sections 7.12 and 7.13 of the ULDC provide many factors for consideration with respect to encroachments and penetrations. Although the text describes many of these factors, it is the opinion of the IPE that not all ULDC considerations have been addressed. We believe a spreadsheet summary approach for each encroachment/penetration would better enable a review of all the factors that require consideration for the finding, and that the details of the hazard evaluation be documented. If desired, the IPE can review the spreadsheet headings for concurrence prior to completing the analysis. In addition, while the spreadsheet provides a good summary of the encroachment/penetration information and evaluation, it is not a complete documentation. There needs to be a set of references where documents such as design drawings, inspections, and full evaluations are documented - these can be referenced in the spreadsheet.	Spreadsheet created, and included in the tabs connected to this document. Reference pages were included in the report to highlight drawings, maps, as-builts, and dimensions at the encroachment/penetration locations	Partial concur. The addition of Table 2 is very helpful, but does not fully address the IPE's recommendation for a spreadsheet that lists the ULDC factors considered and how they were resolved. Also, references for the design/construction documents for the different encroachments/penetrations were not provided. In fact, there are no references provided at all, even in the revised document. Recommend that the appropriate criteria and design/construction documentation be added to a list of references. (Also, suggest adding actual levee crown width at the Perimeter Levee Pump Station - actual crown width should be much, much greater than the "*Over 30 feet*" stated)	As-Built Drawing references are included for Bradshaws Crossing, Pump Station 9, recycled water lines, and Stage 1 cross levee encroachments. As-Built crown width at Pump Station 9 from WS hinge of existing San Joaquin River levee to LS hinge of Perimeter levee is approximately 150 feet. Information has been included in text.	Response accepted, comment closed.	
2	The document does not include any utilities (if any) that may underlie the levee embankments at depth. These would include gas lines, communication lines, etc that may have been installed using HDD methods.	Sub - excavation occurred along the entire levee construction for each levee section. It is highly unlikely that any penetrations exist that have not been removed	Non-concur. Comment not addressed.	There are no known utility lines under the Perimeter levee that traverse through or under the San Joaquin River. All known adjacent irrigation lines landward of the project levee were removed during the 2007 perimeter levee fill project. The existing ground at least 5 feet landward of the levee toe and 26' feet of foundation material was over-excavated 5 feet deep prior to fill placement. The risk of any unknown pipes is low along the Phase 1 Project Area. The probability of unknown pipes failing the oversized levee is very low.	Response accepted, comment closed	
3	The description of the Bradshaws Crossing Bridge seems unclear and/or incomplete. It is described as a non-penetration encroachment, but the ULDC describes bridges that are lower than the adjacent levee crown as being transportation penetrations. Perhaps part of the clarity issue is associated with the elevations described in the TM text. The text in the TM states that there is several feet of clearance between the concrete structure and the levee crown. However, the text also states that the base of the bridge at the levee is 6 feet above the DWSE, but that the MTOL for the levee is 29.4 feet. It also states that the levee crown elevation is 31.6 feet. If the MTOL is 29.4 feet, the DWSE would seem to be about 26.4 feet (29.4 feet - 3 feet). This gives a levee freeboard of about 5.2 feet for the 200-year DWSE (31.6 feet - 26.4 feet). Adding 6 feet to 26.4 feet results in an elevation of 32.4 feet for the base of the bridge's concrete structure. However, this is only 0.8 feet higher than the adjacent levee crown (32.4 feet - 31.6 feet) - *not several feet* . In addition, it would seem that the crown of the levee has to be higher than the base of the bridge adjacent to the bridge just to allow traffic to go across (although this may be a very localized ramp or raise). Further, there are pipes installed for future connection in the base of the bridge structure, and it is not clear how these relate to the levee. Additional explanation and, perhaps, a sketch is warranted. The text should also document that there are no piers in the river channel and that there are no hydraulic impacts.	The encroachment section was updated to show more detail, photos, and a table to illustrate Bradshaws Crossing Bridge.	Concur Additional information, including text, drawings, and photographs in revised document address comment. The only exception is that there is not an explicit statement in the text that there are no bridge piers in the river channel. *Please state in text that there are no bridge piers in the river channel.* Close comment.	There are two bridge piers in the river channel. We cannot state that there are no bridge piers. the closest pier to the Perimeter levee is 138 feet, six inches, from the abutment. The clearance between the two piers is 170 feet.	Response accepted, comment closed.	
4	Please add diagrams showing the excavation and reconstruction of the Perimeter Levee as well as the overexcavation for the Cross and Interior Levees to help demonstrate that this work significantly reduced the potential for unknown penetrations to exist in the levee.	Typical cross sections were provided in the text. These cross sections are from the construction plans	Concur Additional information provided in new Figures 4 and 5 very helpful. Please clarify and show in Figure 4 that the typical figure and dimensions apply to the location of the pump station that is under discussion - right now it doesn't make it that clear where this typical geometry applies, and we know it doesn't apply everywhere on the Perimeter Levee.	At the location of the pump station, the new levee construction landward of the Project levee was an approximate 90 foot gap between the hinges of the levee crown. The new levee construction built a levee with a 40 foot wide levee crown interior of the project levee. The footprint for this levee was overexcavated prior to construction. Similarly, in 2006 when the infill between the new and Project levee was performed, this areas was also overexcavated 5 feet deep, and at least 26 feet laterally past existing levee toe, with a transitional 1:1 slope up to the existing levee crown. This left approximately 8 feet of the levee crown in place. TM revised to clarify.	Response accepted, comment closed.	

No.	EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (APRIL 2016)
5	Have all pipe penetrations had videotape inspections or pressure-tested over the last 5 years as per ULDC? If not, is there a schedule to do so?	All pipe penetrations have not been videotaped. There is not a schedule to perform these yet, but it is the responsibility of the owner of the penetration to perform these inspections	Non-concur. Comment not addressed. TM commonly states that penetrations comply with Title 23, but it is important that they comply with ULDC requirements, which are not the same. This document needs to address compliance with the ULDC requirements.	All pipes under pressure will be tested or CCTV inspected by the end of May 2016. The District and City of Lathrop is coordinating with pipe owners and inspection/testing companies to ensure compliance with ULDC requirements. The pipes at Pump station 9 on the San Joaquin River are the only penetrations through the Perimeter levee.	Response accepted, comment closed.	Video pipe inspections on the three recycled lines and three pump station pipes were performed in April 2016. Inspection and results were added to memo. Pipes were determined to meet PACP certification approved by USACE. All other penetrations were installed and tested within the past five years and therefore video inspection is not required at this time.
6	For the pipe penetrations near RM 54.97, please add a sketch to illustrate what is meant that the pipes are above the 100-year levee crown (but not DWSE), and are outside of the levee "prism" - they are still embedded in the levee - true? A sketch would be most helpful.	A sketch has been included, along with cross sections that illustrate the progression of construction from 2005 through 2007.	Concur. Sketch added in new figure 5. Sketch does not show elevations, but text states that pipes are above 200-year DWSE. Close comment.			
7	The text states that several older pipe penetrations were removed. Were they completely removed from the levee, or just within the excavation? If the latter, were the other sections of pipe filled with grout? Are there any unremediated sections of pipe left in or beneath the levee?	There are no abandoned pipes that were left within the footprint of any of the levee alignments. I map drawing was included that illustrated the areas where pipes were demolished and removed prior to levee construction.	Non-concur. The new paragraph that is Section 3.4 on Page 10 briefly mentions that multiple irrigation pipes were removed from the footprint of the Perimeter and Interior levee alignments, and refers to Figures 4, 8, and 9. However, Figure 4 refers to the pipes at the pump stations; Figure 8 is unclear, but appears to be showing generally grading plans; and Figure 9 is also hard to read, but appears to show some irrigation pipes in plan view, but these pieces of information are not sufficient to provide the details of the remedial measures for the older pipe penetrations as requested in the original comment. Recommend adding a table listing all older/abandoned penetrations and a description of the abandonment procedure together with a simple sketch detailing the abandonment procedures and limits.	Table 2 has been included to delineate locations and descriptions of removal of pipes and ditch features along the levee sections. There were no buried utilities through the San Joaquin River Project levee alignment, only irrigation lines adjacent to the landside toe that were removed and laterals that were removed that crossed the interior levee construction that were demolished and removed prior to the project. The interior levee alignment had two irrigation pipe alignments demolished and removed along with a ditch that was excavated and backfilled prior to construction. These locations are listed in the text. The plan sets for the 2005 and 2006 levee fill projects identify the overexcavation limits as typical cross sections, and the profile pages identify the extents of the encroachments. The only penetrations that remained were the Pump Station 9 pipes at LM 1.6. New pipes replaced the pre-existing pipes at this location.	Response accepted, comment closed.	
8	For the two 16-inch pipes described in the text for the Interior Levee, are these the ones shown in Figure 3 at LM 0.5 and 1.5? If so, please add this detail to the text. For the two penetrations shown in Figure 3 at about LM 0.1 and 0.3 - do all of the penetrations mentioned in the text (7 pressurized pipes and 18 utility lines) lie at these locations? Please clarify. Also, it would be good to show a sketch or two to illustrate how the pipes/lines tranverse the levee section in addition to mentioning the elevation where they cross the levee crown.	This additional information was included in the evaluation, in both text, and a table referencing coordinates, levee mile, and general stationing. The table also references elevations of pipe inverts. There is also an as-built drawing showing the general alignment and cross section view of the utilities crossing the cross levee. The Joint trench detail has been modified and corrected.	Partial concur. The addition of Table 2 is very helpful, but it lists only the pressurized pipe penetrations and does not include the other 18/19 utility lines. Suggest text be re-written to address the following: a. There appears to be a discrepancy as the text states that there are 7 pressurized pipes in the Cross Levee and Table 2 indicates that there are 8 pipes - please clarify. b. Please add an additional table that lists the other 18/19 utility lines and their characteristics. c. Paragraph 1 on Page 8 refers to Figure 6 to show the alignment of the penetrations near Stewart Road; however, it is Figure 7 that appears to show the alignment. Also, where is Stewart Road and what is its significance? Do all of the utilities cross here? It would appear that other utilities cross at other locations give the station in Table 2. Figure 7 is pretty much illegible - can it be replaced with a simpler, clearer figure? d. Figure 6 illustrates the detail for the joint trench - is there only 1 joint trench, or several? What are their locations? Table 2 indicates that penetrations transit the Cross Levee at least between Station 60+00 and 68+00 - too wide for one joint trench - please clarify.	a. The Joint Trench is listed as a penetration. The Joint Trench is made up of 18 separate lines: 11 L.I.D. communication lines, 3 AT&T lines, and 4 Comcast lines. There is a 6" gas line within the joint trench as well. b. No additional table will be included to list the attributes of the other 17 lines. Joint trench as-built plan details included as reference, Figure 6 updated. c. Figure 7 has been updated and highlighted to clarify alignment. All as-built plan sets are listed as references for encroachment memo. d. There is only one joint trench crossing the Cross Levee, but along the public roadways there are several joint trench designs. This figure is being replaced with the appropriate joint trench detail for the Cross Levee alignment only. The joint trench is at station 67+80.	Response accepted, comment closed. (Figure 7 would benefit by labels to show alignments)	Figure 7 was modified to include labels.
9			Section 3.0, Cross levee, last sentence. Who is the Civil Engineer mentioned?	O'Dell Engineers has been included in the document as the Civil Engineer	Response accepted, comment closed.	
10			Section 4.0 It states that "Operation, inspection, and maintenance of all encroachments and penetrations will be in accordance with ULDC. Should it also state that these things for penetration and encroachments are in the O&M manual, specifically located, and what to look for in the manual?	A District manual with the various components for O&M will include an encroachment/penetration checklist to be used for periodic updates and inspection. Language will be included in the memo to point towards this documentation.	Response accepted, comment closed.	
11			Section 2.0 Is the "base" of the bridge the minimum low chord?	Yes. Term revised.	Response accepted, comment closed	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S RESPONSE (APRIL 2016)
1	Section 1	The appropriate Figure from ULDC Chapter 7.16.8 should be included in the text (probably either Figure 7.5 or 7.6) in either Section 1 or Section 2 (perhaps Section 2 would be better).	Figures 7.5 and 7.8 added in Section 2	Response accepted, comment closed Suggest referencing ULDC in figure titles	ULDC referenced in figured titles.
2	Section 2	This section needs to be rewritten as it misunderstands what the levee *vegetation management zone* is. According to the ULDC Section 7.16, the vegetation management zone extends from a point 15 feet landward of landside levee toe, runs to the landside levee toe, up the entire side of the landside slope, across the entire levee crest, and then stops at the upper portion of the waterside levee slope. Only the upper 20 feet of the waterside slope distance (about 7 feet vertically) is part of the vegetation management zone. Based on the descriptions of the tree locations in Table 1, none of these trees are within the vegetation management zone as they are at the mid-slope of the waterside slope, or further waterward. Consequently, they do not require to be trimmed up or thinned (unless they pose an unacceptable risk) according the ULDC Section 7.16.6. However, over the course of several years, they may pose an unacceptable risk to due excessive growth or decay - but this should be addressed in the O&M manual. The misunderstanding of the extent of the management zone makes the entire discussion in this section inaccurate and should be revised.	Updated Section 2, reworded section to state vegetation is beyond vegetation management zone. Woody vegetation will still be trimmed periodically to maintain visibility.	Response accepted, comment closed	
3	Section 2	There should be a cross section shown for each tree to confirm 1) the location on the levee slope; 2) the oversize levee cross section.	Cross Sections added to document	Response accepted, comment closed	
4	Section 2	Table 1 should provide the tree diameter at breast height.	Table updated	Response accepted, comment closed	
5	Section 3	Provide documentation that the RD 2062 operations and maintenance manual includes the appropriate requirements to meet ULDC with respect to vegetation maintenance. (see above comment - there may not be a need for trimming/thinning of trees outside of vegetation management zone as long as tree is healthy and not in the vegetation management zone)	The District O&M Manual for vegetation maintenance includes management for woody vegetation, herbaceous vegetation, and grasses.	Response accepted, comment closed	
6	Photos	Based on the photographs, it does not appear the levee is being maintained to prohibit weeds greater than 12 inches in height in accordance with ULDC Chapter 7.16.5. Please confirm and document that the appropriate maintenance procedures are being carried out. ~~(This applies only to trees in the vegetation management zone). (RC) I made this statement under the assumption that "ground cover" would include weeds/grasses.~~	Conditions vary seasonally. Photos have been included to show conditions at different times of year. The District maintains to the ULDC standard.	Response accepted, comment closed	
7	Section 1. Background and Purpose	The last sentence says the Interior and Cross levees are new - but they were constructed in 2006? - almost 10 years ago!	New levee context removed in two locations	Response accepted, comment closed	
8	Section 3. Findings	The reference to "*the Phase 1 project levees*" is confusing as the Cross and Interior levees are non-project levees. Recommend you clarify that the Cross and Interior levees are free of woody vegetation as they are relatively newly constructed, and that the oversized Perimeter Levee is free of woody vegetation in the vegetation management zone and has only non-decayed, healthy trees on the lower waterside slope	Language updated to reference all three levee segments	Response accepted, comment closed	

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS - Last Iteration January 2016

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT	ENGINEER'S RESPONSE	BACKCHECK COMMENT	BACKCHECK RESPONSE	EXPERT'S FINAL COMMENT (January 2016)
1	General	The report needs a clear conclusion that the analyses were performed in accordance with and results meet the requirements of ULDC	An additional statement has been included in the methods of analysis sections and in the results section.	Response accepted. Close Comment.		
2	General	The report needs to have some documentaion it was independently reviewed by a California licensed Civil Engineer	The cover page states that the report has been reviewed by a licencesed Civil Engineer.	Response accepted. Close Comment.		
3	General	There should be diagrams prepared that indicate the parameters (and locations) used for the analysis. Ie, length of fetch, depth of water, breach locations.	Figures 2 and 3 in the report have been updated.	The figures added are helpful but no information on fetch lengths and water depths are shown on the figures or in any tables	A table with the critical fetch lengths has been added to Figure 3. The water surface elvations are given in the MBK H&H report.	Response accepted. Close Comment.
4	General	There is no documentation either in the Wind Wave Analysis Tech Memorandum or the Erosion report that wind/wave action against the levee embankments will not cause a breach	A statement saying that no appreciable erosion should be expected has been added to the results section.	No such statement is in the results section	The erosion report by MBK will discuss the findings regarding the levee embankments.	Response accepted. Close Comment.
5	Results, Table	The table on Page 7 needs additional clarification. The text defines "R" but there are no descriptions for Rs (significant wave runup?), R10, or R2	These tables have changed and been updated based on the revised analysis.	Response accepted. Close Comment.		
6	Results, Table	Wave heights and levee crest elevations should be provided to confirm analysis results	This information has been added to the tables	Response accepted. Close Comment.		
7	MBK H&H TM	The MBK hydraulics report states the wind setup and wave runup height is 4.7 ft for the Interior levee and not 4.9 to 5.3 ft as in the Tech Memo text	These numbers have been updated based on the revised anlaysis.	Response accepted. Close Comment.		
8	Method of Analysis	ULDC says engineer has discretion on method to use but has COE and DWR say it is ok to use this software?	The ACES model used for the Interior and Cross Levee analysis is permitted by FEMA for runup and overtopping calculations. It should be noted that ACES v1.07 is on the FEMA list of accepted coastal models used for restricted fetch wave growth analysis and runup on vertical structures, which can be found at https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping/numerical-models-meeting-minimum-requirement. It should also be noted that ACES uses more up to date methods than those contained in the Shore Protection Manual (USACE, 1984).	Response accepted. Close Comment.		
9	Method of Analysis	Have these spreadsheets been QA/QC by external reviewers? If internally reviewed, who did it and what are their qualifications?	The hydraulic reviewer's name has been added to the report.	Mr. Buck is shown as a reviewer for the report but the text does not state that the spreadsheets were Q/A ed by either him or others	A statement has been added to the text that the report and spreadsheets were reviewed.	Response accepted. Close Comment.
10	Determining Physical Parameters	was 200 year flood depth assumed?	Reference MBK H&H report (page 2)	Response accepted. Close Comment.		
11	Determining Physical Parameters	Page 2: was really a hydraulic analysis	Corrected in the report	Response accepted. Close Comment.		
12	Determining Physical Parameters: Fetch Length	can we see the same type of figure specific for this project? Also show the fetch length used.	Figure 3 has been updated.	Response accepted. Close Comment.		

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT	ENGINEER'S RESPONSE	BACKCHECK COMMENT	BACKCHECK RESPONSE	EXPERT'S FINAL COMMENT (January 2016)
13	Determining Physical Parameters: Fetch Length	Page 2: and setup?	Yes, the report has been updated.	Response accepted. Close Comment.		
14	Determining Physical Parameters: Fetch Length	Page 3: interpolated fetch length?	Yes, the report has been updated.	Response accepted. Close Comment.		
15	Determining Physical Parameters: Wind Speed	Were any other wind data locations found? Compare with Mossdale Landing info?	Determining Physical Paramter: Wind Speed Section has ben updated - The Stockton Weather Station was the closest weather station to the site which had a significant amount of historical wind speed and direction data which is why it was selected. Wind data at Mossdale landing only dates back to 2011. The maximum wind speed recorded at the Mossdale Landing is 60.39 mph while the maximum wind speed at the Stockton Airport is 71 mph. Additionally, the maximum calculated 72.6 year return period is 64.26 mph which is greater than the maximum wind speed recorded at Mossdale Landing therefore our results are likely more conservative.	Response accepted. Close Comment.		
16	Determining Physical Parameters: Wind Speed	What was the maximum one hour wind speed recorded? Compare using the CEM Figure II-2-1 and 0.5 hour adjusted speed to fastest 2 min.	Determining Physical Paramter: wind Speed Section has ben updated - The maximum one hour wind speed recorded is 60.75 mph. This value was found by using CEM Figure II-2-1 to adjust the fastest 2-min-average wind speed (71mph) to the one hour wind speed.	Response accepted. Close Comment.		
17	Engineering Analyses, Wind Speed Adjustment...bulleted list	Page 4: would like to see pertinent information that was ultimately used for each levee such as average fetch depth, fetch length, wind direction, levee slope, raw and adjusted wind speeds, etc.	Table 1 and Table 2 in the report now include this information.	Response accepted. Close Comment.		
18	Engineering Analyses, Wave Runup...bulleted list	Page 5: If slope is revetted, this would change and the runup would be lower. Will River Islands revet the levee?	The slope is not revetted and is not planned for revetment. Refer to MBK erosion TM.	The report should state this - the assumption that there is no existing and there will not be revetment in the future and that this is considered a conservative assumption	Additional language has been added to the report which now states that the slope will not be revetted.	Response accepted. Close Comment.
19	Engineering Analyses, Wave Runup Adjustments	Page 6: why was 2 percent selected?	2 percent was selected because overtopping rates are minimal when there is sufficient freeboard for the 2% exceedence runup plus wind setup.	This should be stated in the report	This is explained on page 8 under the Overtopping Rate section of the report.	Response accepted. Close Comment.
20	Results	Page 7: Would like to see plot of runup height and wind direction	The Determining Physical Parameters section of the report describes how the critical wind speed was selected. Prior to running the anlysis the wind speed which would create the worst-case-scenario for each analysis location was determined rather than running through entire analysis for each wind direction. The highest wind speeds (which come from varying directions) have been analyzed for location 10 as a check, the plot is provided on the next sheet of this reponse to comments.	Response accepted. Close Comment.		
21	Results, Table	Page 7: Is this computed at the lowest point of the interior levee? (refering to Q)	This section of the report has been changed based on the revised analysis. Since each analysis location has sufficient freeboard to contain the 2% exceedence runup plus wind setup the overtopping rate for each point on the levee was assumed to be 0.001 cfs/foot or less. Analysis location 3 of the interior levee represent the lowest point on the interior levee.	Response accepted. Close Comment.		
22	Results	"significant" wave height	See comment 5.	Response accepted. Close Comment.		
23	Results	Page 7: The freeboard is the top of the levee to the 200 year WSEL	Yes	This should be stated in the report	Additional language has been added to the report to clarify what freeboard refers to in the Overtopping Rate section and in Table 2.	Response accepted. Close Comment.
24	Results	Page 7: Should cite ULDC although it is from the COE	This has been updated.	Response accepted. Close Comment.		

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT	ENGINEER'S RESPONSE	BACKCHECK COMMENT	BACKCHECK RESPONSE	EXPERT'S FINAL COMMENT (January 2016)
25	Email, 9/2/2014	Verify the QC review was conducte by Civil Engineer knowledgable of such hydraulic analysis.	The hydralic reviewer's name has been added to the report.	Response accepted. Close Comment.		
26	Email, 9/2/2014	Present elevation of Stillwater surfaces that the various wind and wave effects build upon for the different levees.	This information has been added in Table 1 of the report.	Response accepted. Close Comment.		
27	Email, 9/2/2014	Discuss the effect of the UPRR embankment in front of the Cross Levee and its influence on wave height.	The determining Physical Parameter: Fetch Length section has had the following added - The Cross levee is located a little over 100 feet north of the Union Pacific Railroad (UPR) tracks. The UPR embankment is at an elevation of approximately 25 feet, which is 4.5 feet above the 200-year water level. This reduces the flooded area over which the fetch was taken to the area between the UPR embankment and the Cross levee.	Response accepted. Close Comment.		

RD 2062

RECLAMATION DISTRICT 2062
RIVER ISLANDS AT LATHROP PHASE 1 LEVEE SYSTEM
URBAN LEVEL OF FLOOD PROTECTION
ENGINEER'S REPORT - APPENDIX L:
EXCEPTION TO THE ULDC FOR EMERGENCY ACTIONS
(August 8, 2015 Draft; March 2016)

	REVIEW BY THE INDEPENDENT PANEL OF EXPERTS				
No.	**LOCATION IN DOCUMENT**	**EXPERTS' COMMENT (January 2016)**	**ENGINEER'S RESPONSE (March 2016)**	**EXPERTS' COMMENT (April 2016)**	**ENGINEER'S FINAL RESPONSE (XXXX 2016)**
1a	General	An operational plan should be developed for the relief cuts. While perhaps not necessary to have this fully completed at this time, at least the basic elements should be outlined at this point to include the general parameters of: • What equipment will be necessary to induce breaching within a few hours (note that backhoes are generally safer than bulldozers for levee breaching). • Where will this equipment be stored? • How will the equipment be transported to the relief cut sites? • Will the equipment and operators be pre-positioned prior to some flood elevation on the San Joaquin? If so, what elevation? • Who will be trained to operate the equipment and be at the site by a certain time? • How, and how often, will relief cut drills be conducted? Every year?	An Emergency Operations Plan is in place and includes the necessary information for the implementation of the relief cut.	Either a copy of the portion of the Emergency Operations Plan that relates to this Relief Cut Operation or a summary answering the questions previously asked in the review comment should be provided. Should also note that personnel need to be pre-positioned as well as equipment.	
1b	General	The details of the relief cut excavation plan should be outlined and the relief cut plan justified as being reasonable and realistic. Several initial questions: • For the RD 2107 relief cut on Paradise Cut, it appears that the assumption is that the equipment and personnel will need to be pre-positioned and when the San Joaquin River Levee breaches, excavation for the relief cut will be initiated. However, until the flood waters equalize, Table 1 indicates that there will be no excavation that would release flood waters from Paradise Cut into RD 2107. Rather, after 2 to 3 hours, the relief cut will apparently be deepened and allow the flood waters that have built up in RD 2107 to start enlarging the manmade portion of the relief cut to then fully enlarge the relief cut. This seems unrealistic given that the flood waters on both sides of the levee have now almost equalized with only a 3- or 4-foot difference in flood elevation – this is probably not going to create a full-sized breach. A more realistic scenario would be to start manmade excavations immediately after the San Joaquin River has breached and to have the full head of Paradise Cut enlarge the opening to a full breach geometry by flowing into RD 2107 instead of out of it. This latter scenario appears to be consistent with the plan for the relief cut in RD 2062. • For the RD 2062 breach scenario, there is a description of ponding and then breaching of the northern/western line of the UPRR that is west of Interstate 5. However, there is also another UPRR line that is east of Interstate 5 in RD 2107. How is this eastern line considered in the breach scenarios and hydraulics? This should be explained and documented.	Bullet 1 - Upon the identified trigger, personnel and equipment will be mobilized. The intention is to start the relief cut as soon as possible after breaching. However, it is unrealistic to assume that a relief cut could be started immediately after a levee breach occurs given that a breach could occur in any location during any point of the patrol. To account for such uncertainty, the analysis assumed a 2 to 3 hour delay to begin the cut. Bullet 2 - The eastern UPRR embankment on RD 2107 has two trestles, one ~200 feet wide and one ~20 feet wide. Floodwaters are assumed to flow through these as occurred in 1997. The TM has been revised to indicate the presence and flow-through conditions of the eastern line.	Response did not address comment regarding whether it is reasonable to assume that the RD 2107 relief cut would be enlarged by flood waters with only a few feet of differential head. Please address this comment. The basic question is: provide supporting evidence that the size (width and depth) of the relief cut being assumed will actually be formed by manmade efforts aided by differential flows.	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (XXXX 2016)
2	General	It is the understanding of the IPE that the relief cuts will be made and the remnant embankment will "fail to ground". That is, the breach depth will be to at least the grade of the waterside or landside ground elevation (whichever is lower). There is nowhere in the document where this assumption is described. Additionally, the furnished experience of the District personnel in making relief cuts in previous breach events (1997) does not include a description of the breach depth.	Size and depth information for the 1997 relief cut can be found in *Phase III PIR for the Emergency Levee Repairs for SJ 6 - Reclamation District 2062 and 2107*, dated May 1997, prepared by Ayres Associates for USACE (MBK library RD-2062-02-003): "The relief breach was over 150 feet long with scour depths between 5 and 10 feet below the contiguous landside surface. The average scour depth was 7 feet." This document has been added as a reference to the TM. Note the quoted "relief cut" was a dewatering cut.	Please provide a summary of this in this document. A comparison of the dimensions of the 1997 relief cut to those assumed in this analysis should also be provided in a drawing. It is also not clear how much of the cut was made by excavation by men and machines and how much was produced by overtopping flows. Drawings and text should be provided to support this.	
3	Section 4	In the case of the RD 2107 relief cut, the maximum differential head across the breach opening is less than about 4 ft. What is the total levee height and is it practical to assume the breach will occur full depth under these conditions?	Based upon eyewitness accounts (Gilbert Cosio of MBK) the differential head at the 1997 relief cut was less than 1 foot, therefore it is not impractical to assume that the Phase 1 relief cut would be able to form to the size assumed. Also, the ULDC recognizes the uncertainty associated with relief cuts and limits the reduction in ponded water elevation to no lower than the levee crown elevation.	See previous backcheck comment on response to Comment 2 above.	
4	Section 4	In the case of the RD 2062 relief cut, the maximum differential head across the breach opening before any significant flow occurs is less than about 6 ft. What is the total levee height and is it practical to assume the breach will occur full depth under these conditions?	Based upon eyewitness accounts (Gilbert Cosio of MBK) the differential head at the 1997 relief cut was less than 1 foot, therefore it is not impractical to assume that the Phase 1 relief cut would be able to form to the size assumed. Also, the ULDC recognizes the uncertainty associated with relief cuts and limits the reduction in ponded water elevation to no lower than the levee crown elevation.	See previous backcheck comment on response to Comment 2 above.	
5	Section 1	Should cite 7.20 2) of the ULDC (Emergency actions) to show where this all fits in. May even quote it.	Reference to the ULDC permitted emergency actions is made in Section 2 of the TM. The TM had been modified to specifically reference Section 7.20 of the ULDC.	Assuming the referenced TM is the Hydraulic TM, comment closed. Is the TM being mentioned Appendix L?	
6	Section 2, para 2	Should expand a bit on why the "relief plan relies on floodwaters to aid in making the levee relief cuts."	TM has been modified as recommended.	Assuming the referenced TM is the Hydraulic TM, comment closed. Is the TM being mentioned Appendix L? The statement that "*the flood relief plan relies on floodwaters to aid in making the levee relief cuts due to the uncertainty of real-time conditions and the ability of flood-fighters to safely make the relief cut, and is therefor an exception to the ULDC*" is worded poorly. Also, the statement on Page 9: "*That is, this exception is based on the assumption that operators will not be able to safely excavate the entire dimension of the levee relief cut as the embankment would be eroding away and unstable*" actually undercuts this Exception. It seems that the Exception is being made to allow for flood-assisted relief cuts so that the DWSE is lower. Why should the Exception be concurred with if you don't believe it is reliable. Please revise.	
7	Section 3, para 1	State what model was used and if it was an unsteady flow model.	TM has been modified as recommended.	Assuming the referenced TM is the Hydraulic TM, comment closed. **Is the TM being mentioned Appendix L?**	
8	Section 3, para 1	How were the breach widths of 500 feet for the San Joaquin River left bank levee and 200 feet for the UPRR embankment determined? What are the effects of shorter or wider widths? What is the rate of breach and time to reach full breach? What were the depths (both sides) modeled for the different breaches?	Details of the simulated breach widths are documented in the Hydraulics TM, Appendix C of the Engineers Report. Breach widths were estimated based on review of breaches that occurred in 1997, including to the UPRR embankment. Aerial photos taken by DWR on 1/6/97 and 1/13/97, along with aerial photos taken by Joe Countryman of MBK on 1/23/97 were instrumental in this review. TM was revised to indicate that model assumptions were based on review of 1997 breaches.	Are these observations of the 1997 in the Hydraulics TM in the Ayres report? If so, comment is closed. **A lot of this should be in the Appendix L TM**	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (XXXX 2016)
9	Section 3, para 1	The description and ramifications of doing nothing needs to be expanded	The TM has been revised to indicate that failure to make the relief cuts along with the unlikely scenario of no naturally occurring relief breaches occurring on the overtopped Paradise Cut levee would result in a reduction of the minimum freeboard on the Interior and Cross Levees from 5.4 feet to 3.0 feet. Under the highly improbable scenario that the design event occurs, and the max wind and wave occurs within 20 hours of the peak of the event, some overtopping of the Interior Levee could occur.	What specifically is "some overtopping" and how does it compare to the USACE allowable overtopping rate? The remaining freeboard for the Interior and Cross levees has been described to range from 5.4 ft (relief cuts made) to 3.0 ft (no relief cuts made). Proposed minimum widths of the relief cuts are provided. However, there is no minimum depth of cut/scour of the remnant embankment provided which was assumed/calculated in order that the ponded water (DWSE for the Interior and Cross levees) is no greater than the lowest downstream levee crest elevation. In other words, if the proposed RD 2062 200 ft wide relief cut degrades 0 ft, freeboard is 3.0 ft; degrades 2 ft, freeboard is 4.0 ft; degrades 8 ft, freeboard is 5.4 ft. (insert actual degrade depths here). In addition to reductions in freeboard, the increase in water surface also impacts seepage, underseepage, and slope stability. Please address these issues as well.	
11	Section 4	Will a notch be make and if so, what dimensions and with what kind of equipment? See first comment and recommendations	Notching, as a standalone complete action, is not proposed; the intention is to make the relief cut as soon as possible following a breach. Under an ideal scenario, this would achieve the same results of the notching. Under the more likely scenario that there is some delay between the breach and the relief cut, past experience still shows sufficient eroding of the levee due to water.	Should specifically state that the relief cut will be made in its entirety and not dependent on a notch that is smaller.	
13	Section 4	If the notches do not erode to a satisfactory width or depth can they safely be increased by more excavation with the same equipment??	Notching, as a standalone complete action, is not proposed; the purpose of the relief cut is to reduce the encroachment into the freeboard. Therefore, any amount of levee reduction is beneficial. It is impossible to know what would or would not be safe in the field at this time. If it safe to excavate more, it would be done.	It should specifically state that if more cut is required, it will be done only if safe to do so. If it may not be safe to excavate the required amount to make the relief cut, then is this a reliable approach? If not, what good is this Exception? If the Exception is not reliable, then the lower DWSE is not appropriate.	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (XXXX 2016)
16	Table 1	Table 1 indicates that the water in RD 2107 increases to Elevation 24.1 feet (NGVD) prior to the development of the Paradise Cut breach. It would seem that this is loaded against the unbreached portion of the UPRR embankment. How does this affect the Cross Levee that is right behind the UPRR embankment, particularly for underseepage, since Elevation 24.1 feet is significantly higher than the Elevation 20.5 feet DWSE for the Cross Levee.	Given the presence of the relatively intact waterside blanket and the very short-term transient nature of the flood hydrograph, it is our opinion that modeling a steady-state waterside flood stage of 24.1 feet (NGVD 29) would result in an unrealistic result. Therefore, it remains our opinion that the current models should be used for ULDC evaluation.	Non-concur. 1. The overall scenario and sequence that is expected to transpire, including the sequences of breaching, rise in flood waters, creation of relief cuts, and impacts to the Cross and Interior Levees need to be described in more detail. 2. Assumptions regarding potential impacts to the Cross Levee underseepage should be prominently documented in the geotechnical evaluation. 3. The scenario assumes that the Northern UPRR line breaches in a certain place due to overtopping. Please provide more details why the breach has to occur in this location, including UPRR embankment height profile. Further, the UPRR embankment was near failure in many locations in 1997 (see DWR aerial photographs). If the UPRR embankment fails somewhere else due to through seepage piping (indicated in 1997 photographs) or overtopping, could breach flows fail the Cross Levee which is only about 120 feet behind it? Does there need to be a relief cut in the UPRR to guarantee that it breaches in the assumed location and does not fail the Cross Levee?	
18	Breach Cut Locations	Are the levees at the breach locations highly sandy or otherwise very erodible so that we can rely on nature to fully breach the levee cross sections with just a few feet of head on them? The levee and foundation material should be fully described at these locations. Note that some relief cuts have been difficult to actually make in just a few hours (e.g. 1997 Sutter Bypass relief cut).	ENGEO has reviewed previous explorations performed through and adjacent to the levee crown in the vicinity of the planned relief cut locations. Given the relatively sandy conditions, the embankment soils at these locations would likely be erodible under a relief cut condition. The levee embankment soils in the vicinity of the RD 2062 relief cut generally consist of 3 to 4 feet of silty clay to sandy silt underlain by 8 to 10 feet of relatively loose silty sand. The foundation soils generally consist of approximately 13 feet of fine-grained blanket clay underlain by approximately 30 feet of silty sand to poorly graded sand with silt. The levee embankment soils in the vicinity of the RD 2107 relief cut generally consist of 3 to 9 feet of interbedded clayey to sandy silt, sandy clay and silty sand underlain by 5 to 10 feet of loose silty sand. The foundation soils generally consist of approximately 25 feet of fine-grained blanket clay underlain by approximately 20 to 30 feet of poorly graded sand with silt.	This should be documented in this TM, including geotechnical data.	
19	Historical Breach Cuts in Stewart Tract	A full description of the relief cut(s) made in 1997 at Stewart Tract should be provided and used to justify the assumptions in this document. What equipment was used to create the relief cut? How successful was it? What were the dimensions of the relief cut over time? How long after the initial breach did it take to get the equipment there? What were the water surfaces on either side of the levee? How does this case history justify the assumptions in this TM	The experience in 1997 is not intended to be the sole support for the justification but rather one of many factors considered. Comment 19(1) tab has MBK memo and photos by Gilbert Cosio documenting field visit at start of dewatering cut. Comment 19(2) tab has MBK memo by John Wright dated 1/21/97 on a 1/20/97 inspection of the dewatering cut. Additional information is in Ayres report noted in response to Comment 2. These references have been added to the TM.	This documentation should be appended to this TM, not just referenced.	
10	Figure 4	Should show the direction of flow at the relief cuts as well as the anticipated locations of flows into the RDs with directional arrows. This should also be done for the "no notch" condition to illustrate the need for the notches.	The flow of water through the relief cut changes based on the water surface elevations of the interior and Paradise Cut. Water will flow from high elevations to low elevations. A figure showing which way the water will flow changes over time is not provided, although his information is contained in Table 1 and Table 2. If there is no relief cut, water would flow from the breach to the lower topographic elevations at the west end of Stewart Tract until it overtops the Paradise Cut levee.	Comment closed.	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' COMMENT (April 2016)	ENGINEER'S FINAL RESPONSE (XXXX 2016)
12	Section 4	How were the widths of the cuts determined?	Size and depth information for the 1997 relief cut can be found in *Phase III PIR for the Emergency Levee Repairs for SJ 6 - Reclamation District 2062 and 2107*, dated May 1997, prepared by Ayres Associates for USACE (MBK library RD-2062-02-003): "The relief breach was over 150 feet long with scour depths between 5 and 10 feet below the contiguous landside surface. The average scour depth was 7 feet." This document has been added as a reference to the TM. Note the quoted "relief cut" was a dewatering cut.	Comment closed.	
14	Section 5	In Section 2, para 2, it states "The RD 2062 flood relief plan relies on floodwaters to aid in making the levee relief cuts." However in Section 5, it states "for flood relief cuts, floodwaters may not be relied upon to aid in making the relief cut." Please explain or elaborate.	The TM was modified to clarify that the second statement is from the ULDC. The entire purpose of this TM is to support making an exception to this statement.	Comment closed.	
15	Section 5	Should state that the actual plan to initiate the cutting of the notches as soon as overtopping/breaches occurs is a better situation that what is modeled - which is several hours afterwards.	TM has been modified to clarify that intention is to begin the relief cut as soon as breaching occurs, as indicated in the EOP, and that the modeling assumed a 2-3 hour delay to account for delays in awareness of a breach.	Comment closed.	
17	Table 2	The TM should identify that, per the ULDC, even though the ponded flood surface in RD 2062 is calculated to be no higher than Elevation 17.5 feet as shown in Table 2, the 200-year DWSE was set at Elevation 20.5 feet as that is the lowest elevation of the existing RD 2062 levee crowns.	This information is provided in the hydraulics TM which provides the technical details for the relief cut.	Comment closed.	

RD 2062

RECLAMATION DISTRICT 2062
RIVER ISLANDS AT LATHROP PHASE 1 LEVEE SYSTEM
URBAN LEVEL OF FLOOD PROTECTION
ENGINEER'S REPORT - Appendix M
Levee Inspection Trench Observation Summary
November 2015 - Revised April 21, 2016

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT	ENGINEER'S RESPONSE	EXPERTS' COMMENT
1		Is there any documentation (as built drawings/surveys) as to the final invert elevations of the excavated inspection/observation trenches and keyways? Is there information to show where the inspection trench was deepened to remove sandy soils? Was there a maximum depth that this was done even though sandy soils may have extended to greater depths?	Text revised to read, "It should be noted that as-built records of the inspection trench and keyway excavations were not produced." As previously stated, "...any sandy soils, exposed at the trenches/keyways invert elevation, were removed prior to backfilling". The locations where the inspection trench was deepened to remove sandy soil layers was not documented. Text revised to read, "Near-surface sand lenses were removed to their terminal depth and there was no maximum depth of sandy soil removal. "	Response accepted, comment closed.
2	Cover Sheet	Please provide a table identifying the levee reaches (e.g. Interior Levee and stationing) where these observations were made and which trenches were observed (some levee cross sections indicate more than one trench, keyway, or excavation).	We do not feel that a table will help clarify as stationing has changed several times. As previously stated, "...observation/inspection trenches and keyways were observed by an ENGEO Geologist and Geotechnical Engineer." Text revised to read, "Observations included inspection/observation trenches and keyway Subexcavations shown on the Geotechnical Grading Plans (ENGEO 2005 & 2006)."	Response accepted, comment closed.
3	Cover Sheet	Shouldn't the first page show as Appendix M with appropriate format to be consistent with the other appendices?	See revised cover page.	Response accepted, comment closed.
4	Cover Sheet	Were there any buried pipes, objects, or other utilities encountered in the trench excavation?	Text revised to read, "In addition, buried pipe, utilities or other deleterious materials were not observed in the trench excavations."	Response accepted, comment closed.
5	Cover Sheet	Were the soils observed in the trenches logged or sampled in any way?	No.	Response accepted, comment closed.
6	Cover Sheet	Where is the documentation located to show what soils were backfilled into the trench, the methods of placement and compaction, and record tests?	Text revised to read, "As indicated in Reference 2 above and the Grading Plans prepared by Carlson, Barbee, & Gibson (2005) the Inspection Trench backfill was placed as levee fill in accordance with the project specifications."	Response accepted, comment closed.

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (April 2016)	ENGINEER'S RESPONSE (April 2016)	EXPERTS' *PRELIMINARY* COMMENT (April 2016)	ENGINEER'S RESPONSE (June 2016)	EXPERTS' COMMENT (June 2016)
1	General	The document needs to be more specific with respect to the locations referenced (ie, distance to levee landside toe. Is this the distance to the theoretical levee prism toe or the actual levee toe?). It is not possible to verify the length of the seepage entry point to the exit point using the figures provided.	Changed sentence to "We selected the three cross section locations with the shortest distance to lake slopes from the inscribed levee toe" and changed Table 1 with corresponding distances to the lakes.	4/21 - RC - (Text should be revised to avoid confusion with the distances. Figure No. 1 shows the inscribed landside levee toe for confirmation of the distances shown in Table 1. Figure Nos. 2 and 3 do not show the inscribed levee toe location for confirmation of the Table 1 distances. Table 1 should state "Distance to Lake Measured from Inscribed Landside Levee Toe". Text should not state "...each of which has a Lake modeled within 500 feet of the levee landside toe." when the distance at Station 35+00 is greater than 500 feet).	Revised section now reads "We selected the three cross section locations with the shortest distance to lake slopes from the inscribed levee toe to analyze for internal erosion. The cross sections selected for analysis are identified in Table 1 below."	
2	Cover Sheet	If this is Appendix N, shouldn't it have the same cover sheet and identification as Appendix N as do other appendices?	Cover sheet formatted to match existing appendicies.			
3	METHODS OF ANALYSIS Page 2	Please describe/justify why these three analysis locations were chosen for the analyses - hopefully, they were determined to be the most critical based on highest seepage pressures in aquifer and shortest distance to lake slopes. Please document.	Changed sentence to "We selected the three cross section locations with the shortest distance to lake slopes to analyze for internal erosion, each of which has a Lake modeled within 500 feet of the levee landside toe."	4/21 - RC - see response #1	See response to backcheck comment No. 1 above.	
4	METHODS OF ANALYSIS Changes to Seepage Models, Figure 1b, Page 2	The depth of water in the lake shown in Figure 1b should be illustrated by shading in the trapezoid above the light blue nodal points, and the elevation used in the analyses (5 feet) should be labeled.	Figure 1b updated as requested.			
5	METHODS OF ANALYSIS Changes to Seepage Models, Page 2	The text states that all other boundary conditions are discussed in the Stage 1 ULDC Evaluation (ENGEO, 2015). However, the Stage 1 ULDC Evaluation for the Interior Levee assumed fixed head nodes at a distance waterside of the levee. When we discussed this previously with ENGEO staff, ENGEO staff stated that they had changed the waterside boundary conditions to a No-Flow condition for the analyses of the lakes behind the Interior Levee. This would allow for almost no water to seep into the foundation. In discussions with the IPE, the IPE recommended using both sets of boundary conditions for the analyses of the lakes. So, which set of boundary conditions were used for the results shown in this Draft document, and can you show the results for the other set of boundary conditions as well?	The original model considered utilized a no-flow waterside boundary, due to the intact blanket layer that was identified during the exploration of the Stage 2A and Phase 2 levees. However, per the previous discussions with the IPE, the waterside boundary condition was set to a fixed head boundary, equivalent to the DWSE (20.5 feet NAVD 88). Because this assumption is conservative, we did not model the no-flow boundary condition that was originally considered.			
6	Methods of Analyses	It should be clear the 5 foot measurement is an elevation head and not a depth below existing grade. What assurances are in place to prohibit the lakes from being drawn down below Elevation 5 during a flood stage event?	The lake elevations were designed to maintain an elevation of 5 feet, ± 9 inches. A system of pumps,designed by PACE Incorporated, is located in each lake to automatically raise or lower the lake elevations during changing groundwater elevations or fluctuations in river stage. This system opperation is under control of Reclamtion District 2062 partly to allow flood protection concerns to be an intergral part of the lake operations.	4/21 - RC - (Confirm this operation requirement is included within the O&M manual for the flood protection system).		
7	Creep Ratio	The Lane creep ratio method/criteria was used in the analysis. Since there are no vertical interuptions along the length of the seepage path, it would seem more useful to use the Bligh method/criteria. Alternatively, consider showing both sets of results and criteria. Please also detail the intermediate calculations of B and V values so that the calculations can be followed.	Updated appendix to show both Bligh and Lane methods and results. See Table 3 for updated results.	4/21 - RC - (Should refer to Table 2 rather than Table 3 in "Response". B and V not defined in Table 2).	TM corrected, Table 2 contains creep ratio analysis results referred to in comment.	
8	Seepage Severity	There are several statements here that should be clarified. The text states the volume of seepage during a flood event was calculated. There is no result furnished for the volume of seepage during a flood event. Additionally, the seepage quantity flow rates furnished only are valid for the slope of the lakes nearest the levee. The text also mentions identifying the locations of "nuisance water". What is meant by "nuisance water"? The text states "...the higher the flow rate though the slope, the more likely that internal erosion of the fines will occur." The soils exposed along the slope are primarily clean sands. The piping failure mechanism for clean sands does not involve "internal erosion of the fines".	To quantify seepage was not the specific objective of this evaluation, but rather to further evaluate potential for internal erosion. Appendix changed to "To further evaluate the potential for internal erosion that would be anticipated during a flood event..." Mention of "nuisance water" removed from appendix. Appendix revised to "... internal erosion of soil pariticles will occur."			
9	Seepage Severity	For Table 4 on Page 7, please clarify that the Qs seepage value is the seepage per lineal foot of levee/lake slope. The amount of seepage for the Interior Levee is basically the same as that for the Perimeter Levee, which is highly surprising since the Perimeter Levee has a direct connection to the river while the Interior Levee does not. Please review and clarify.	Appendix updated, "We should note that the value of Q_s measured from our analysis is representative of the volume of flow per linear foot of lake slope." Because we are using a constant head boundary condition on the waterside edge of the model at 80+00, the aquifer effectively has a direct connection to the river. In addition, the depth of the lake, and subsequently the height of the lake slope, is considerably larger in Lake 3 than the other lakes, which further controls the total quantity of seepage.			
10A	Critical Gradient for Particle Detachment	Several comments: A. It is not clear how the exit gradients were calculated. Please explain, and preferably show in the figures.	Added "We calculated the local y-gradient by selecting a Gaussian area along the lake slope face of the SEEP/W model with limited influence from calculated points of singularity."			

10B	Critical Gradient for Particle Detachment	B. Hopefully, you didn't use the equation you listed on Page 5 as it has at least one major typographical error in it (typo in original paper by O'Leary et al.). However, since this equation has a major typo in it, it begs the question as to how you did calculate the maximum allowable gradients. Please explain.	We did utilize the equation on Page 5. Appendix revised to reflect the correct equation, outlined in *Seepage Hydraulics* (Kovacs, 1981) rather than the erroneous O'Leary et al. paper. Subsequent analyses and tables have been revised.			
10C	Critical Gradient for Particle Detachment	C. It is not clear how you calculated different exit angles (a) for different analyses. Assuming you are using the equation based on Figure 5 in the paper by O'Leary et al., for a submerged side-slope of 3:1, B would be 18.4 degrees and a would be -71.6 degress (using the assumption that flow is normal to the lake slope (i.e. B - a = 90 degrees). If all of the lakes have 3:1 side slopes (i.e. B = 18.4 degrees), shouldn't they all have the same a values?	A majority of the seepage flow exits the slope face perpendicular to the slope, and our original analysis was performed with this assumption. However, the IPE specifically informed us via conference call (February 9, 2016) that this assumption is incorrect. Our analysis indicates that at the most critical location (at the interface of the conductive sand layer and the confining clay layer), the seepage flow is diverted to a non-perpendicular angle that would normally be expected in a tailwater condition due to the presence of the low permeability clay layer. The direction of the flow at this location was significantly controlled by the anisotropy angle of the sand layer, hence the sensitivity analysis and discussion provided at the end of the results section. Based upon these observations, we calculated the flow direction from the X- and Y-velocity vectors, at a Gaussian area along the lake slope face of the SEEP/W model with limited influence from calculated points of singularity.			
10D	Critical Gradient for Particle Detachment	D. If we apply the same criteria for traditional exit gradients across a top stratum, a maximum allowable exit gradient for vertical seepage of 0.5 translates to a factor of safety of 1.6 assuming a saturated unit weight of 112.5 pcf. However, if we use the same unit weight, the critical gradient becomes 0.385 (this matches the value indicated in Figure 8 for the O'Leary et al., paper), not 0.45, 0.82, or 1.25 (note in the O'leary et al. paper, the critical gradient for horizontal or inclined seepage is never higher than that for the vertical gradient, which would be assumed to be 0.8 for a unit weight of 112.5 pcf). If you are using higher unit weights than 112.5 pcf, this would not be consistent with traditional criteria based on the 0.5 maximum allowable gradient. Please review and correct.	Our critical exit gradients were the result of using the erroneous equation reported in the O'Leary et al. paper. Appendix revised to reflect the updated equation and results, as previously discussed.			
10E	Critical Gradient for Particle Detachment	E. It is not clear how the different sensitivity analyses affected either the seepage angle or the critical gradients.	As discussed above, the anisotropy ratio was found to be a significant factor in the calculated critical exit gradient. This effect is also discussed in (the non-erroneous portions of) the O'Leary et al. paper, where the "likelihood of backward erosion piping is... increased by increased horizontal to vertical permeability ratio." The change in anisotropy generally flattened the seepage angle (closer to horizontal) which resulted in a decreased critical exit gradient.			
11	Figures for Critical Gradient for Particle Detachment	Figures 1 through 3 support the seepage analysis results for the Critical Gradient for Particle Detachment analyses. Please revise or add to these figures to show: 1. Waterside boundary areas to illustrate head losses through waterside portion of the model. 2. Material properties of model layers (e.g. horizontal and vertical permeability values).	Suggested changes incorporated into figures.			
12	Minor Comments	Page 4: Change *"waster"* to ***"water"***	Appendix updated.			
13	Minor Comments	The order of tables should follow the sequence of discussion. For example, Table 3 (Creep Ratios) is actually discussed before Table 2 (Seepage Severity). Also, please have tables either on the same page that they are first mentioned, or follow on the next page. Right now, Table 3 (which should be Table 2) follows on Page 7 three pages after it is first mentioned in the text on Page 4.	Traditionally, as in the GER, the results are presented separately from the selected criteria and methodology. However, we reorganized the technical memorandum to accommodate the IPE.			
14	Minor Comments	Change the definition of Lw on Page 5 from *"Weighted Line of Creep"* to "*Weighted Length of Line of Creep*"	Appendix updated with sugested change.			
15	General	Similar to comment 6. Will the lake ever be drained on purpose? If so, can it be assured that the drawdown rate will not create instability? What if the lake is drawn down for "maintenace" and a flood occurs?	See response to comment 6. In addition, complete evacuation of the lake water is not part of the lake operation and maintainance system nor would the lake pump system be capable of completely dewatering the lakes given their penetration into the higly permeable aquaifer.			
16	Method of Analysis	Changes to Seepage Model. It should be stated that the 5 feet (should be stated as elevation) produces a lake depth of 20 feet	Comment noted. The total depths of the lakes vary.			
17	Method of Analysis	Changes to Seepage Model. Please cite where the following came from. "5 feet was assumed, which is approximately the maintained lake level for each of the interior lakes within Stage 1."	Lake elevation of 5 feet,± 9 inches, NAVD88 is specified on the grading plans, and is the design elevation, maintained by a system of pumps in each lake. Citation added to references.			
18	Method of Analysis	Seepage Severity. Should explicity say the seepage analysis results fit the "Light" category instead of having the reader look at Table 4 and then look back at Table 2.	Added explicit statement of category: "The results indicate that the severity of seepage can be considered "light" for Perimeter Levee, Station 92+50 and "negligible" for Interior Levee, Station 80+00 and Perimeter Levee, Station 35+00."			
19	Method of Analysis	Seepage Severity. May want to state that the Interior levee and part of the perimeter levee fall in the category of "negligible"	Added explicit statement of category, see previous response.			
20	Results	Seepage Severity. May want to state that "maximum flow rate of 5 gallons per minute, per foot of head, per 100 feet of levee" is in the "light" category and can see in the 4th column that the results are below this.	Added explicit statement of category: "we considered a maximum flow rate of 5 gallons per minute, per foot of head, per 100 feet of levee, which falls in the "light" severity of seepage category in Table 2, to be an acceptable criterion for the initiation of internal erosion."			
21	Results	First parapgraph says "The results of the analyses are presented in Tables 3, 4, and 5 below." There are 6 tables of results.	Tables were reorganized on account of Comment 13.			
22	Results	Below Table 6. It states "...anisotropic ration of this material to be at least 0.5 or higher; and therefore, in excess of the minimum selected FS criteria for particle detachment." Ration should be ratio. Last part is a bit confusing. Suggest ".. and therefore, are lower than the minimum selected FS criteria."	Our opinion is that the anisotropic ratio is higher than 0.5 (0.5 being the minimum as stated), and therefore results in a FS larger than our cirteria (1.6/1.3).			
23	Method of Analysis	Should cite where you got the DWSE and put into references.	Cited MBK 2014 and added to references.			

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS					
No.	**LOCATION IN DOCUMENT**	**EXPERTS' COMMENT (April 2016)**	**ENGINEER'S RESPONSE (April 2016)**	**EXPERTS' *PRELIMINARY* COMMENT (April 2016)**	**ENGINEER'S RESPONSE (April 2016)**
1	Cover Sheet	Shouldn't the first page show as Appendix O with appropriate format to be consistent with the other appendices?	Cover sheet formatted to match existing appendices.		
2	Methods of Analysis	The text states a cross section was selected near Station 65+00. Figure Nos. 1, 2, and 3 reference a cross section at Station 76+00. but this cross section does not match the cross section in the original geot rpt for Station 76+00.	Figure title block updated.	No station location of the cross section is shown on the Figures. If near Station 65+00, so state on the Figures.	Updated.
3	Methods of Analysis	The text states that several geotechnical explorations were used to develop the model; however, the model development sheet was not provided. Please provide the model development sheet together with a plan view showing where all of the explorations are located - the existing plan and profile sheets do not show all of the explorations cited.	Model development sheet added to figure set. We should note that explorations 10-CPT1A, 10-CPT1B, and 10-CPT2A, 10-CPT2B were not used to analyze material parameters, but were only pushed to evaluate the strength of the engineered fill for the foundation of the pedestrian bridge. These explorations were used for interpretation, but are not shown on the model development figure due to scaling issues.		
4	Methods of Analysis	There is no as built grading plan furnished for the reviewers to confirm the configuration of the cross section used in the analyses. Is the top of the embankment actually 30 feet higher than the 200-year DWSE? We would like to see plan and cross sections of the grading plans, in part to understand the 3D aspects.	Correct, the highest elevation of the fill is approximately 55 feet, NAVD 88, or 28.6 feet above the DWSE. This is primarily due to the fact that this bridge will need to clear one of the only two major thoroughfares onto the island (so far). As-built grading plans have not been produced by O'Dell Engineering at this time because the bridge has not yet been constructed. Topography and exploration locations are shown on the site plan of the Pedestrian Bridge Geotechnical Exploration.	Please provide IPE with a copy of the Pedestrian Bridge Geotechnical Exploration Report.	Figures from GeoExplReport provided
5	Methods of Analysis	The text refers to seismic slope stability and the minimum factor of safety adopted to be 1.0. However, seismic slope stability is not required for intermittently loaded levees. The text should clarify that the pseudostatic analysis results are presented for information. Should also clarify that no liquefaction was determined to occur at this location in order to use the strengths assumed - this too should be justified if these results are to be presented.	Text updated to reflect that the ULDC does not specify a stability criteria for seismic loading. Liquefaction was identified within several of the explorations within the vicinity of the pedestrian bridge. However, this location has already been identified as an area anticipated to sustain significant deformation following a seismic event.	(Note: Is the City of Lathrop aware the bridge structure could sustain significant damage during a seismic event? Is this damage due to the additional surcharge weight of the ped bridge embankment fill?)	The City is aware of the potential seismic deformation at the bridge abutment location. The bridge has been designed to allow the deck to shear from the pile cap during the design earthquake. This potential deformation design is independent of the ped bridge embankment fill.
6	Methods of Analysis	The figures show both undrained and drained shear strengths for the different materials. For the unsaturated cohesive fills above the water table, the undrained strengths probably shouldn't be used if they give higher factors of safety. For each loading condition (e.g. steady-state, RDD (hopefully you used both), and pseudostatic), please identify which strengths are used for each soil material.	Engineered fill above the phreatic surface changed to drained soil strength parameters. Soil strength parameters follow the same convention that was used in the Stage 1 GER. Figures adjusted to include the parameters utilized for seismic analyses.		
7	Results	Table 1 should also include the allowable ULDC criteria for the levee.	FS Criteria added to Table 1	Response accepted, comment closed. (Table 1 results for Landside and Waterside Post Earthquake FOSs are reversed).	Corrected
8	Results	The text states "...we determined that the stability of the levee slope adjacent to the Pedestrian Bridge is not adversely affected by the addition of fill for the pedestrian bridge." It might be more accurate to state that the addition of the pedestrian bridge fill does not result in a condition where the underlying levee does not meet ULDC criteria for stability.	Agreed, appendix revised to say, "As shown on the attached stability analysis, we determined that the presence of the Pedestrian Bridge does not result in a condition where the underlying levee does not meet the criteria established by the ULDC for stability. Furthermore, we would like to note that the critical failure surfaces for the steady state stability analyses do not intersect the theoretical levee prism."	Response accepted, comment closed. (It should be noted the minimum failure surfaces for all landside stability analyses do not intersect the theoretical levee prism).	Added
9		Similar to comment 1, perhaps the cover letter should state the following is what will be in the Engineer's report as Appendix O?	"Appendix O" added to cover sheet.		
10	Minor Comments	Page 1, Last Paragraph: Please clarify what a "rockery retaining wall" is. Page 2, 2nd Paragraph from bottom: extra "."	A rockery retaining wall is a gravity retaining wall composed of stacked, interlocked boulders that is meant to look more "natural" than typical retaining wall materials. The rockery walls on this site are located above the top of levee, adjacent to either side of River Islands Parkway, at the base of the fill. Therefore, they do not contribute to the stability of the flood retaining structures, and were not inlcuded in this memorandum. Supplementary punctuation removed from appendix.		
11	last page	Should this be sealed by the responsible engineer? Is Ana Lua an EIT? What is her and Joe's title within the company?	Job titles/seal added to the end of the report.		
12	Method of Analysis	5th paragraph. Please cite the "separate hydraulic study".	Separate hydrologic study refers to the RD-17 ULDC evalution on the opposite side of the river from River Islands (Rd-17). The results of the evaluation are attached to the updated Appendix.		
13	Table 1	Where did the WSE come from in the last 2 entries "Pseudostatic – Landside and Waterside"?	The text states that the water surface elevations utilized for our seismic analyses were "interpolated using the average annual high river stage between two DWR gage stations on the San Joaquin River (Department of Water Resources, Division of Flood Management, Hydrologic data for Mossdale Monitoring Station) The upstream station (Station Number B95820) is located adjacent to the Mossdale Crossing Railroad Bridge, and the downstream station (Station Number B9576) is located near the Old River and San Joaquin River confluence. The period of record used for the water surface elevation dated back as early as 1983." We should also note that the same procedure was utilized for the Stage 1 ULDC GER.		

REVIEW BY THE INDEPENDENT PANEL OF EXPERTS

No.	LOCATION IN DOCUMENT	EXPERT'S COMMENT (April 2016)	ENGINEER'S RESPONSE (June 2016)
1	General	ORIGINAL COMMENT BY IPE IN ER (#41) - This section seems to be an appropriate place to address the potential for scour erosion and impacts to the Interior Levee that might be induced by a failure of the existing Old River Levee at the northeast corner of the Stage 1 levee system - this hasn't been addressed yet.	
2	General	In general, the figures in the MBK document and the ENGEO attachment are difficult to read, if not illegible. For a reviewer or member of the public, strongly recommend the use of figures that are legible, clear, and properly annotated.	
3	MBK Memorandum for File, Risk Assessment, Page 3	The discussion of locations and various stationing is not possible to follow given the different stationing used by MBK versus ENGEO. Recommend a consistent set of stationing be used in the documents together with clear and annotated figures to denote the reaches of interest.	
4	MBK Memorandum for File, Risk Assessment, Page 3	Reference is made to historical seepage at locations along Old River, but these locations are not detailed in either this document or in the ENGEO document. Please add pertinent information as it is critically important to the evaluation. Please note that the confusing use of different stationing makes it difficult to understand where the seepage has occurred.	
5	MBK Memorandum for File, Risk Assessment, Page 3	There is no discussion provided as to how the station limits of 361+00 and 397+25 were selected. We assume that these stations are those where the setback Interior Levee is behind the existing San Joaquin/Old River Project levee, but this is not clear. Please explain in text and show in a figure.	
6	MBK Memorandum for File, Risk Assessment, Page 4	Several issues: 1. The text refers to Figures 4 and 5 to show that at the 200-year water surface the levees are oversized, but these figures do not show the 200-year water surface elevation in the cross section so the figures are not very useful.	
7	MBK Memorandum for File, Risk Assessment, Page 4	2. The stationing referenced in the first paragraph of Page 4 (e.g. Stations 13+50 to 25+00) should be referenced to a specific levee alignment as these same stations occur on both the Interior Levee and the Perimeter Levee in Figure 3 (i.e. there is a Station 15+00 and a Station 20+00 on both levees)	
8	MBK Memorandum for File, Risk Assessment, Page 4	3. Reference is made to a "City road," but this is not described or shown in the figures, so the discussion becomes unclear.	
9	MBK Memorandum for File, Risk Assessment, Page 4	4. What is the basis for ENGEO's conclusion that the likely failure location for the rural portion of the RD 2062 levee would be outside of the critical reach?	
10	MBK Memorandum for File, Risk Assessment, Page 4	5. The second paragraph on Page 4 refers to a critical reach as MBK Stations 13+00 to 22+00 - should this be Stations 13+00 to Station 26+00 for the Old River/San Joaquin alignment? Please review, clarify, and correct.	
11	MBK Memorandum for File, Risk Assessment, Page 4	6. The stationing in Figure 3 are almost illegible, please revise so that they are easily readable, and clarify/differentiate the stationing from the Old River/San Joaquin River levee system versus the Interior Levee system. Also, the title of the figure is pretty unclear unless there is a reference to the specific levee alignment.	
12	MBK Memorandum for File, Risk Assessment, Page 4, Figure 3	Between Stations 15+00 and 20+00 there is a potential 3D underseepage effect. Additionally, this could be a point bar area where the levee is underlain by sandy (more permeable) materials	
13	MBK Memorandum for File, Task 2, Page 6	The document describes a 250 ft setback of the San Joaquin River levee and the Interior levee within the Stage 1 project area. There is no setback present where the Interior levee intersects the San Joaquin River levee at the junction with the Perimeter levee near Perimeter levee Station 26+00. How do you address the varying distance between the San Joaquin Levee and the setback Interior Levee?	
14	MBK Memorandum for File, Task 2, Page 6	Also, when the critical reach is referenced (MBK Stations 13+00 to 22+00), do you actually mean Stations 13+00 to **26**+00 along the Old River/San Joaquin levee? Please clarify - same comment for multiple references.	
15	MBK Memorandum for File, Task 2, Page 6, Photo 1.	Please clarify that this is a photograph of the breach prior to repair as opposed to breach repair. Note also that there are aerial photographs available with DWR of this breach - please consider presenting them in this document.	
16	MBK Memorandum for File, Task 2, Page 7	Please clarify that the depth of scour (20 ft. +/-) is the depth relative to the landside ground surface as opposed to the levee crown. Then use this convention in this document.	
17	MBK Memorandum for File, Task 2, Figure 6, Page 8	Please correct the title of Figure 6 to show that this is the breach repair for the Paradise Cut levee failure and not the San Joaquin River levee - the San Joaquin River Levee did not fail at this location in 1997.	
18	MBK Memorandum for File, Task 2, Figure 7, Page 10	The red hatched area of a potential scour hole only 50 feet landward of the levee seems unrealistic given past scour holes in the Delta that reach hundreds and thousands of feet landward of the levee. Please provide justification for this very small scour hole length.	

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19	MBK Memorandum for File, Task 2, text on Page 10 and Figure 8 on Page 11.	The red hatched area of a potential scour hole only 200 feet landward of the levee seems unrealistic given past scour holes in the Delta that reach hundreds and thousands of feet landward of the levee. Please provide justification for this small scour hole length. Note also that labels in Figures 7 and 8 are basically illegible.	
20	MBK Memorandum for File, Task 2, text on Page 10 and Figure 8 on Page 11.	The red hatched area of a potential scour hole only 200 feet doesn't seem so bad at this location as the setback Interior Levee is located much farther landward. However, if the breach was further to the east (upstream), the setback levee is much closer and would be within the scour zone. How is this addressed?	
21	MBK Memorandum for File, Task 2, text on Page 10 and Figure 8 on Page 11.	Several items on Page 12: - Why was the location of a potential levee breach selected at this particular site? What does the text mean by selecting this location as opposed to a location on San Joaquin River due to the relative thickness of the levee?	
22	MBK MFR - page 12	When the text states levee thickness, do you mean horizontal width? Please clarify and clarify what the 'thickness" values cited mean - do they mean horizontal widths at the DWSE?	
23	MBK MFR - page 12	The statement that the levee thickness at the 200-year flood elevation ranges from 50 to 70 ft at the selected breach location, making it much smaller than the San Joaquin River levee" is very unclear. What is meant by this statement?	
24	MBK MFR - page 12	The statement that the location is also at the end of a bend is at a minimum unclear, and also possibly incorrect. What is the significance of this statement? What is the significance of the statement that "turbulent flows" are more likely here?	
25	MBK MFR - page 12	Again, the red hatched area of a potential scour hole in Figure 8 on Page 11 only 200 feet doesn't seem so bad at this location as the setback Interior Levee is located much farther landward. However, if the breach was further to the east, the setback levee is much closer and would be within the scour zone. How is this addressed?	
26	MBK Memorandum for File, Task 2, text on Page 10 and Figure 9 on Page 12.	Several more items on Page 12: - The second paragraph states that the final width of the breach was 250 feet, approximately 50 times the depth of water on the levee at the time of the breach. This indicates that the depth of water on the levee at the time of the breach was only 5 feet - this doesn't seem realistic.	
27	MBK MFR - page 12	The text states that the final width of the breach (only 250 feet) was assumed to have fully formed in two hours. Since the relief cut is assumed to begin after 12 hours, the relief cut would have no effect on the final breach dimensions. Why is the relief cut being described as a significant flood reduction measure? Note that without prepositioning of relief cut equipment and personnel, there is no way that a relief cut would be completed within 12 hours - this should be addressed. Why was the location of a potential levee breach selected at this particular site? What does the text mean by selecting this location as opposed to a location on the San Joaquin River due to the relative thickness of the levee?	
28	MBK Memorandum for File, Task 2, text on Page 13 and Figure 10 on Page 13 and Figure 11 on Page 14.	The breach flow velocities and discussions are not credible. What is needed is a realistic discussion of this potential failure mode that describes what realistically would be expected to happen and the potential impacts: For breach flows, the flow velocities could reach 15 to 20 fps, not the tame 3 to 6 fps cited in the text and Figure 10. These latter values are simply not credible.	
29	MBK Memorandum for File, Task 2, Figure 12, Page 15	The floodplain velocities in Figure 12 are unreadable. It should also be noted that they are not credible and also would not apply if the breach was closer to the setback Interior Levee. Same comment for Figure 13 on Page 16.	
30	MBK Memorandum for File, Task 2, text on Page 16.	The statement on Page 16 that the modeling shows that if a breach were to occur in the critical reach then relief cuts could be made to minimize the risk that a significant scour hole would develop is not supported by evidence and may be incorrect.	
31	MBK Memorandum for File, Conclusion, Page 16	The statement that there are other levee reaches in the Project Levee that have geotechnical conditions which indicate a more likely probability of failure is not supported.	
32	MBK Memorandum for File, Conclusion, Page 17	The statement that a relief cut plan to further mitigate the flood risk posed by this reach is not realistic. The document does not support the idea that relief cut would reduce scour erosion on the setback Interior Levee.	
33	ENGEO Breach Potential Evaluation Page 1, Paragraphs 1 and 2	Absolutely essential to add a new figure containing stationing and labels for levee reaches under description.	
34	ENGEO Breach Potential Evaluation, Page 1, Paragraphs 3 and 4	The information in this document and in the MBK document is not a risk assessment. Please define what a "project" levee is. Remove references to Stage 2 and Stage 2A levees, they only confuse the issue and they are not ever explained.	
35	ENGEO Breach Potential Evaluation, Methods of Analysis, Page 2.	The description of the hydraulic head across the levee is unclear. Please describe this as the Gross Hydraulic Head (River Stage minus LS Ground Surface) as the head in the aquifer at the landside toe is not equal to the ground surface. In third paragraph, cite full MBK reference. In fourth paragraph it seems incorrect to state that the thicker clay blanket is conservative. In the fourth paragraph, the approach described by ENGEO in neglecting shallow sand layers may be very unconservative. Please provide justification for doing so.	
36	ENGEO Breach Potential Evaluation, Results, Page 2.	Please clarify the locations where significantly higher head to clay blanket thickness ratio was found - please state stationing.	

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37	ENGEO Breach Potential Evaluation, Results, text and Exhibit 1, Page 3.	Several comments on Exhibit 1: - Vertical axis label appears incorrect - should probably be ratio of Gross Head to Blanket Thickness. - Title of Exhibit 1 should probably be Ratio of Gross Head to Blanket Thickness. In first paragraph the ratio of the gross head to blanket thickness appears to be between 0.3 to 0.95 rather than 0.5 to 0.9 - please correct.	
38	ENGEO Breach Potential Evaluation, Results, text and Exhibit 1, Page 3.	(1) the potential for underseepage distress is not just dependent upon the ratio of the gross head to the blanket thickness, but also on the width of the levee, past performance, and thickness of the aquifer. These other factors need to be discussed as well. (2) In fourth paragraph, the text states that the most likely source of historical seepage is through seepage, but no evidence or justification is provided for this statement - Please provide the evidence for this statement. More information concerning past performance is needed	
39	ENGEO Breach Potential Evaluation, Results, text and Exhibit 1, Page 3.	To support Exhibit 1, please provide the following information in a table for each station along the levee: - Stationing - DWSE - LS Toe Elevation - Gross head (DWSE - LS Toe Elevation) - Bottom Elevation of Blanket - Thickness of Blanket (LS Toe Elevation - Bottom Elevation of Blanket) - Width of Levee at DWSE - Width of Levee at foundation level - Ratio of Gross Head/Blanket Thickness - Ratio of Levee Width at foundation over Gross Head	
40	ENGEO Breach Potential Evaluation, Comparative Subsurface Conditions, and Figure 1, Page 4.	Several issues for Figure 1: - Labels of cross sections and locations of explorations are largely unreadable. Please make them readable. - Show locations of San Joaquin River, Old River, and Paradise Cut. - Please eliminate label "Site" - Show boundaries of RD's. Need more detail of information in breach areas - perhaps additional figures. Text in last paragraph states that it is ENGEO's opinion that the depositional environment is this area is similar to that of the rest of Stewart Tract is provided with no substantiation. Please provide information to demonstrate this rather than a simple statement.	
41	ENGEO Breach Potential Evaluation, Comparative Subsurface Conditions, Cross Sections, Pages 5 and 6.B22	Several issues for cross sections: - There is no horizontal scale furnished to evaluate the length of the scour features shown on the cross sections. - The cross sections are largely unreadable, and therefore of little use. Please reformat the fonts and labels to make them readable. - Should add figure numbers to the cross sections. Most importantly, the interpretations and conclusions from these figures would appear to almost certainly be incorrect. The areas labels as Suspect Scour Backfill are generally not in the areas where the levee failed and was scoured out: - For Cross Section A-A', the Suspected Scour Backfill appears to be almost a mile landward of the levee breach and near I5 and landward of UPRR embankment - it is not credible to imply that this was a scour hole caused by a failure of the levee at the San Joaquin River. - For Cross Section D-D', the Suspected Scour Backfill is associated with explorations that are relatively far from the levee breach, and therefore have little value in this assessment. - For Cross Section E-E', the Suspected Scour Backfill appears to be mainly in the middle of the cross section, whereas the breach was located at the northern end of the cross section. Further, the cross section does not appear to accurately reflect the geometry of the levee along the section. **<u>These cross sections do not demonstrate meaningful value regarding potential scour dimensions</u>**.	
42		Not useful to describe the historic seepage areas correlating well with the "ratio of head differential to blanket thickness" results when the observed seepage is characterized as through seepage.	
43		Should describe why a wider levee cross section (upstream of about Station 14+00) has a lower potential for failure than the narrower levee cross section downstream of this location.	
44	MBK Memorandum for File	How will the proposed relief cut location be accessed downstream of the breach location.	
45	MBK MFR -	Figure 12. The text describes a max velocity through the breach (no relief cut made) on the order of 6 fps. The mesh diagram indicates an average velocity of about 4 fps. The velocity "coloration" at the breach location is similar to the velocity "coloration" at the Interior levee. If these calculated velocities are similar and the max velocity is about 6 fps, what is the erosion potential for the Interior levee at this location?	
46	MBK MFR -	Where is the relief cut plan for this breach scenario documented?	
47	MBK MFR - General	If document is to be included as Appendix P, the heading should reflect this.	
48	MBK MFR - 1. Purpose	Non-technical comment: May want to shorten this sentence.	
49	MBK MFR - 2. Risk assessment	Start of page 4. States width is from 40 to 130 ft. Top width?	
50	MBK MFR - 2. Risk assessment, Historic breaches	In trying to determine the scour dimensions, were there efforts to obtain repair documents such as volume of material to fill the holes, as builts, payment schedules, etc.? No aerial photo? LandSat? Also, what was the likely causes of the breaches?	
51	MBK MFR - 2. Risk assessment	Please compare the 1997 event with the 200-year event. Flow rates, flow depths, frequency of the 1997 event, duration of flow, depth of water at the toes, etc., to get an idea of the similarities other than just geotechnical.	
52	MBK MFR - Task 3	Can machinery excavate a relief cut of 400 feet in 2 hours?	

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1	Figure 1	Not all of the Perimeter levee is considered a "super levee" (ie, greater than 120 ft crown width). Also, Interior and Cross Levees do not have minimum crown widths of 40 and 50 feet as stated on Page 3 and other places in the report - according to the Levee Evaluation TM, the crown widths are as low as 27 feet for the Interior Levee and 35 feet for the Cross Levee.	Text was revised to clarify Perimeter levee crown widths vary between 60-400 feet. Crown widths of 40 and 50 are correct; ENGEO Levee Eval report was revised to reflect update levee geometry.	Response accepted, comment closed.	
2	Figure 2	The delineation of the ring levee should be updated to show the current alignment and current lake locations and configurations.	The figure was meant to show the ring levee in its original location as constructed in 2005 and not in its current configuration. The narrative and the figure will be updated to further clarify.	Response accepted, comment closed	
3	Figure 3	Replace aerial photograph with more recent photograph	Figure 3 was meant to show the status of the levee construction in 2006 after the construction of the ring levee and "fill" between the ring levee and project levee along the San Joaquin River.	Response accepted, comment closed	
4	Section 1.3	The text states that by 2016, a new access point will be established via Bradshaw's Crossing Bridge - it is now 2016 - is the crossing active? Also, can people sneak across the bridge on foot now?	The crossing is not yet active and construction is currently taking place for the roadway approaches to the bridge. A fourth quarter 2016/first quarter 2017 date is estimated for the roadway to open. The narrative in the report will be updated to further clarify the status. Since the site is an active construction site, access to the general public is prohibited.	Response accepted, comment closed	
5	Figure 4	This figure is hard to read and the scale is too small. Replace with larger figure that better shows the roads and access points	Noted. The figure has been updated and included as a separate 11 x 17 sheet in the plan for better readability.	Response accepted, comment closed (Note the figure plotted out on 8 1/2 x 11, so not sure it is set to be 11x17 size).	
6	Section 1.4	There is no description of the elevation of the intake/discharge lines for Pump 9 and the Lake 1/2 pump facilities. It is not clear why Pump 9 is considered as a "critical infrastructure (necessary for life safety)" if it only pumps water into the development. Also, is there any way for the lake levels to drop abruptly by either accident or sabotage, particularly during a flood? This could cause an increased internal erosion risk for lakes close to the levee.	Noted. The section has been updated to remove the "critical infrastructure" designation from this facility. Lake level drops are gradual and not sudden and currently managed by RD staff. There is not as much risk as indicated.	Response accepted, comment closed	
7	Section 2.1 Measure 4	It would be advisable to have a back up TLO should the primary individual not be available for service. The back up should also receive the appropriate training.	Noted - the text has been change to add the inclusion of training of other personnel and designation of other staff to serve as TLO as necessary.	Response accepted, comment closed	
8	Section 2.3	The Security Plan does not propose installation of levee performance alerting mechanisms at this time. IPE suggest this be reconsidered in light of the USACE Sac District SOP recommending instrumentation of levee reaches. Further, the Cross and Interior levees have never been loaded. It would be helpful to provide instrumentation to help confirm analysis assumptions concerning the presence of an intact waterside blanket layer, etc. Further, USACE criteria (and therefore ULDC criteria) calls for the installation of piezometers along the levee system - one piezometer per reach. It may not be necessary to place piezometers along the Cross and Interior Levees as they are dryland levees and temporary in nature. However, it is probably necessary to place at least 2 piezometers along the Perimeter Levee where the cross sections are more narrow and/or where underseepage issues are more marginal.	Noted. Alerting mechanisms are not required per ULDC, however, RD 2062 is considering the installation of at least one piezometer for the interior, cross and San Joaquin River project levees. The location, installation and operation of the piezometers will be included in the District's Operation and Maintenance (O&M) Manual	Response accepted for comment in this document; however, it should be noted that piezometers are required by USACE criteria and should be discussed under geotechnical concerns elsewhere in the ULOP compliance document - consideration or plan to install piezometers is insufficient - plan to install should have been developed by now and date for installation of piezometers should be included.	Given the IPE's recommendation for the installation of two piezometers per levee reach, RD 2062 will install a total of six piezometers by the end of 2016. A figure showing where the piezometers are being installed as well as operation procedures will be included in the District's Operation and Maintenance (O&M) Manual.

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9	EAP	The Security Plan may not be the best place for this comment, but it is related to the EAP which the IPE has not yet seen or had an opportunity to review. Somewhere in the EAP there should be the following: - Flood-fight procedures and protocols, including patrolling the levee system and reading piezometers and documenting high water stages - Relief cut procedures and protocols - Evacuation procedures and protocols - Procedures to document levee performance and distress during high water events and any information during high water inspections - Procedures to inspect and document levee performance and distress following an earthquake - even if no liquefaction or seismic vulnerability is predicted for an earthquake, there should be a set of procedures and protocols to inspect the levee system and appurtenances following an earthquake and to document the results of that inspection	The District has completed and submitted to County OES for approval its Emergency Operations Plan (EOP). The EOP addresses some of the items listed here (e.g. relief cuts and evacuations). As mentioned below, levee performance and monitoring is included in the updated Operations and Maintenance Manual for the District.	The IPE would like to verify that the items mentioned in the original comment are incorporated into the O&M and EOP plans.	Acknowledged.
10	Section 2.2	When will the levee gates that are in need of maintenance or replacement, as stated on Page 12, have this work done?	This work, planned for completion in 2017, is not required for the ULDC certification. The proposed work is an improvement to existing access controls.	Response accepted, comment closed	
11	Section 2.2	Who has the keys and access to the keys to the gates on the levee? How is these gates kept secure?	The keys and access to the gates are by RD 2062 personnel, that have been contracted for maintenance and flood fighting purposes.	Should state this in the text.	Text added to Section 2.2: "The District is responsible for maintaining and securing the key inventory."
12	Section 2.3	It is recommended that a security camera also be placed at the appropriate location to monitor Pump 9 and the Lake 1/2 pump facilities at the locations where levee security conditions are most critical.	Since the initial security cameras are mobile, moving a camera to this location can be done if warranted during regular monitoring of this facility.	Response accepted, comment closed	
13	Section 2.3	There are references to "River Islands security" in this section and other sections. It is not clear what this security force is and what it is responsible for. Please add a paragraph or section to describe its function and abilities, particularly with respect to security patrols during flood events. Also, is there a substation for the Lathrop Police Department planned for River Islands?	Historically, the River Islands master developer provided security on the Stewart Tract and for construction sites. This has now shifted to the River Islands Public Financing Authority (RIPFA, a public agency), which is contracting with a professional security firm for these purposes. The firm is being trained on using the video surveillance system for monitoring purposes. A paragraph has been added to address this issue in the plan.	Response accepted, comment closed	
14	Section 2.3	The text on Page 13 states that in addition to video cameras, that motions detectors, alarms, and "invisible trip wires" will be installed. While there is some discussion of the 4 video cameras in use as part of the trial program, there is little discussion of the other security items. It is not clear what Measure 10 is about - it seems to be hedging on earlier statements and commitments. Please clarify.	The pilot program is not required for ULDC certification nor was it developed specifically for an ULOP Finding. As a pilot program, it is intended to be adaptable and therefore some features may work better than others. Measure 10 was included to provide flexibility if certain features were not effective; however, this is inherent in a pilot program and Measure 10 was therefore removed. Use of non-camera features such as motion detectors and trip wires is being developed as the next phase (cameras, installed in March-April 2016 were the first phase).	Response accepted, comment closed	
15	Section 2.4	The text states that Security patrols will be fully engaged during high water/flood events to prohibit unauthorized access. Who is doing these patrols and what will be their charge?	RD 2062 contracts for maintenance and flood fighting with a dedicated contractor and coordinates directly with RIPFA security patrols on a daily basis. During a high water/flood event, this communication/coordination will be heightened.	Should state this in the text.	The text was revised to include the highlighted text: *Security patrols, a collaboration between the District and RIPFA , will be fully engaged during high water events to prohibit unauthorized access with the surveillance camera system aiding in this effort.*
16	General	The Cross and Interior levees only become loaded due to a breach in the adjacent/surrounding levees. Although these two levees are designed for the subsequent hydraulic loading, it may be prudent for the neighboring maintenance agencies to also implement at least some components of this Security Plan.	Since the entirety of the Stewart Tract north of the Union Pacific Railroad is under RD 2062 jurisdiction, the interior levee is covered on both sides by the District. An effort will be made to discuss the Security Plan with RD 2107 regarding the cross levee. The EOP and FCM are a joint effort between the two RDs.	Response accepted, comment closed	
17	General	There is a relief cut proposed For the Paradise Cut portion of RD 2062. How will the Security Plan incorporate the requirements for this relief cut to be made?	The relief cut protocol is better included in the Emergency Operations (EOP) and other documents of the District regarding maintenance and flood fighting. A copy of the EOP is being provided.	Response accepted, comment closed	
18	Section 1	May want to cite ULDC 7.18	Noted - the reference has been added.	Response accepted, comment closed	
19	Section 1	2nd paragraph of Page 4, should the CA Emergency Management Agency and CA Office of Emergency Services be included?	The governor has restored the previous name of OES (from the former EMA). A reference has been added.	Response accepted, comment closed	
20	Section 1	Page 4, last paragraph, should cite report that states the levees are not frequently loaded.	Noted - the reference has been made.	Response accepted, comment closed	
21	Section 2.1	Will there be re-training (refresher) on a periodic basis?	Yes. Measures have been revised to clarify frequency.	Response accepted, comment closed	
22	Section 2.2	The critical access points map should be used for assignment of deterrent personnel and/or signage during high flow periods.	Agreed - a reference has been added.	Response accepted, comment closed	

No.	LOCATION IN DOCUMENT	EXPERTS' COMMENT (January 2016)	ENGINEER'S RESPONSE (March 2016)	EXPERTS' FINAL COMMENT (APRIL 2016)	ENGINEER'S RESPONSE (June 2016)
23	General	Table 2 summarizes the 12 Mitigation Measures planned to address security issues. However, this draft was written some time ago and calls for certain items to be done in the future, but before the Urban Level of Flood Protection finding is made. However, it is the understanding of the IPE that the ULOP finding is planned to be made in the next few months. So the question is: have all of the actions called for in this document been actually implemented and completed? Specific questions would include: 1. Have all employees and contracted personnel been provided training with the SAR system? 2. Has a Neighborhood Watch program for the community been set up? 3. Has the TLO been identified and has that person attended meetings regarding terrorism and has the TLO implemented the training program called for in Measure 3? 4. Have all employees and contracted personnel been provided with training on InfraGard, COES, and HSIN-CS? 5. Have potential flood-fight personnel been provided with training regarding security and access during high water events? 6. Has new signage been placed at all levee access points? 7. Have all gates been refurbished, replaced, or added to meet RD 2063 standards? 8. What is status of video surveillance system, motion detectors, alarms, and "invisible trip wires?" 9. What is status of District's EAP/EOP? 10. Have the proposed contacts been made with the Lathrop Police, Fire, County, etc... agencies been made? Have the proposed security exercises and training been held? Have protocols been established for the apprehension of detected intruders during high water events been established?	Security measures have been clarified and Table 2 has been updated. The Security Plan is a living document that is updated annually. It was prepared in a way that would identify the measures to be undertaken on an annual and ongoing basis. Items identified as occurring on an annual basis will be done in 2016, and annually thereafter. ULDC does not require that these be done at the time of the ULOP Finding.	Response accepted, comment closed	
24	References	Add a list of references for the documents cited in this TM	A list of references has been added as suggested.	Response accepted, comment closed	
25	Minor Comments	Minor Comments: - Page 3 - renumber to start this page at Page 1 - Page 3 - capitalize district - Page 3 - RD 2062 does not own state-federal project levees - it operates and maintains them - Page 3 - update to include current number of lakes - Page 3 - spell out ULDC and ULOP the first time they are used in second-to-last paragraph - Page 4 - Correct spelling of **Sherriff's** office - Page 4 - no need to spell out Central Valley flood Protection Board here as this was done on previous page - Page 4 - remove "an" in front of "elevated threats" in last paragraph - Page 5 - add label for "Perimeter Levee"	All corrections have been made as suggested.	Response accepted, comment closed	

Attachment 2:

Resumes for Members of the Independent Panel of Experts

RAY COSTA, PE, GE

Education
BS Civil Engineering, University of California, Davis 1976

Registrations
Geotechnical Engineer, CA, 1987
Professional Engineer - Civil, CA, 1978

Experience Summary

Mr. Costa is a recognized expert in levee evaluation and seepage mitigation. He has performed evaluations and designed remediation measures for over 170 miles of levees in the Sacramento River Flood Control System. He has provided design, evaluation, and construction recommendations for numerous levees in the Sacramento area and northern California. He performed independent review and assisted in preparation of levee performance curves for the DWR Urban and Non-Urban Levee Evaluation programs. In this role, he performed technical review for over 1,200 miles of levees along the Sacramento and San Joaquin Rivers. He has participated in Expert Elicitations for the Natomas levee system as well as reliability impacts of vegetation, burrowing mammals, and deferred maintenance. Mr. Costa is currently involved with Safety Assurance Reviews for the SAFCA Local Area Project and Cache Creek setback levees. He also served as project manager for the SAFCA vegetation variance technical analyses for Natomas.

Select Project Experience

The following is a representative list of Mr. Costa's relevant project evaluation/design experience.

Levee Study	Client	Location
Marysville Levee	**Marysville Levee Commission**	**Marysville, California**
Yuba City Interceptor LD 1	**Yuba City Consortium**	**Yuba City, California**
NEMDC West Levee	**SAFCA**	**Sacramento, California**
NEMDC East Levee	**SAFCA**	**Sacramento, California**
Dry/Robla Creek Levee	**SAFCA**	**Sacramento, California**
Arcade Creek Levee	**SAFCA**	**Sacramento, California**
PIR Pocket Levee	**SAFCA**	**Sacramento, California**
PIR Bear River Levee	**RD 2103**	**Wheatland, California**
Natomas Internal Drainage Levees	**RD 1000**	**Sacramento, California**

North Beach Lake Levee	**SAFCA**	**Sacramento, California**
PIR Bear River and WPIC Levee	**RD 784**	**Yuba County, California**
PIR Feather and Yuba River Levees	**TRLIA**	**Yuba County, California**
Cache Creek Setback Levee	**DWR**	**Yolo County, California**
PIR Sacramento River (Natomas)	**SAFCA**	**Sacramento and Sutter Counties**
PIR Natomas Cross Canal (Natomas)	**SAFCA**	**Sutter County, California**
PIR Lower American River (Natomas)	**SAFCA**	**Sacramento County, California**
Natomas Setback Levee	**SAFCA**	**Sacramento and Sutter Counties, California**
Site 20 (Feather River Levee)	**USACE**	**Sutter County, California**
Pocket Levee (Seepage)	**USACE**	**Sacramento, California**
Pocket Levee (Sites 2 and 9)	**HDR**	**Sacramento, California**
Pocket Levee (Underseepage Control)	**SAFCA**	**Sacramento, California**
PIR West Sacramento	**RD 900**	**Yolo County, California**
PL 84-99 Levee Repairs	**USACE**	**Sacramento and Sutter Counties, California**
PIR Sutter County Levees	**County of Sutter**	**Sutter County, California**
Mayhew Drain Levee	**SAFCA**	**Sacramento County, California**
San Marcos Levee	**Parsons Brinckerhoff**	**San Marcos, California**
Lake County Levee Breach	**County of Lake**	**Lake County, California**
Old Sugar Mill Levee Study	**County of Yolo**	**Clarksburg, California**
Pioneer Reservoir Levee Seepage Evaluation Study	**Nichols Consulting Engineers**	**Sacramento, California**
Dry Creek Levee	**RD 2103 and RD 817**	**Wheatland, California**
Seepage Evaluation	**LD 9**	**Sutter County, California**

Leslie Harder

Senior Technical Advisor

Dr. Harder serves as a Senior Water Resources Technical Advisor for HDR and its clients. He both manages and provides technical support for the planning and design of a full range of water resources and environmental restoration related projects. Prior to joining HDR, Dr. Harder was the Deputy Director for Public Safety for the California Department of Water Resources (DWR). During his 30-year tenure with DWR, Dr. Harder was extensively involved with engineering projects on the State Water Project and the Central Valley Flood Protection Project. Les played a key role in the development of FloodSAFE and the Early Implementation Project Program, and served on the California Levee Vegetation Roundtable. He authored the section on vegetation management in the recently published International Handbook on Levees.

EDUCATION

Doctor of Philosophy, Civil Engineering, University of California at Berkeley, 1988

Master of Science, Civil Engineering, University of California Davis, 1977

Bachelor of Science, Civil Engineering, University of California Davis, 1975

REGISTRATIONS

Professional Engineer - Civil, California, No. C 30472

Professional Engineer - Geo Technical, California, No. GE 000378

PROFESSIONAL MEMBERSHIPS

American Society of Civil Engineers (ASCE), Member

Association of State Dam Safety Officials, Member
ASTM International, Member

Earthquake Engineering and Research Institute, Member

International Society for Soil Mechanics and Geotechnical Engineering, Member

United States Society on Dams (USSD), formerly USCOLD, Member

RELEVANT EXPERIENCE

County of Riverside Flood Control & Water Conservation District, West Cathedral Canyon East Levee Certification, Riverside, CA. HDR worked with the Riverside County Flood Control & Water Conservation District to complete the evaluation and certification for the West Cathedral Canyon Channel East Levee (approximately 1.7 miles) to meet Federal Emergency Management Agency's (FEMAs) regulatory requirements as identified in Title 44 of the CFR, Section 65.10. The evaluation and certification of levees is based on design criteria (freeboard, closures, embankment protection, embankment and foundation stability, settlement and interior drainage), operation plans and criteria (for closures and interior drainage), maintenance plans and criteria and the actual certification requirements (i.e. as-builts, forms, documentation and data).

FEMA requested the district to provide the necessary documentation to continue showing the existing levee as providing protection from the base flood on the new countywide Digital FIRM (DFIRM). All certification requirements have been outlined in FEMA Procedural Memorandum 34 - Draft Certification Procedures and Plan, dated August 22, 2005, and must be followed. The HDR team completed the engineering and geotechnical analyses to address the design criteria as required by 44 Code of Federal Regulations (CFR) 65.10, as well as the O&M and as-built requirements. The certification package was completed and submitted to FEMA in 2008.

San Bernardino City Flood Control District, FEMA Levee Certification Project Phase II, San Bernardino, CA. HDR assisted with evaluating and certifying existing levees within San Bernardino County based on FEMA regulatory requirements as identified in Title 44 of the CFR, Section 65.10. The evaluation and certification of levees is based on design criteria, operation plans and criteria, maintenance plans and criteria, and the actual certification requirements (i.e. as-builts, forms, documentation, and data).

City of Council Bluffs, 2011 Flood Assistance, Council Bluffs, IA. Geotechnical Engineer. Provided expert levee engineering support to the City of Council Bluffs during the 2011 flood fight. Support included patrolling levees looking for distress, assessing distress reported by others, and then developing flood-fight measures to combat levee deterioration. Work also included developing the official requests by

the City of Council Bluffs for federal assistance through the state of Iowa and the US Army Corps of Engineers (USACE). Once federal assistance was secured, coordinated with the USACE to prepare advance and emergency levee repairs and specific recommendations for improvements to pump stations, roads and temporary pumping.

City of Oroville, Levee Evaluation, Oroville, CA. HDR provided an initial assessment of whether the levee on the south bank of the Feather River is eligible for accreditation by FEMA under the National Flood Insurance Program.

West Sacramento Implementation Design, City of West Sacramento, CA. Provided preliminary geotechnical services for evaluation of underseepage, slope stability and erosion assessment for a portion of the levee system surrounding West Sacramento. Also performed problem identification and alternatives analysis as a preliminary level investigation of possible improvements to the levee system.

Natomas Levee Improvement Program, Sacramento Area Flood Control Agency (SAFCA), CA. Chair, Board of Senior Advisors. Led the group of senior technical advisors who provided oversight of this levee repair project that includes a drainage study, pre-design, design, environmental documentation, permitting assistance, bid period, and construction support services on approximately 4 miles of levees on the lower Sacramento and American Rivers. Levee repairs were needed to retain FEMA certification and achieve a 200-year level of flood protection, and included levee crown raising for all four reaches, seepage berms (2 and 5A), and cutoff walls (4B). Redesign of the Garden Highway was required along the project reaches, as well as relocation of utilities and other infrastructure. Dr. Harder's specific area of oversight was geotechnical engineering.

Nevada Countywide Digital Flood Insurance Rate Map (DFIRM) Production, Levee Certification Reviews, and El Dorado County Restudy, FEMA, NV. The purpose of this Task Order is to assist FEMA Region IX with scoping activities and the production of a DFIRM and Flood Insurance Study text for Elko County, Nevada. HDR will assist in coordinating and conducting a kickoff meeting with the community representatives to discuss the National Flood Insurance Program and Map Modernization Initiative. Once the Preliminary DFIRMs have been completed, the HDR shall mail copies of the preliminary map panels to affected community for a 30-day comment period. HDR will assist in coordinating and conducting a final meeting with community representatives to discuss the revised maps. HDR will then finalize all maps, incorporating recent Letters of Map Change and minor refinements identified during the comment periods that were not previously incorporated. Once finalized, digital files in the format required by FEMA will be prepared and final deliverables will be submitted to the Map Service Center.

Feather River West Levee Rehabilitation Early Implementation Project, Sutter Butte Flood Control Agency, Sutter and Butte Counties, CA. Strategic/Technical Advisor. Dr. Harder is leading a group of strategic/technical advisors who are providing engineering oversight of this levee project that involves the rehabilitation, restoration and necessary improvements to 44 miles of the west levee of the Feather River. The goal of the project is two-fold: 1) to rehabilitate the levee so that segments 1-7 can be accredited as meeting FEMA standards for providing protection against the 100-year flood event, and 2) to rehabilitate the levee so that segments 1-6 meet the new state standard of 200-year flood protection for urban areas. A major role is to negotiate with various State and Federal agencies regarding the financing and technical requirements for the project. Major interactions

and negotiations are involved with the DWR, the Central Valley Flood Protection Board, and USACE.

Upper Yuba River Levee Improvement Project, Three Rivers Levee Improvement Authority, CA. Provided engineering analyses and design services to identify problems and provide corrective information and documents (PIRs, TMs, PS&E and environmental documentation) to support the repair of a reach along the Yuba River South Levee (from SR70 to Yuba Gold Fields) in order to achieve FEMA certification. Specifically, services include: geotechnical investigations and lab testing, topographic data acquisition, preliminary engineering and alternatives analyses, preparation of Technical Memos, preparation of a Problem Identification Report, development of final construction documents (plans, specifications, and construction cost estimate); preparation of Basis of Design documents, construction permit application preparation, environmental analyses and documentation, preparation of DWR EIP project documentation, and preparation of FEMA Levee Certification documents (as required).

American River Common Features WRDA96 Remaining Sites, USACE, Sacramento, CA. Lead Geotechnical Engineer. Directed the geotechnical portion of this project by providing evaluation and design of levee improvements for the 10 sites along the American River. Most of the levee system along the American River was remediated with slurry cutoff walls and the sites under this SOW are located between areas of non-remediated segments of the levee. Two of the sites (L8 & R8) were geotechnically-evaluated (seepage and stability) and designed by HDR in 2009, and constructed (summer of 2010). The third site (L9A) is slated for jet-grouting and was geotechnically-evaluated and designed to 95% plans and specifications during the work and additional geotechnical exploration is necessary due to the cobble materials below the levee. HDR was also tasked to perform exploration and laboratory testing, evaluate potential underseepage, through seepage, and slope stability for the gaps in the existing remediated levee alignment for seven remaining sites known as Phase 2. The result of the HDR analysis was that only five of the seven remaining sites needed remediation, however they recommended the two sites not needing remediation for further exploration and evaluation. The analysis results were included in the Draft Remediation Methods Report, November 2010. HDR will design these five sites as well.

Marysville Ring Levee, USACE, Sacramento District, CA. Geotechnical Engineer. Directing geotechnical tasks related to the design of levee improvements that meet FEMA requirements for levee accreditation under the National Flood Insurance Program.

Simi Arroyo Levee Improvements, Moorpark, Ventura County, CA. HDR prepared a retaining wall and flood wall designs for the County of Ventura. Scope of work included designing a three-foot high retaining wall that provides access to the existing sewer manholes at two locations along the stretch of Simi Arroyo that is adjacent to the Science Drive and north of Los Angeles Avenue in Moorpark, CA.

Southport EIP TO #4, Sacramento, West Sacramento Area Flood Control Agency (WSAFCA), CA. HDR provided engineering services to WSAFCA for initiation of 60% design work on the preferred levee improvements for Segments A, C, D, E, and G of the Southport EIP. This fourth phase in the project involved preparation of contract documents, including final construction plans, specifications, estimates, and general and special provisions; an environmental impact statement for public release; and associated project permit applications.

California Levee Vegetation Research Program/Vegetation Assessment Working Group, DWR and SAFCA, CA. Dr. Harder has served for several years as a technical advisor to DWR and SAFCA in developing science and applying both science and engineering in the development of programs for the management of vegetation on levees. He has been a Principal Investigator in research projects for several years and has published technical papers on the subject. He has also provided guidance and review to DWR and SAFCA with regard to research investigations conducted by others including notably the USACE. He is currently providing expert guidance to DWR as a member of the Vegetation Assessment Working Group in the development of a levee vegetation management plan and screening tool for managing woody vegetation on state-federal levees in the Central Valley.

NON-HDR EXPERIENCE

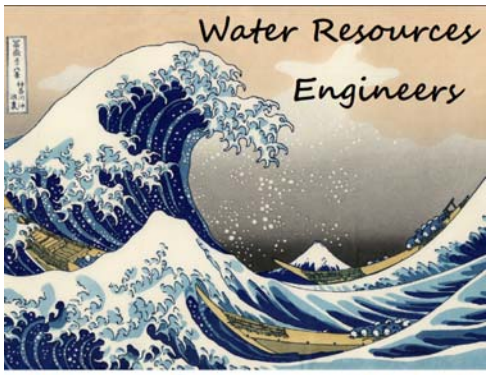
DWR, Civil Engineering Branch, Division of Engineering, CA. Principal Engineer and Chief. Duties included directing the activities of more than 100 civil engineers, architects, geologists, and technicians in preparing preliminary and final designs for various civil engineering structures. Major design projects included the new intake for the San Bernardino Tunnel and design support for the Coastal Aqueduct Phase II Project. Also headed the Restructuring Subcommittee tasked with reorganizing the Division of Engineering.

DWR, Civil Engineering Branch, Division of Engineering, CA. Principal Engineer and Chief. Duties included directing the activities of more than 50 civil engineers and technicians in preparing preliminary and final designs for various civil engineering structures. Major activities included preliminary designs of South Delta facilities and Los Banos Grandes Dam.

DWR, Division of Flood Management, CA. CEA and Chief. Duties included directing the work of 200+ engineering and floodplain professionals responsible for flood management activities across California. Flood management responsibilities included the maintenance of more than 300 miles of levees in the Central Valley, inspecting more than 1,600 miles of State-federal project levees, floodplain management and mapping, local assistance programs for the Sacramento-San Joaquin Delta, emergency preparation and emergency response during flood events. As Chief of this division, he worked closely with the State Reclamation Board, the U.S. Army Corps of Engineers, and local flood control agencies. During his tenure, the Division was reorganized, the Departments White Paper on Californias flood crisis was published, and the Delta Risk Management Strategy was initiated.

DWR, Division of Flood Management, CA. CEA and Chief. Duties included directing the work of up to 300+ engineering professionals and technicians responsible for performing engineering services for the Department of Water Resources. Engineering services include preparing preliminary and final designs, preparing construction contract documents and cost estimates, bidding and awarding of construction contracts, administration and inspection of construction work, and resolution of construction claims. Major projects worked on during this time included the Coastal Branch Aqueduct Phase II, East Branch Extension Project, San Bernardino Tunnel Intake, Hyatt Power Plant Turbine Refurbishment, South Bay Aqueduct Refurbishment, South Delta Temporary and Permanent Barriers, Jones Tract Breach/Dewatering and Levee Repairs, and numerous emergency canal repairs. After 2003, was also responsible for leading the staff formerly within the Division of Land and Right of Way and responsible for providing real estate and surveying services to the Department and to the Reclamation Board.

DWR, Public Safety and Business Operations, CA. Deputy Director. Responsibilities include the public safety programs of the Division of Flood Management, Division of Safety of Dams, and the Department Security program, and the administrative programs of the Division of Technology Services and the Internal Audits Office. Specific activities included working on new legislation and bond measures related to flood control reform, developing the FloodSAFE California program, developing flood bond expenditure plans and strategic vision for improving flood protection in California. He helped coordinate emergency responses to the flood events of January and April 2006. In addition, Dr. Harder worked closely with the Governors Office on policy issues, testified in several legislative hearings, served on numerous public workshops and conference panels related to flood policy, and gave several briefings to Congressional representatives, Senator Feinstein, and Governor Schwarzenegger.



DTW and Associates, LLC

David T. Williams, Ph.D., P.E., P.H., CPESC,
CFM, F.ASCE, D.WRE

DTW and Associates, Engineers, LLC
1112 Oakridge Dr., Suite 104, PMB 236
Fort Collins, CO 80524
Email: David@dtwassoc.com
Cell: 619-823-4778

Education

Ph.D., Civil Engineering, Colorado State University
M.S., Civil Engineering, University of California, Davis
B.S., Civil Engineering, University of California, Davis

Registrations

Professional Engineer (Civil) license number and date:

Arizona 24349, 1990
Colorado 42353, 2008
Louisiana, 34075, 2009
New Mexico 12187, 1993
Texas 80003, 1994
Missouri 2012015265, 2011
California 57020, 1997
Hawaii 7796, 1993
Mississippi 08242, 1981
Oregon 16963, 1993
Washington 27190, 1990

Registered Professional Hydrologist (PH: 96-H-1146)
Certified Professional, Erosion and Sediment Control (CPESC: #703)
Certified Floodplain Manager (CFM; US-08-03224)

Work History

2011 – 2012: Director of Water Resources, NV5, Centennial, CO

2008 – Present; President, David T. Williams and Associates, Engineers, LLC, Fort Collins, CO

2005 - 2008; National Technical Director for Water Resources, PBS&J, Fort Collins, CO

2002 - 2005; National Director for Hydrology and Hydraulics, HDR Engineering, San Diego, CA

1988 - 2002; President and co-founder of WEST Consultants, a premier water resources engineering firm

1979 - 1988; Research Hydraulic Engineer, Hydraulics Lab, Engineering and Research Development Center (formerly Waterways Experiment Station), Vicksburg, MS

1983 - 1984; Acting Chief, Hydrology and Hydraulics Section, Baltimore District Corps of Engineers

1977 - 1979; Civil Engineer, Hydrology Branch, Nashville District Corps of Engineers

1975 - 1977; Research Hydraulic Engineer, Planning Branch and Research Branch, Hydrologic Engineering Center (HEC), Davis, CA

1972 - 1975; Infantry Platoon Officer and Combat Engineering Unit Officer, 7th Special Forces Group, Fort Bragg, NC

Professional Affiliations

American Society of Civil Engineers
American Academy of Water Resources Engineers
International Erosion Control Association (IECA – past president)
American Society of Testing and Materials (ASTM)
American Institute of Hydrology (Chair, Board of Registration and Executive Committee Board member)

Honors and Awards

Fellow and Life Member, American Society of Civil Engineers
Founding Diplomate, American Academy of Water Resources Engineers
Hogg-Owen Award for Meritorious Achievement, Floodplain Management Association
Sustained Contributor Award, IECA
Small Business Person of the Year, Chamber of Commerce, Carlsbad, California, 1993
Sustained Superior Performance, USACE
Special Act Award, USACE
U.S. Army Commendation Medal
U.S. Army Commendation Medal with Oak Leaf Cluster

Summary

David T. Williams and Associates (DTW) is a certified MBE, SBE, DBE and Disabled Veteran owned business. Dr. David Williams, the president of DTW, has over 35 years of experience in the water resources industry and is known nationally and internationally for his contributions to the industry. He served as Principal-in-Charge for several FEMA flood insurance studies in San Diego and Orange counties. He has written the new HEC-6 User Manual for the U.S. Corps of Engineers Hydrologic Engineering Center, performed HEC-6 and local scour analysis of pipeline crossings in Arizona and New Mexico, headed the Keene Ranch groundwater modeling study and the Nile River sedimentation evaluations for the World Bank. He is well versed in the computer programs HEC-1, HEC-HMS, HEC-2, HEC-RAS, HEC-6, STORM, and WQRRS. Dr. Williams is also a nationally recognized expert in sedimentation engineering and in developing innovative solutions to difficult hydraulic and hydrologic design problems in rivers and estuaries.

Dr. Williams previously served as a two time President of the International Erosion Control Association. He has served as chair of the ASCE Task Committee on Analysis of Laboratory and Field Sediment Data Accuracy and Availability. He is also a past chair of the ASCE Sedimentation Committee as well as the Computational Hydraulics Committee and currently serves on the ASCE River Restoration Committee. He served as a committee member of ASTM A05.12 (Wire specifications), where he helped develop the standards for both welded and twisted (woven) gabions. He also served on ASTM D18.25 (Erosion Control Products), where he helped develop a variety of standards related to erosion control. While chair of the Federal Interagency Technical Committee on Sedimentation when Dr. Williams was with the U.S. Army Corps of Engineers, he worked with hydraulic and sedimentation experts from the Federal Highway Administration, Bureau of Reclamation, U.S. Geological Survey, Bureau of Land Management, Forest Service, TVA, Bureau of Land Management and the Agricultural Research Service. His work with the Committee involved developing sediment sampling equipment and sediment data collection methods. He is the author of more than 100 technical papers and reports on hydraulics and sedimentation. Dr. Williams was formerly an Associate Editor of the ASCE Journal of Hydraulic Engineering, as well as a reviewer. He was selected the 1993 Small Business Person of the Year by the Carlsbad, California Chamber of Commerce, and served as chair of the Carlsbad Beach Erosion Committee.

His professional experience includes more than eighteen years as a hydraulic engineer with the U.S. Army Corps of Engineers at the Waterways Experiment Station (WES) in Vicksburg, Mississippi, both the Nashville and Baltimore Districts, and the Hydrologic Engineering Center (HEC) in Davis, California. While at WES, Dr. Williams worked on research applications of sediment transport in rivers and reservoirs and the solution of unusual hydraulic and sediment related problems using computer models and other state-of-the-art techniques. He also worked on the development of the cohesive and network versions of the HEC-6 sediment transport computer model and wrote the Reservoir

Sedimentation Chapter in the U.S. Corps of Engineering Manual on Sedimentation Investigations. At the Nashville District, Dr. Williams performed erosion control and sedimentation studies for the Tennessee-Tombigbee Waterway Project and also conducted sedimentation and floodplain information studies of proposed flood control projects. He was acting Chief of the Hydrology and Hydraulics Section at the Baltimore District Corps of Engineers. During the mid 1970's, Dr. Williams worked at HEC, helping in the development of spatial data management techniques, evaluation of the economic benefits of flood control projects, and sedimentation in rivers and reservoirs.

Dr. Williams has been a frequent short course instructor for ASCE, Federal and State Agencies for computer training workshops on using HEC-2, HEC-RAS, HEC-HMS and HEC-6. In addition, he has taught short courses on channel bed scour for toe protection design, sediment transport, bridge scour and streambank protection.

Selected Projects

Expert and Independent Technical Review Panels

Member of 4 Board of Senior Consultants/Safety Assurance Review Panel – The Sacramento Area Flood Control Agency (SAFCA), the West Sacramento Area Flood Control Agency (WSAFCA), and the Three Rivers Levee Improvement Authority (TRLIA) are each upgrading their levee systems in the northern California to the 200 year protection level and the City of Dallas (Trinity River Watershed Protection) to the 100 year flood level. After the devastation brought on by Hurricane Katrina, the U.S. Army Corps of Engineers required that all new or upgraded flood control projects that received federal cost sharing funding are to have an Independent External Technical Review (IETR) comprised of national experts in the appropriate disciplines. In response to this edict, these agencies appointed Dr. Williams as a member of the Board of Senior Consultants (BOSC) for their 4 project to review and provide expert advice on the risk and uncertainty analysis, plan formulations, erosion control, sediment transport analyses, fluvial geomorphology, hydrology and hydraulic aspects of the project.

Member, FEMA’s Scientific Resolution Panel (SRP), Washington DC - The Federal Emergency Management Agency makes available an independent scientific body referred to as the Scientific Resolution Panel (SRP) that can be convened when deemed necessary by FEMA or upon a joint agreement between FEMA and a community. SRPs are independent panels of experts organized, administered, and managed by the National Institute of Building Sciences. They are established for the purpose of reviewing and resolving conflicting scientific and technical data submitted by a community challenging FEMA's proposed flood elevations. Dr. Williams is on a pre-qualified roster of national experts on FEMA regulations and procedures and was recently appointed to a Panel for a dispute in Texas.

NCHRP 24 – 34, Risk Based Approach for Bridge Scour Prediction. For the U.S Department of Transportation, Transportation Research Board, Dr. Williams is on the

technical advisory committee for this research. The project objective is to develop a risk-based methodology that can be used in calculating bridge pier, abutment, and contraction scour at waterway crossings so that scour estimates can be linked to a probability. The developed probabilistic procedures would be consistent with LRFD approaches used by structural and geotechnical engineers.

EPA Selection Panel, Washington D.C. – Dr. Williams has served on 3 EPA selection panels in the areas of climate change, ecological indicators and thresholds. The panel evaluated research proposals from universities and non-profit organizations and made recommendations to EPA on which proposals to approve. The panels were comprised of experts in the engineering and naturals sciences. Dr. Williams was the only private consultant on each panel, which was composed of academic and government personnel.

Flood Control and FEMA Mapping

FEMA Studies of 27 Streams in the Unincorporated Areas of San Diego County, California – Dr. Williams was the principal-in-charge for this project for FEMA. He also took on some of the studies are the project manager. The studies involved over 50 miles of streams using FEMA standards for surveying, hydraulic modeling and floodplain and floodway delineations which and resulted in new and updated FIRM maps.

Approximate Floodplain Study for Orange County, California - Dr. Williams and his team prepared an approximate floodplain study for the Orange County Flood Control District to delineate 100-year floodplains for the East Garden Grove - Wintersburg Channel (C05), the Ocean View Channel (C06), and seven tributaries to the C05 channel. This project was undertaken by the District to facilitate lifting of the Santa Ana River floodplain (zone A99) after the completion of the Santa Ana River flood protection project by the U.S. Army Corps of Engineers (Corps). The Corps project has controlled breakout flows from the Santa Ana River (SAR), but the flooding from other sources underlying the SAR floodplain, needed to be delineated before the A99 zone was lifted by FEMA. The study area is located in the Cities of Huntington Beach, Fountain Valley, Westminster, Santa Ana, Garden Grove, Anaheim, and Orange, in Orange County, California. The C05 and C06 channel system consists of a complex network of leveed channels, storm drains, and detention basins that convey stormwater runoff from highly urbanized low-lying interior areas to the Pacific Ocean. About 16 miles of flood control channels were analyzed using an approximate hydraulic analysis with the Corps HEC-RAS program. The C05 channel laterals were analyzed using various computer programs including the Corps HEC-RAS program and the HEC-2 program with the split-flow option, and the Los Angeles County Flood Control Districts WSPG program. To obtain a model for an approximate level of analysis, all levees, bridges, and culverts, were removed from the cross-sections. Engineering judgment was used to interpret the model results based on output that appeared reasonable in accordance with field observations. Field observations were used to verify flow directions, track flow paths, and evaluate the effect of floodplain features such as elevated highway embankments. Approximate studies in urban environments can be especially challenging because of the need to make

appropriate assumptions in order to simplify complex hydrologic and hydraulic phenomena. A Zone A approximate 100-year floodplain was delineated. The results of the study satisfied FEMA requirements and were subsequently published for the benefit of the community. Dr. Williams was the Project Manager and Principal in Charge.

St. Tammany Flood Control Analysis, U.S. Army Corps of Engineers, New Orleans District, New Orleans, Louisiana - Dr. Williams and his engineers developed a conceptual flood management plan for St. Tammany Parish in southeast Louisiana. Flood management in St. Tammany Parish was a unique challenge, with 100 square miles drained by a complex network of natural bayous and man-made canals. Hydrologic and hydraulic models were needed to evaluate existing conditions and compare flood management alternatives. The results of the hydrologic models provided the input for hydraulic modeling to the New Orleans District Corps of Engineers with useful answers about their proposed flood management plan, allowing the District and the citizens of St. Tammany Parish to make informed decisions about their watershed.

Dam Breach Analyses for San Diego County Water Authority (SDCWA) – As principal in charge, Dr. Williams also acted as the technical advisor for this series of contracts to analyse numerous dam breach projects for SDCWA. This contact involved using the NWS DAMBreak model for FERC re-authorization of existing hydroelectric dams as well as for scenarios of raising dams to obtain additional storage and power. The results, which included numerous breach scenarios, output hydrographs and resulting inundation areas for FEMA flood mapping, were used to create new or revise Emergency Action Plans.

Hydraulics and Hydrology

Reservoir Sedimentation Analysis for FERC relicensing, Alcoa Power Generating Inc. – Dr. Williams was in charge of this reservoir sedimentation study for the High Rock Dam in North Carolina. The client needed this information for the application for relicensing of the dam. The sediment transport model was used to evaluate the effects of the dam on sedimentation that had a potential to adversely affect adjacent infrastructure.

Examination of Hydraulic Rollers at Run of the River Dams, Illinios Dept. of Natural Resources, Springfield, IL – As technical advisor to this project, Dr. Williams provided technical guidance in developing solutions to the hydraulic roller problem at the downstream portion of the weir at Geneva Dam. The temporary solution was the placement of rock riprap at this location and its design based upon high turbulence conditions.

Eastern Arkansas Water Supply Study - Study included extensive model application and model calibration to analyze the effect of in-basin water transfers on surface water flow magnitude, frequency, and duration in the La Grue Bayou stream network using Corps of Engineers' programs HEC-1, HEC-2, HEC-DSS, and HEC-FFA. A unique feature to this study was the application of the Memphis District's program HUXRAIN to develop long

term (50 years) synthetic discharge hydrographs using calibrated antecedent precipitation index coefficients, a long term rainfall data base, and computed unit hydrographs for the sub-basins. Another component of this work was an interior hydrology study for the city of Clarendon, Arkansas. Several scenarios were analyzed using HEC-IFH for continuous simulation with 50 years of data.

IDIQ for Los Angeles District Corps of Engineers - During this IDIQ contract for hydrology and hydraulics with the Los Angeles District, Dr. Williams and his team completed multiple work orders. A spillway inundation study was conducted for Carbon Canyon simulating dam break using HEC-RAS. A two-dimensional link node model was applied to Mission Creek in Santa Barbara to evaluate flooding due to overspilling of the channels to lower elevations and connector streams. In the Santa Margarita river watershed study, HEC-1, HEC-2 and HEC-6 were used to evaluate flooding extents and sedimentation problems in the river. Two channel restoration and environmental enhancement plans were developed in Phoenix area for the Tres Rios and Rio Salado projects. Tres Rios involved HEC-6 modeling and Rio Salado had both HEC-RAS and HEC-6 models developed for the Salt River. A major flood map revision study and levee analysis report was conducted for the Los Angeles River and Compton Creek, resulting in hundreds of thousands people taken out of the 100 year regulatory floodplain. During this study, numerous HEC-2 models were modified to reflect levee system changes made by the Los Angeles District. Overbank models were also modified to analyze split flow conditions.

Lindo Lake Park Water Quality Study, Lakeside, California - Dr. Williams conducted detailed study of water quality conditions, to evaluate lake rehabilitation alternatives, and to develop a restoration plan to improve water quality conditions and to support a wide array of beneficial uses, including active recreation for Lindo Lake Park. Lindo Lake Park Water Quality Study. The Lindo Lake Park Water Quality Study was comprised of five major tasks: 1) public meetings; 2) report on inventory, bibliography and proposed methodology; 3) Quality Assurance Project Plan according to EPA guidelines; 4) Water quality study and associated technical report; and 5) Implementation plan.

Minnesota and Red River CWMS Watershed Modeling, U.S. Army Corps of Engineers, St. Paul District - To establish a flood forecasting system and reduce future flood damage in the Red River of the North basin (4,010 square miles) and Minnesota River basin (1,770 square miles), Dr. Williams, along with his staff and the U.S. Army Corps of Engineers, St. Paul District (the Corps), developed a Corps Water Management System (CWMS) model to assist in real time operation of the reservoirs to regulate reservoir outflows. Dr. Williams' team developed snow process, hydrologic, water control, and hydraulic models that will be incorporated by the Corps into CWMS as model components. The modeling work included development, calibration, and verification of the Distributed Snow Process Model (DSPM), HEC-HMS, HEC-ResSim, and HEC-RAS models.

Wellhead Protection Plan for the Los Angeles Corps of Engineers, Planning Division, San Luis, Arizona - The components included the delineation of wellhead protection

areas, the compilation of a contaminant source inventory, the development of management tools to protect the groundwater and the formulation of a contingency plan for both short and long term losses of one or more wells.

Two-Dimensional Study of the Missouri River, Chamois Reach, USACE, Kansas City District IDC - Dr. Williams was Principal in Charge for a 2-D study of the Missouri River called the Chamois reach between RM 116.5 and RM 113.5. The model used was RMA2, which is a part of the WMS system. It was used to identify low and medium flow habitat areas and the depths and velocities associated with those areas. The results were used to determine opportunities for habitat enhancements.

West Tennessee Tributaries Project Limited Evaluation Study, Tennessee - A reconnaissance level analysis was conducted to evaluate the proposed restoration of old river meanders that were cut off from the Middle Fork Forked Deer River by historical channelization projects. This study included an extensive combination of hydrological, hydraulic, and sediment transport simulations, using historical rainfall and runoff records, current field data, and calibration to 1960 and 1979 channel geometry survey data. In addition to Corps of Engineers' programs HEC-1, HEC-2, HEC-DSS, HEC-FFA, and HUXRAIN for surface water flow modeling and standard computer program HEC-6 for sediment transport analysis, the newer HEC-6T, "Sedimentation in Stream Networks", developed by William A. (Tony) Thomas, was used to evaluate the sediment transport of flow converging and diverging at the junctions of the main channel and the old meanders. A sediment-weighted histogram generator modified by WEST Consultants was used to generate the hydrology input for the HEC-6 programs. Designs for rock riprap diversion weirs and bridge protection, and an in-line sediment trap were developed in this study.

White River Unsteady Flow Model, Arkansas - An unsteady flow model using the computer program UNET was developed for 70 miles of the White River in eastern Arkansas. Model parameters were calibrated to historical stage and flow records before executing two 47 year simulations. Simulations were run for existing conditions and conditions after installation of an inlet canal and pumping station for an irrigation scheme. Results were provided to the District to help them evaluate effects of the irrigation project on the river. A second part of this project involved evaluation of the irrigation canals for sediment transport and scour/deposition. The computer program SAM was used to help determine stable channel parameters and the amount of scour/deposition that could be expected with the District's design geometry and slope.

Expert Testimony and Support

Expert Consultant: Flooding of property by US Army Corps of Engineers, Missouri, for private party

Expert Consultant: Stream restoration design and construction defects, North Carolina, for private party

Expert Testimony: Flooding death, for Metropolitan St. Louis Sewer District

Expert Testimony: Gabion technical claims dispute, for Terra Aqua Gabions

Expert Consultant: Subdivision Flooding, for City of Reno, NV

Expert Consultant: Analysis of Milltown Dam Removal and Potential Deposition at Thompson Falls Reservoir, Montana, for Pennsylvania Power and Light

Expert Consultant: FERC relicensing, North Carolina, for Alcoa Power Generating Corporation

Expert Consultant: Scour Evaluation of Grading Plan Changes for Cyrus Wash, for Kern County, CA

Expert Consultant: Baker River FERC relicensing, WA, for Puget Sound Energy

Expert Consultant: Blackfoot and Clark Fork River Restoration Plan, Montana for unnamed client

Expert Consultant: Agua Fria River Streambank Scour Analyses, Phoenix, AZ, for Flood Control District of Maricopa Co., AZ

Expert Consultant: Erosion and Drainage, Newport Beach, California, for private client

Expert Consultant: Subdivision Flooding Problems and Floodplain Mapping Procedures, Dayton, Ohio, for private client

Expert Consultant: Flooding Problems, Unnamed creek, Los Angeles, California, for private client

Expert Testimony: Murrieta Creek Flooding, Riverside County, California, for Riverside Co. Flood Control District

Expert Testimony: Flooding Potential and Analysis of Coconut Grove, Kailua, Oahu, Hawaii, for private client

Expert Consultant: Subdivision Flooding Problems, Waialae Iki V, Oahu, Hawaii, for private client

Expert Testimony: Flood Problems at Carlton Oaks Country Club, Santee, California, for private client

Expert Consultant: Alpine Mobile Home Park Flooding, Alpine, California, for private client

Expert Consultant: River Effects of Sand Mining Operations, San Luis Rey River, California, for private client

Expert Testimony: Pecos Road Pipeline Scour, Phoenix, Arizona, for El Paso Natural Gas Company

Expert Consultant: San Diego Creek Revetment Failure, Irvine, California, for private client

Expert Consultant: San Luis Obispo Creek Flooding, San Luis Obispo, California, for private client

Expert Consultant: Kern River Ordinary Highwater Litigation, Bakersfield, California, for private client

Misc. Floodplain Hydraulics and Flood Protection

Reconnaissance Study Report and Project Management Plan for the Tijuana River Watershed Study – USACE, Los Angeles District

Spillway, Outlet, and Stilling Basin Design for Reelfoot Lake Sedimentation Basin – USACE, Memphis District
FEMA Studies of River System near Huntington Beach, Orange County, California
River System Studies near Huntington Beach for Orange County for Submittal to FEMA, Orange County, California
FEMA Studies of 27 Streams in the Unincorporated Areas of San Diego County, California
Hydraulic Analysis and Levee Elevation Design of West Williamson, West Virginia, Flood Control Project, for USACE, Huntington District
Flood Information Study of Pineville, Kentucky, for USACE, Nashville District
Murrieta Creek Flood Control and Environmental Restoration Project – USACE, Los Angeles District
Hydraulic Design of Supercritical and Subcritical Flood Control Channels for the Rio Puerto Nuevo Flood Control Project, San Juan, Puerto Rico, for USACE, Jacksonville District
Flood Control Channel Design, Buena Vista Creek, Vista, California, City of Vista, CA
Forest Falls Community Flood Warning System – USACE, Los Angeles District

Publications (abbreviated)

Professional Papers

Wu, Weiming, Williams, David T., et.al, "Earthen Embankment Breaching, "Earthen Embankment Breaching," *J. Hydraul. Eng.*, 137(12), 1549–1564, 2011

Williams, David T,. and Stedinger, Jey R., "Practical Applications of Risk & Uncertainty Theory in Water Resources: Shortcuts Taken and Their Possible Effects," *Proceedings*, World Environmental & Water Resources Congress 2011, Environmental & Water Resources Institute, ASCE, Palm Springs, CA, May 22 - 26, 2011

Yescas, Alex, Norman, Kirk, Williams, David T.,"Bank Stabilization by Redirective Structures on the Santa Clara River, Ventura Co., CA," *Proceedings*, World Environmental & Water Resources Congress 2011, Environmental & Water Resources Institute, ASCE, Palm Springs, CA, May 22 - 26, 2011

Williams, David T., Harder, Leslie, Jr., Sills, George, and Martin, Ray, "The Value Added to Flood Control Projects By Use of External Review Panels," *Proceedings*, World Environmental & Water Resources Congress 2010, Environmental & Water Resources Institute, ASCE, Providence, RI, May 16 - 20, 2010

Depue, Michael, Williams, David T., and Esterson, Kris, "Planning for Climate Change in the Technical Analysis of Floodplain Mapping and Flood Control Projects," Association of State Floodplain Managers Conference, Orlando, FL, June 2009

Su, Yu-Chun, Wobig, Loren, Winters, Brad, He, Xin, and Williams, David T., "The Geneva Dam, IL Hydraulic Roller Problem: Design of a Temporary Steep Riprap Ramp," *Proceedings*, World Environmental and Water Resources Congress 2009, Kansas City, MO

Williams, David T., and Countryman, Joseph, "Uncertainty Analysis: You Need to Know What You Don't Know," *Proceedings*, World Environmental and Water Resources Congress 2009, Kansas City, MO

McEvoy, Donald M., and Williams, David T., “Proposed Procedures in Utilizing Risk and Uncertainty Principles in Floodplain Management and Mapping,” *Proceedings*, Association of State Floodplain Managers Conference, Reno, 2008.

Philips, Bruce M., and Williams, David T., “Design Considerations for Confining and Guiding Levees on Alluvial Fans,” *Proceedings*, World Environmental and Water Resources Congress 2008, Honolulu, Hawaii, May 12–16, 2008.

Kreymborg, Leo, R., and Williams, David T., “The PBS&J Scour Spreadsheet: A Tool for Stream Restoration, Utility Crossings and Streambank Protection Projects,” *Proceedings*, World Environmental and Water Resources Congress 2008, Honolulu, Hawaii, May 12–16, 2008.

Williams, David T., “Tips on Using the Dambreak Option in HEC-RAS,” *Proceedings*, Arid Regions and CASFM Conference, Breckenridge, CO, 2007.

Williams, David T., and Houghland, Sarah, “Alluvial Fan Management and Analysis: Methods used in the State of Colorado,” *Proceedings*, Arid Regions and CASFM Conference, Breckenridge, CO, 2007.

Williams, David T., “So You Have Been Asked to Be an Expert Witness? Now What?” Floodplain Managers Association Annual Conference, San Diego, CA, Sept., 2008

Thomas, Iwan M., and Williams, David T., “Common Modeling Mistakes Using HEC-RAS,” Proceedings, World Environmental and Water Resources Congress 2007: Restoring our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Kreymborg, Leo R., Williams, David T and Thomas, Iwan M., “Rapid Floodplain Delineation,” Proceedings, World Environmental and Water Resources Congress 2007: Restoring our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Williams, David T., “Finessing 1-D Hydraulic Models into 2-D Performance,” Proceedings, World Environmental and Water Resources Congress 2007: Restoring Our Natural Habitat, Tampa, Florida, May 15–19, 2007.

Williams, David T., Marcy, Jennifer K., and DePue, Michael, “FEMA Levee Analysis Requirements for Floodplain Mapping,” Proceedings, Association of State Floodplain Managers Conference, Norfolk, VA, 2007.

Desai, Harshal, Baird, Matt, and Williams, David T., “2-D Floodplain Hydraulic Modeling using 1-D Hydraulic Models,” Proceedings, Association of State Floodplain Managers Conference, Norfolk, VA, 2007.

Williams, David T., and Kreymborg, Leo R., “Are You Double Counting, Over Conservative, or Misapplying Safety Factors for Stream Scour Analyses?” Floodplain Management Association Annual Conference, Coronado, CA, September 5-8, 2006

Williams, David T., and Doeing, Brian J., "Variation in Depth of Toe Scour Computations For Stream Restoration Bank Protection Design," Proceedings, International Erosion Control Annual Conference and Exposition, Las Vegas, NV, February 24-28, 2003.

Williams, David T., Gusman, A. Jake., and Teal, Martin J., "Proposed Methodology for Floodway Determination Using Unsteady Flow in HEC-RAS," Proceedings, ASFPM Conference, Biloxi, MS, June 23-28, 2003.

Williams, David T., Hu, Henry H., and Stefanovic, Dragoslav, "Sediment Flushing From a Flood Control Channel Outlet Into the Pacific Ocean", Proceedings, EWRI 2002 Conference on Water Resources Planning and Management, Symposium on Managing the Extremes: Floods and Droughts, First Symposium on Environmental and Water Resources Systems Analysis, Roanoke, Virginia, May 19-22, 2002.

Williams, David T., and Doeing, Brian J., "Predicting Bed Scour for Toe Protection Design in Bank Stabilization Projects," Short Course notes, International Erosion Control Association 33rd Annual Conference and Expo, Orlando, Florida, February 25, 2002.

Williams, David T., Hu, Henry H., Doeing, Brian J., and Phillips, Craig, "Headcut Analysis Due to Overbank Sand and Gravel Mining." Proceedings, Floodplain Management Association 21st Semi-Annual Conference, Lake Tahoe, NV, September 23-26, 2001.

Stefanovic, Dragoslav, Williams, David T., "Two-Dimensional-Vertical Numerical Modeling of Stratified Environments", Proceedings, World Water and Environmental Resources Congress Conference, Orlando, Florida, May 20-24, 2001.

Williams, David T., Teal, Martin J., and Bradley, Jeffrey B., "Use of GIS and Regional Relationships to Determine Subbasin Sediment Yields for Input to a Sediment Transport Model", Invited paper, Proceedings, ASAE International Symposium, Honolulu, Hawaii, January 3-5, 2001

Williams, David T., and Teal, Martin J., "Between A Rock And A Soft Place: Which Riprap Method Should I Use for My Project?" Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Teal, Martin J., Schulte, Marc A., Williams, David T. and Remus, John I., "Sediment Modeling of Big Bend Reservoir, South Dakota", Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Schulte, Marc A., Forman, Selena M., Williams, David T., Mashburn, Glenn, and Vermeeren, Rene, "A Stable Channel Design Approach for the Rio Salado, Salt River, Arizona", Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Forman, Selena M., Williams, David T., and Remus, John I., "Development of Methodology to Reduce Suspended Sediment Sample Collection on the Missouri River at Sioux City, Iowa", Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Chintala, Ramesh S., Williams, David T., Allen, Peter M., "Channel Response and Sediment Yields in Brookeen Creek, Central Texas", Proceedings of the International Erosion Control Association (IECA) Conference, Palm Springs, California, 2000

Doeing, Brian J. and Williams, David T., "Development, Calibration, Confirmation, Project Production Runs and Sensitivity Analyses of One Dimensional Sediment Transport Models", Proceedings, ASCE and EWRI 2000 Joint Conference On Water Resources Engineering and Water Resources Planning & Management, Minneapolis, MN, July 30-Aug 2, 2000.

Attachment 3:

Letter from Ric Reinhardt, MBK Engineers, dated June 1, 2016

MBK ENGINEERS
Water Resources ◆ Flood Control ◆ Water Rights

GILBERT COSIO, JR., P.E.
MARC VAN CAMP, P.E.
WALTER BOUREZ, III, P.E.
RIC REINHARDT, P.E.
GARY KIENLEN, P.E.
DON TRIEU, P.E.
DARREN CORDOVA, P.E.
NATHAN HERSHEY, P.E., P.L.S.
LEE G. BERGFELD, P.E.
BENJAMIN T. TUSTISON, P.E.

ANGUS NORMAN MURRAY
1913-1985

CONSULTANTS:
JOSEPH I. BURNS, P.E.
DONALD E. KIENLEN, P.E.

Mr. Raymond Costa, PE, GE
Dr. Leslie Harder, Jr., PE,GE
Dr. David Williams, PE

June 1, 2016

Dear *RD2062 Urban Level of Flood Protection Independent Panel of Experts*,

Supported by River Islands and Reclamation District (RD) 2062, it has been the intention of the City of Lathrop to make an Urban Level of Flood Protection Finding (ULOP Finding) pursuant to California Senate Bill 5 (SB 5) by July 2, 2016. Since 2014, RD 2062 (as the local maintaining agency) and its consultants have been working with you to ensure a record, complete with substantial evidence, demonstrating that the River Islands at Lathrop, Stage 1 Levee System is in compliance with the State of California Department of Water Resources' *Urban Levee Design Criteria* (ULDC) for providing protection from the 200-year flood event. Your involvement in this process has proven valuable in establishing a thorough and robust record. However, a few items still require resolution before this record is complete.

As SB 5 requires cities to make findings by July 2, 2016, and we have not completed the substantial evidence record to support an ULOP Finding, the City of Lathrop now intends on making an Adequate Progress Finding on June 20, 2016, in accordance with the State of California Department of Water Resources' *Urban Level of Flood Protection Criteria*, EVD-3 process. To this end, I am requesting your consideration of the *Reclamation District 2062, River Islands at Lathrop Stage 1 Levee System, Urban Level of Flood Protection Engineer's Report* (March 2016), in addition to my certification, as demonstration that an urban level of flood protection will exist upon completion of the substantial evidence record.

While the City of Lathrop is preparing to make its Adequate Progress Finding, we look forward to our continued involvement as we work towards making an ULOP Finding in the very near future.

Sincerely,

Ric Reinhart, PE
MBK Engineers

455 University Avenue Suite 100 ◆ Sacramento, California 95825 ◆ Phone: (916) 456-4400 ◆ Fax: (916) 456-0253 ◆ Website: www.mbkengineers.com

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APPENDIX D

ENGINEER'S REPORT

RECLAMATION DISTRICT 2062

RIVER ISLANDS AT LATHROP STAGE 1 LEVEE SYSTEM

URBAN LEVEL OF FLOOD PROTECTION ENGINEER'S REPORT

MARCH 2016

FINAL

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LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

ACES	Automated Coastal Engineering System
CCTV	closed-circuit television
cfs/ft	cubic feet per second per foot
CPT	Cone Penetration Test
CVFPB	Central Valley Flood Protection Board
DDC	Deep Dynamic Compaction
DWR	California Department of Water Resources
DWSE	Design Water Surface Elevation
EM	Engineering Manual
FEMA	Federal Emergency Management Agency
GPR	ground-penetrating radar
H:V	horizontal-to-vertical ratio
HTOL	Hydraulic Top of Levee
LF	linear feet
LM	Levee Mile
LSJR Model	MBK Lower San Joaquin River HEC-RAS model
MBK	MBK Engineers
MTOL	Minimum Top of Levee
NA	not applicable
NIMS	National Incident Management System
O&M	operation and maintenance
pcf	pounds per cubic foot
RD	Reclamation District
RM	River Mile
SB	Senate Bill
SEMS	Standardized Emergency Management System
SJR	San Joaquin River
SOP	Standard Operating Procedure
SPFC	State Plan of Flood Control
SPK	Sacramento District (USACE)
SSJDD	*Sacramento San Joaquin Drainage District*
ULDC	*Urban Levee Design Criteria*
ULOP Criteria	*Urban Level of Flood Protection Criteria*
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
WSE	water surface elevation

INTRODUCTION

In 2007, the California Legislature passed Senate Bill (SB) 5, which requires all cities and counties within the Sacramento-San Joaquin Valley to make findings related to an urban level of flood protection for lands within a flood hazard zone. The bill defined "urban level of flood protection" as the level of flood protection necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources (DWR). *Urban Level of Flood Protection Criteria* (ULOP Criteria), implementation guidance issued in November 2013 by the State, requires that these findings be based on substantial evidence in the record.

This document and its associated appendices provide substantial evidence that the levee system protecting Stage 1 of the River Islands at Lathrop project is able to withstand flooding from a 1-in-200-year flood event in accordance with the State of California's *Urban Levee Design Criteria* (ULDC) issued in May 2012. The technical assessments performed as part of this effort are not an assessment of how floods may impact improvements (i.e., impacts to structures, facilities, docks, parks, etc.). The assessments considered a single flood event, the 200-year flood.

ULOP Criteria (EVD-1) require that the substantial evidence include at a minimum "a report prepared by a Professional Civil Engineer registered in California to document the data and analyses for demonstrating the property, development project, or subdivision has an urban level of flood protection." Further, the ULOP Criteria indicate that the Engineer's Report should include the following with regard to the facilities used for the finding:

- A list of the flood management facilities, including but not limited to State Plan of Flood Control (SPFC) facilities;
- The location of the flood management facilities;
- The entities that operate and maintain the flood management facilities; and
- A list of, and consideration of, reports, evaluations, inspections, and performance history of the flood management facilities.

This report addresses the items listed above: the reports, evaluations, inspections, and other documents that evaluate the condition and performance of the facilities are included as appendices. The ULOP Criteria also require a report by an Independent Panel of Experts (Panel) on the review of this Engineer's Report; the Panel's report and responses to the Panel's comments are also appended.

DESCRIPTION OF FLOOD MANAGEMENT FACILITIES

Site Location

The River Islands at Lathrop project is a master planned community located within the limits of the City of Lathrop on Stewart Tract. Stewart Tract is an island in the Sacramento-San Joaquin Delta that is surrounded by levees. The island can be divided into two sections delineated by the Union Pacific Railroad (UPRR) embankment, which coincides with the jurisdictional boundary between Reclamation District (RD) 2062 and RD 2107 (Figure 1).

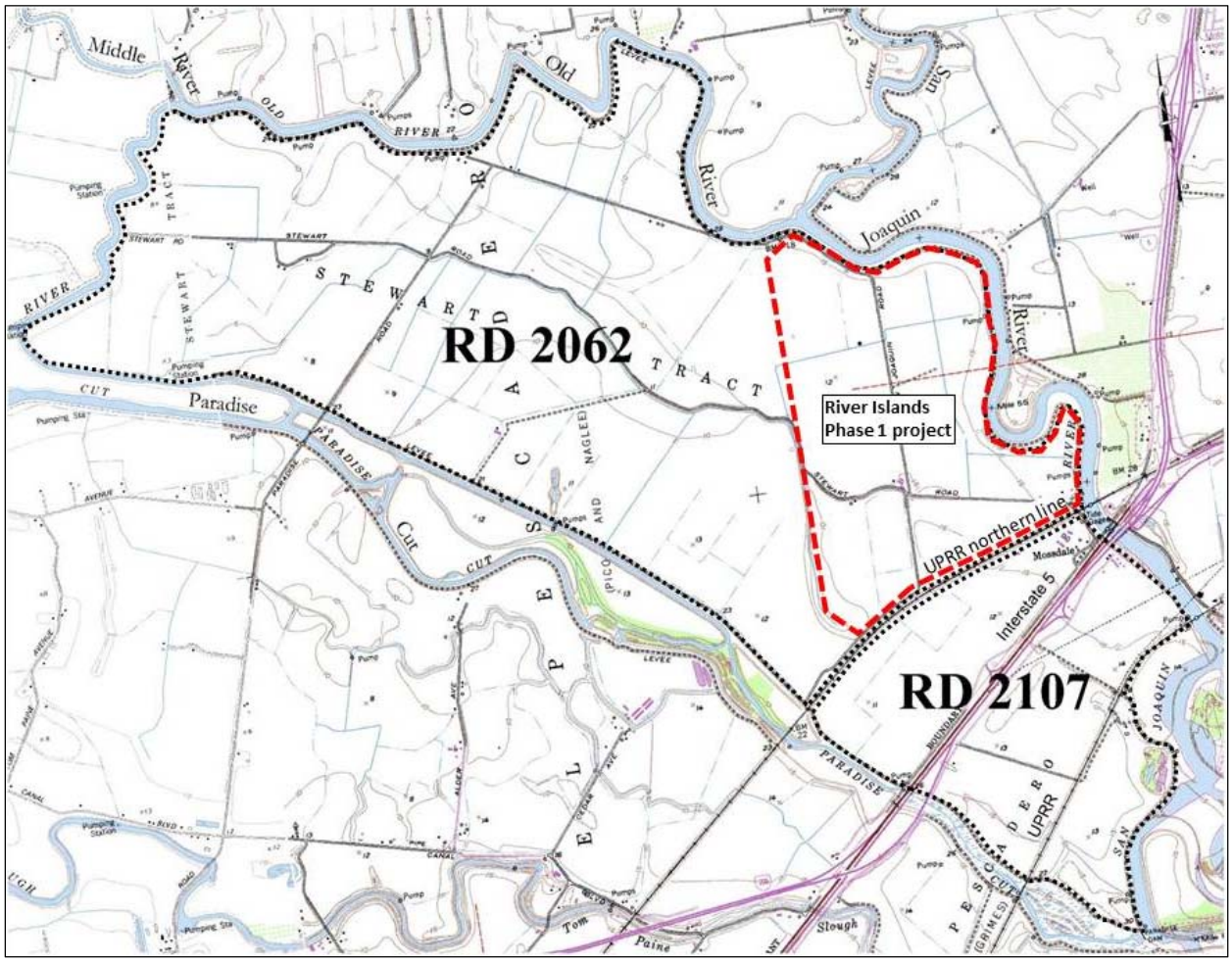
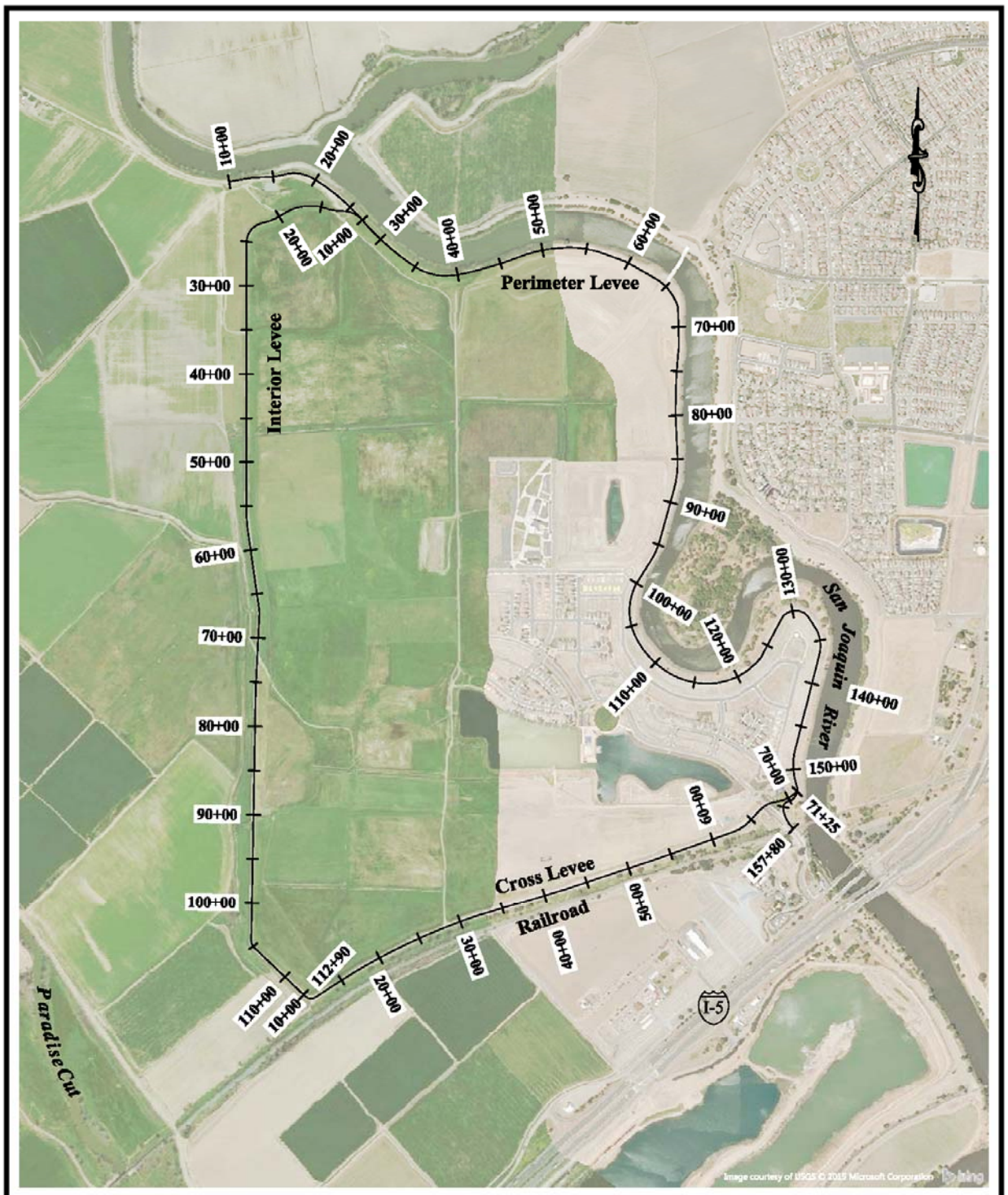


Figure 1. River Islands at Lathrop Project Location Map

RD 2062 can be further delineated by the Interior and Cross levees (Figure 2) into two areas that correspond to the Stage 1 and Phase 2 project areas of the River Islands at Lathrop development. The Stage 1 area is surrounded by the Perimeter Levee, Interior Levee, and Cross Levee, which comprise an interior ring levee. RD 2062 maintains all three levees.



MBK ENGINEERS 455 University Ave, Suite 100 Sacramento, California 95825 Phone: (916) 456-4400 • Fax: (916) 456-0253	**RECLAMATION DISTRICT NO. 2062**	SCALE:	1" = 1,500'
		JOB NUMBER:	4458
		DRAWN BY:	MB/AR
	DISTRICT MAP	DATE:	11/12/2015
		SHEET:	1 OF 1

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Figure 2. River Islands at Lathrop Stage 1 Project Levee Segments

Perimeter Levee

In 2005, River Islands constructed a non-Project setback levee landward of the federally authorized San Joaquin River left bank levee from the UPRR embankment and bridge (Comp Study[1] River Mile [RM] 55.85) to the confluence of Old River (Comp Study RM 53.40).

Subsequently in 2006, under permission from the Central Valley Flood Protection Board (CVFPB) and the U.S. Army Corps of Engineers (USACE) under Encroachment Permit No. 18018-1, River Islands filled the area between this non-Project levee and the Federal levee to create an oversized embankment, now referred to as the "Perimeter Levee". The filling involved major reconstruction of the Federal levee (CBG, 2006). There is no visual or functional difference between the two levees, meaning that there is no way to discern the two levees visually in the field and the entire (overbuilt) embankment reduces flood risk. The two levees can be delineated on paper through as-built drawings.

The Perimeter Levee is approximately 12,500 feet long and connects the eastern extent of the Cross Levee (Station 152+50, RM 55.9) to the northern extent of the Interior Levee (Station 27+00, RM 53.4), protecting the Stage 1 area from flooding along the San Joaquin River.

Specific information about the Perimeter Levee is provided by subject in the appended technical memoranda.

Interior Levee

The Interior Levee was constructed in 2005 (CBG, 2006) by River Islands to protect the Stage 1 area from damage due to overland flooding from RD 2107, or a potential levee breach from the Paradise Cut right bank levee to the west. The Interior Levee connects the western extent of the Cross Levee (Station 112+90) to the northern extent of the Perimeter Levee (Station 10+00).

The Interior Levee is a non-Federal levee and not within the SPFC; it is approximately 10,000 feet long. It is a dry-land levee in that it is interior to the federally authorized levees surrounding Stewart Tract. The Federal levees do not currently protect from the 100- or 200-year events, except as described for the Perimeter Levee.

The Interior Levee is intended to serve a flood control function for a short time frame (no more than 5 years), in that construction of future River Islands levees will eliminate the need for the Interior Levee. This work is expected to be completed by 2020.

Specific information about the Interior Levee is provided by subject in the appended technical memoranda.

Cross Levee

The Cross Levee was constructed in 2005 CBG, 2006) by River Islands to protect the Stage 1 area from overland flooding from RD 2107, or a potential levee breach from the Paradise Cut right bank levee to the

[1] *Sacramento and San Joaquin River Basins Comprehensive Study*, USACE, 2002.

west. The Cross Levee is situated along the UPRR embankment and connects the Perimeter Levee (Station 71+25) to the Interior Levee (Station 10+00).

The Cross Levee is a non-Federal levee and not within the SPFC; it is approximately 6,000 feet long. It is a dry-land levee in that is interior to the federally authorized levees surrounding Stewart Tract. The Federal levees do not currently protect from the 100- or 200-year events, except as described for the Perimeter Levee.

Specific information about the Cross Levee is provided by subject in the appended technical memoranda.

EVALUATION OF FLOOD MANAGEMENT FACILITIES

The ULDC presents requirements for analyses (e.g., determining the Design Water Surface Elevation [DWSE] and Hydraulic Top of Levee [HTOL]) as well as performance (e.g., Minimum Top of Levee [MTOL] elevation). These requirements are broken down within 20 major criteria:

7.1 Design Water Surface Elevation
7.2 Minimum Top of Levee
7.3 Soil Sampling, Testing, and Logging
7.4 Slope Stability for Intermittently Loaded Levees
7.5 Underseepage for Intermittently Loaded Levees
7.6 Frequently Loaded Levees
7.7 Seismic Vulnerability
7.8 Levee Geometry
7.9 Interfaces and Transitions
7.10 Erosion
7.11 Right-of-Way
7.12 Encroachments
7.13 Penetrations
7.14 Floodwalls, Retaining Walls, and Closure Structures
7.15 Animal Burrows
7.16 Levee Vegetation
7.17 Wind Setup and Wave Runup
7.18 Security
7.19 Sea Level Rise
7.20 Emergency Actions

RD 2062 evaluated the levees surrounding the Stage 1 area for compliance with each of the ULDC. The following report sections summarize these evaluations which are documented in technical memoranda and reports detailing these evaluations.

ULDC 7.1: Design Water Surface Elevation

The DWSE is the 200-year water surface elevation (WSE) used to design levees and floodwalls. The ULDC offers two options for determination of the DWSE: 1) the Federal Emergency Management Agency (FEMA) approach, and 2) the USACE approach. The evaluation for RD 2062 conforms to the FEMA approach. MBK Engineers (MBK) used the July 2014 version of the MBK Lower San Joaquin River HEC-RAS model (LSJR Model) to compute the median 200-year WSE for all three levee segments. Debris loading on bridge piers was included in the analysis and the computed WSE was adjusted for superelevation. The effects of potential sea level rise were also considered. Adjustments for climate change, updated hydrology, and updated hydraulic models, which are optional in the ULDC, were not made. A detailed description of the methodology and results for the determination of the DWSE is found in *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Hydraulic Analysis* (MBK, 2016b).

An additional water surface elevation required by the ULDC is the HTOL, which is defined as the lower of the DWSE plus 3 feet or the median 500-year water surface elevation.

Perimeter Levee

The computed DWSE and HTOL for the Perimeter Levee at all LSJR Model computation points (cross sections) are provided in Table 1.

Table 1. DWSE and HTOL for the Perimeter Levee

Hydraulic Model River Station (Comp Study River Mile)	Levee Station (feet)	DWSE (feet NAVD88)	HTOL * (feet NAVD88)
55.972	15,440	28.5	30.2
55.92	15,300	28.3	30.0
55.86	14,990	28.4	30.1
55.63	13,740	28.1	29.8
55.4	13,100	27.9	29.5
55.205	12,620	27.7	29.4
55.01	11,120	27.8	29.5
54.805	9,730	27.3	28.9
54.6	8,700	26.9	28.4
54.365	7,460	26.6	28.0
54.13	6,410	26.3	27.7
54.11	6,340	26.3	27.6
53.89	5,310	26.2	27.5
53.735	4,630	26.0	27.3
53.58	3,660	26.0	27.4
53.435	2,740	25.7	27.0
53.29	2,110	25.7	27.0

* The HTOL is equal to the median 500-year water surface elevation for the Perimeter Levee.

Interior Levee

The computed DWSE for the Interior Levee is 20.5 feet NAVD88. The DWSE for the interior levee relies on relief cuts (MBK, 2016b). The HTOL for the Interior Levee is 22.9 feet NAVD88. The HTOL is equal to the median 500-year water surface elevation for the Interior Levee. The Interior Levee DWSE and HTOL are defined by a single value because they are defined by ponded floodwater in the area of RD 2062 unprotected by the Stage 1 levees.

Cross Levee

The computed DWSE and HTOL for the Cross Levee are the same as that for the Interior Levee. The DWSE for the Cross Levee relies on relief cuts (MBK, 2016b).

ULDC 7.2: Minimum Top of Levee

The MTOL is the required minimum elevation for the physical top of levee to provide reasonable assurance of containing the DWSE, and is defined as the higher of the DWSE plus 3 feet or the DWSE plus wind setup and wave runup. A detailed description of the methodology and results for the determination of the MTOL is found in the River Islands Stage 1 Hydraulic Analysis (MBK, 2016b). Wind setup and wave runup were computed by ENGEO (ENGEO, 2015) and are discussed below in ULDC 7.17. Documentation for comparing the MTOL elevation to the levee crown elevation is found in *River Islands at Lathrop Stage 1 Project, Minimum Top of Levee Compliance Evaluation* (MBK, 2016c).

Perimeter Levee

The maximum computed wind setup and wave runup for the Perimeter Levee is 2.9 feet. Since this is less than 3 feet, the MTOL is defined as the DWSE plus 3 feet. The levee crown elevation is in excess of the MTOL elevation by between 1.3 and 2.9 feet as seen in the profiles provided in the River Islands Stage 1 MTOL Compliance Evaluation (MBK, 2016c). The Perimeter Levee **meets** the MTOL elevation.

Interior Levee

The wind setup and wave runup for the Interior Levee was computed at six evaluation sites at an average interval of about 1,400 feet due to the variety of possible wind directions and fetch locations. The wind setup and wave runup for the Interior Levee evaluation sites ranges from 4.1 to 5.6 feet, therefore the MTOL for the Interior Levee is the DWSE plus wind setup and wave runup.

The Interior Levee meets the MTOL elevation for all its length with the exception of 720 feet. This deficient length represents 7 percent of the total length of the Interior Levee and the deficiency averages 0.4 foot with a maximum of 0.7 foot. This overtopping is within the allowable overtopping rate and therefore meets ULDC. Furthermore, this overtopping would occur where the embankment is overwidened (approximately 40 feet). The Interior Levee **meets** the ULDC for MTOL elevation as described in the River Islands Stage 1 MTOL Compliance Evaluation (MBK, 2016c).

Cross Levee

The computed wind setup and wave runup for the Cross Levee is 0.4 foot. Since this is less than 3 feet, the MTOL is the DWSE plus 3 feet. The DWSE for the Cross Levee is a single value, 20.5 feet NAVD88, therefore the MTOL for the Cross Levee is 23.5 feet NAVD88. The levee crown elevation is in excess of the MTOL elevation by between 2.8 and 9.6 feet. The Cross Levee **meets** the MTOL elevation as described in the River Islands Stage 1 MTOL Compliance Evaluation (MBK, 2016c).

ULDC 7.3: Soil Sampling, Testing, and Logging

ULDC 7.3 requires soil sampling, testing, and logging per standard procedures prescribed in guidance documents, including USACE Sacramento District's *Geotechnical Levee Practice Standard Operating Procedures* (SOP) and DWR's Division of Flood Management *Soil and Rock Logging, Classification, Description and Presentation Manual* (2009).

In general, explorations performed for this evaluation do not meet the specific USACE Sacramento District (SPK) SOP of four borings every 500 to 1,000 feet; however, these guidelines were written with the intent of collecting data for levee projects that are primarily linear in nature. Although RD 2062 has linear levee features, it is also a land development project that requires data collection over a broader areal extent as well, and in general, meets the intent of the ULDC with more than 15 explorations per levee mile. As such, the previous subsurface exploration/characterization efforts were also focused on the design of many non-levee features such as residential and commercial structures, schools, man-made lake slopes, bridges, pump stations, underground utilities, etc. The end result of all the subsurface data, combined with the geologic/geomorphologic assessments, provides a very good understanding of the subsurface soil conditions in the subject project area and, in the geotechnical engineer's opinion, exceeds the intended exploration density in the referenced guidance documents (ENGEO, 2016b).

In addition, the as-built plans, conformance laboratory tests, and in-place compaction tests for the construction and improvements of each segment of the Stage 1 levees were retained as part of the ULDC evaluation. This information was used to evaluate the levee geometry and material properties within the newly constructed and improved levee sections. Specifically, the placement of the fill was observed by a representative of the geotechnical engineer, and was subject to compaction testing and material compliance testing. Material compliance testing consisted of Atterberg Limits and grain size distribution tests at approximately 500 foot intervals at various vertical lifts throughout the subexcavation and embankment during fill placement along the levee alignment. Based on the compliance testing, the material generally consisted of lean clay to sandy lean clay, meeting the current criteria for levee material and compaction (ENGEO, 2005b).

During construction of the new levee sections, an observation trench was excavated below the landside toe of the levee prism. The trench was excavated to a depth of 6 feet, with a bottom width of approximately 25 feet. The purpose of the observation trench was both to create an engineered fill key at the base of the levee, and to identify potential seepage paths below the levee. Two representatives from ENGEO observed the trench during excavation and backfill to identify near surface sand layers or other potentially detrimental seepage paths, or to extend the depth of the trench where appropriate. Based on

the observations, no potential seepage paths were identified. The observations are presented in the Levee Inspection Trench Observation Summary (ENGEO, 2016c).

ENGEO prepared the River Islands Stage 1A Geotechnical Data Report (ENGEO, 2016b) to provide a comprehensive summary of the relevant geotechnical data for Stage 1 of the River Islands Project in Lathrop, California. Detailed information about the soil sampling, testing, and logging may be found in the report.

Perimeter Levee

Explorations performed through the Perimeter Levee crown were spaced, on average, approximately 1,000 feet, with a maximum distance of approximately 2,300 feet occurring between Station 29+45 and Station 52+35. Landside explorations were performed at a higher frequency, with an average spacing of less than 500 feet.

The as-built plans indicate the Perimeter Levee was improved from its original condition with the construction of an interior ring levee landside of the existing crown. The landside of the prism of the existing levee was then degraded and reconstructed with levee-specification fill, and the area between the two levees was filled with engineered fill. In situ density tests and soil classification of the improvements were used in the interpretation of the levee geometry, material types and material properties for ULDC evaluation.

Therefore, the Perimeter Levee **meets** ULDC 7.3.

Interior Levee

The Interior Levee was designed and construction was observed by the geotechnical engineer in 2005 (ENGEO, 2005b), and the as-built plans and field and laboratory testing indicate that the entire levee was constructed of levee-specification fill. Additionally, the foundation material below the southern portion of the levee was improved with Deep Dynamic Compaction (DDC) to reduce post-earthquake liquefaction settlement below the levee, with confirmation CPTs performed on an average spacing of approximately 200 feet.

Therefore, few explorations were performed through the crown of the levee and were instead located near the toe of both the landside and waterside of the levee to evaluate the subsurface conditions. Additional explorations for other portions of the River Islands project were also used in the subsurface characterization, including explorations used for various lake construction and DDC confirmation tests.

Based on the volume of existing data from previous projects and the information available from the as-built reports, the Interior Levee **meets** ULDC 7.3.

Cross Levee

Similar to the Interior Levee, the Cross Levee was designed and construction was observed by the geotechnical engineer in 2005 (ENGEO, 2005b). The foundation material below the western portion of the Cross Levee was also improved with DDC to reduce post-earthquake liquefaction settlement, with confirmation CPTs performed on an average spacing of approximately 200 feet. Explorations from other River Islands projects within the vicinity of the Cross Levee, including CPTs and borings, were also used for the interpretation of the subsurface conditions below the levee.

Based on the information available from previous projects near the Cross Levee, the Cross Levee **meets** ULDC 7.3.

ULDC 7.4: Slope Stability For Intermittently Loaded Levees

The slope stability evaluation is documented in ENGEO's *Urban Levee Design Criteria Evaluation, River Islands Stage 1 Levees, Lathrop, California* (ULDC evaluation) (ENGEO, 2016a). Based on the geotechnical engineer's experience with levee stability in the region, locations for slope stability analysis were selected at locations where the potential for seepage was highest. In general, the presence of high seepage pressures will reduce the shear resistance of the soil, and subsequently the stability of the levee. Additional locations were selected based on levee slopes or the presence of soft or loose soil foundation layers. Strength parameters were interpreted from field explorations and laboratory testing. Pore water pressures used during steady state seepage were based on the DWSE or HTOL, respective to the analysis conducted.

ULDC 7.4.1 requires a minimum factor of safety of 1.4, based on the DWSE, for failure surfaces that intersect the levee crown and are greater than a few feet deep in the levee slope. It also requires a minimum factor of safety of 1.2, based on the Hydraulic Top of Levee (HTOL), for failure surfaces that intersect the levee crown and are greater than a few feet deep in the levee slope. ULDC 7.4.2 requires a minimum factor of safety of 1.2 for waterside slope stability during rapid drawdown conditions, similar to USACE guidance. Based on USACE guidance (EM 1110-2-1913), we selected a minimum factor of safety of 1.2 for the Perimeter Levee due to the potentially long exposure to the design water surface. A factor of safety of 1.1 was selected for waterside stability of the Cross and Interior Levees, based on a reduced potential exposure time and the relatively lower flood elevation relative to the landside toe. The HTOL for the Perimeter, Interior and Cross levees were calculated by MBK and are documented in the River Islands Stage 1 Hydraulic Analysis (MBK, 2016b).

The ULDC also provides guidance for the presence of wide (crown width over 20 feet) and extremely wide (crown width over 50 feet) levees with respect to levee stability. A slope may have a factor of safety less than the specified criteria, provided that the minimum levee dimensions are contained within the existing levee prism, and that the minimum levee geometry meets the minimum slope stability and seepage criteria. Based on crown widths, each of the Stage 1 levees can be considered wide levees.

Though the ULDC does not directly address though seepage analyses, it does consider the "potential for erosion" when addressing the integrity of the levee. A through seepage evaluation was conducted (ENGEO, 2016X) and considered the following:

- The ratio of seepage path length to hydraulic head across the levee prism, also known as the Creep Ratio.
- Quantity of through seepage flow.
- Exit height of through seepage in an erodible material above the landside levee toe of the embankment (also called the "breakout" point).

- Slope of the embankment over which the through seepage is exiting.

The results of the through seepage and stability analyses is provided for each levee.

Perimeter Levee

Slope stability and through seepage were evaluated at eight locations along the Perimeter Levee for each of the design criteria under static conditions. The results of the analyses are presented in Table 2 andTable 3. Through Seepage Evaluation Results for Perimeter Levee Table 3 below. Based on the ULDC and selected criteria, the Perimeter Levee **meets** ULDC 7.4.

Table 2. Calculated Factors of Safety Range for Perimeter Levee

	DWSE	HTOL	RDD
Criteria	FS ≥ 1.4	FS ≥ 1.2	FS ≥ 1.2
Results	1.4 to 4.6	1.2 to 4.1	1.3 to 2.1

Table 3. Through Seepage Evaluation Results for Perimeter Levee

Creep Ratio (-)	Seepage Severity (gpm/ft/100feet)	Breakout Height (Feet)
7.1 to 13.2	9.5x10-4 to 4.8x10-3	1.0 to 5.0

Interior Levee

Slope stability and through seepage were evaluated at four locations along the Interior Levee for each of the design criteria under static conditions. The results of the analyses are presented in Table 4 and Table 5 below. Based on the ULDC and selected criteria, the Interior Levee **meets** ULDC 7.4.

Table 4. Calculated Factors of Safety Range for Interior Levee

	DWSE	HTOL	RDD
Criteria	FS ≥ 1.4	FS ≥ 1.2	FS ≥ 1.2
Results	1.4 to 1.7	1.3 to 1.5	1.9 to 2.1

Table 5. Through Seepage Evaluation Results for Interior Levee

Creep Ratio (-)	Seepage Severity (gpm/ft/100feet)	Breakout Height (Feet)
4.8 to 11.2	3.1x10-4 to 4.3x10-3	1.2 to 2.7

Cross Levee

Slope stability and through seepage were evaluated at four locations along the Cross Levee for each of the design criteria under static conditions. The results of the analyses are presented in Table 6 and Table 10 below. Based on the ULDC and selected criteria, the Cross Levee **meets** ULDC 7.4.

Table 6. Calculated Factors of Safety Range for Cross Levee

	DWSE	HTOL	RDD
Criteria	FS ≥ 1.4	FS ≥ 1.2	FS ≥ 1.2
Results	1.8 to 2.5	1.7 to 2.2	2.0 to 2.4

Table 7. Through Seepage Evaluation Results for Cross Levee

Creep Ratio (-)	Seepage Severity (gpm/ft/100feet)	Breakout Height (Feet)
6.0 to 11.9	1.0x10-4 to 5.3x10-3	0.0 to 1.0

ULDC 7.5: Underseepage For Intermittently Loaded Levees

ULDC 7.5 provides levee underseepage criteria for intermittently loaded levees. Analysis locations were selected based on the most critical underseepage conditions identified from our subsurface explorations, laboratory testing, and surface topography. Locations with thin blanket conditions, high head differentials between the waterside head and the landside toe, and interbedded layers of high permeability material were primarily selected as the most critical location for underseepage analysis. Other locations within any particular reach are expected to yield lower exit gradients and higher factors of safety.

Based on USACE Engineering Manual 1110-2-1913 (as modified by ETL 1110-2-569) and the ULDC, the current guidance for acceptable exit gradients through soils with a minimum saturated unit weight of 112 pcf at the toe of the levee (average exit gradient) should be no greater than 0.5 and no greater than 0.8 at a distance of 150 feet from the levee toe for the DWSE. In addition, the minimum criteria for any location between the levee toe and 150 feet from the toe should be linearly interpolated between 0.5 and 0.8 for the DWSE. When modeling a scenario that incorporates the HTOL, the allowable exit gradient is no greater than 0.6 at the levee toe.

Three dimensional effects were considered (ENGEO, 2016a). The surcharge for the cross section located at station 18+00 of the Interior Levee is based on the river bend between the Old River and San Joaquin River confluence rather than the sharper bend in the northern portion of the Interior Levee. Our underseepage analysis indicated that due to the intact clay layer on the waterside of the Interior Levee, a majority of the head caused by the floodwater between the Interior and Perimeter Levee would be dissipated. As a result, the hydraulic head in the San Joaquin River will likely control the pore pressures acting on the landside toe of the Interior Levee. We therefore selected our three dimensional surcharge for this cross section from the levee angle along the Perimeter Levee adjacent to the Interior Levee.

Additionally, the presence of the landside lakes within the vicinity of the levee system were considered and found to reduce the average exit gradient at the toe of the levee, in some cases by a significant amount (ENGEO, 2016d). We should note that these analyses were performed only for the two dimensional analytical models, and that the reduction in the average exit gradients would be expected to be less when three-dimensional effects are taken into account.

Even though the presence of the lakes within the models provides a significant benefit to the underseepage conditions of the levees, the lakes were not considered in the seepage analysis for ULOP purposes as these lakes are not intended to serve a flood control function.

Each of the lakes constructed in Stage 1 were excavated into the sandy aquifer that underlies the entirety of Stage 1, meaning they each have a direct hydraulic connection to the stage in the adjacent San Joaquin River. Though this connection can actually benefit the underseepage conditions of the Stage 1 levees, as the lakes provide some hydraulic relief assuming the water surface elevation in the lake is maintained during a flood event, if the lake is too close to the levee, then the difference in pressure during a high water event could potentially cause instability of the soil particles, leading to internal erosion of the lake slope. If this erosion progresses significantly, then the stability of the lake slope could become compromised. The internal stability of the lakes has been evaluated based on the creep ratio, seepage severity, and the calculation of the critical hydraulic gradient at which particle detachment occurs. Based on our evaluation, none of the lakes within Stage 1 present a stability hazard with respect to internal erosion (ENGEO, 2016d).

Lastly, in general, most of the cross sections were modeled with the design water surface and the hydraulic top of levee boundary conditions for analysis. However, for cross sections located near the intersection of two distinct loading conditions, such as the intersection of the Interior Levee and the Perimeter Levee, multiple hydraulic loading conditions were analyzed to evaluate the most critical condition with respect to underseepage. At cross section 18+00 on the Interior Levee, sensitivity analyses were also performed with the Perimeter Levee removed to evaluate the stability on the interior levee if the Perimeter Levee were compromised. Further details regarding these analyses are presented in ULDC Section 7.9 below.

Perimeter Levee

In an effort to account for the significantly larger width of the Perimeter Levee, the landside levee toe location was selected as the landside hinge point projection approximately 10 feet waterward of the Zone A CVFPB easement (Figure 2, ENGEO, 2016a), was used for the seepage analysis. The locations of the Zone A and Zone B easements are based on the minimum dimensions set by the CVFPB. Additionally, since the landside topography of the Perimeter Levee generally varies, ULDC requirements were used to identify the critical exit gradient for ditches or depressions. Underseepage was evaluated at eight locations along the Perimeter Levee for both the DWSE and the HTOL. The maximum exit gradient identified along the Perimeter Levee is indicated in Table 8 below. The Perimeter Levee **meets** ULDC 7.5.

Table 8. Exit Gradients for Perimeter Levee

Cross Section	DWSE			HTOL
	Distance from Inscribed Levee Toe (Feet)	Exit Gradient	Exit Gradient Criteria at Location	Exit Gradient
36+00	201	0.47	0.80	0.55
46+00	83	0.21	0.67	0.26
52+50	144	0.38	0.79	0.48
60+00	122	0.64	0.74	0.78
76+00	44	0.55	0.59	0.64
81+00	44	0.29	0.59	0.40

92+50	202	0.72	0.80	0.83
136+00	1613	0.19	0.80	0.21
150+00	518	0.25	0.80	0.30

Interior Levee

Underseepage was evaluated at three locations along the Interior Levee for each of the design criteria. The maximum exit gradient identified along the Interior Levee is indicated in Table 9 below. The Interior Levee **meets** ULDC 7.5.

Table 9. Exit Gradients for Interior Levee

Cross Section	DWSE	HTOL
107+00	0.39	0.57
89+25	0.26	0.37
80+00*	0.49	0.66
18+00	0.34	0.40

* Wide levee criteria was utilized for cross section 80+00 due to the roadway fill. Distance to inscribed levee toe is approximately 92 feet, which results in an exit gradient criteria of 0.68.

Cross Levee

Underseepage was evaluated at four locations along the Cross Levee for each of the design criteria. The maximum exit gradient identified along the Cross Levee is indicated in Table 10 below. The Cross Levee **meets** ULDC 7.5.

Table 10. Exit Gradients for Cross Levee

Cross Section	DWSE	HTOL
45+00	0.09	0.26
25+90	0.37	0.53
19+00	0.12	0.26
16+00	0.17	0.33

ULDC 7.6: Frequently Loaded Levees

ULDC 7.6 clarifies that frequently loaded levees are subject to more stringent requirements. Frequently loaded levees are those levees that experience a water surface elevation of 1 foot or higher above the elevation of the landside levee toe at least once a day for more than 36 days per year on average.

Perimeter Levee

An evaluation of the Perimeter Levee is found in *MBK River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Levee Loading Evaluation* (MBK, 2016a). The Perimeter Levee does not meet the definition of a frequently loaded levee Stage 1therefore more stringent requirements do not apply.

Interior Levee

The Interior Levee is a dry-land levee and does not meet the definition of a frequently loaded levee. Therefore more stringent requirements do not apply.

Cross Levee

The Cross Levee is a dry-land levee and does not meet the definition of a frequently loaded levee. Therefore more stringent requirements do not apply.

ULDC 7.7: Seismic Vulnerability

ULDC 7.7 requires an analysis of seismic vulnerability of the levee system for the 200-year return period ground motions. ULDC 7.7.1 indicates that if seismic damage from the 200-year return period ground motion is expected, a post-earthquake remediation plan is required as part of a flood safety plan developed in coordination with pertinent local, State, and Federal agencies.

An analysis was performed to evaluate the seismic stability and another was performed to evaluate the post-earthquake liquefaction potential (ENGEO, 2016X). The Peak Ground Acceleration utilized for the seismic stability analysis, both for the pseudostatic stability analysis and the post liquefaction stability analysis, represents the peak ground motions associated with the 200-year return period earthquake. This level of shaking is consistent with the guidance established by the ULDC, though it does represent a relatively low level of shaking. ENGEO evaluated the lateral deformations for cross sections that indicated a factor of safety less than 1.0 with respect to slope stability. The post-earthquake crown elevation was then calculated and compared to the minimum elevation required for temporary flood protection (10-year WSE plus 3 feet). Based on our selected seismic criteria and analysis, vertical seismic deformations are not expected to reduce the levee crown height below the 10-year WSE plus 3 feet at any location within the levee system.

Perimeter Levee

Pseudostatic slope stability was evaluated at eight locations along the Perimeter Levee where the minimum factor of safety was found to be 1.1 on the waterside and 2.3 on the landside under the 200-year return period ground motions. Although vertical seismic deformations are not expected to reduce the levee crown height below the 10-year WSE plus 3 feet, post-earthquake reduction in soil strength may cause significant waterside deformation within a portion of the Perimeter Levee between Station 38+00 to 75+00 (ENGEO, 2016X). Based on the significant width of the levee in this section, these deformations are not anticipated to affect the performance of the levee with respect to the 10-year WSE plus 3 feet.

The Perimeter Levee meets ULDC 7.7 and does not require an post-earthquake remediation plan to restore the 10-year WSE plus 3 feet within eight weeks of the seismic event.

Interior Levee

Pseudostatic slope stability was evaluated at three locations along the Interior Levee where the minimum factor of safety was found to be 1.6 on the waterside and 1.5 on the landside under the 200-year return period ground motions.

The Interior Levee meets ULDC 7.7 and does not require an post-earthquake remediation plan to restore the 10-year WSE plus 3 feet within eight weeks of the seismic event.

Cross Levee

Pseudostatic slope stability was evaluated at four locations along the Cross Levee where the minimum factor of safety was found to be 1.8 on the waterside and 1.6 on the landside under the 200-year return period ground motions.

The Cross Levee meets ULDC 7.7 and does not require an post-earthquake remediation plan to restore the 10-year WSE plus 3 feet within eight weeks of the seismic event.

ULDC 7.8: Levee Geometry

ULDC 7.8 requires that for new levees or levees with extensive reconstruction situated along major waterways, a minimum 20-foot-wide crown width and 3:1 horizontal-to-vertical ratio (H:V) waterside and landside slopes are required.

ULDC 7.8.1 allows levees wider than the minimum requirement to have steeper slopes if the minimum required dimensions would fit entirely within the actual levee, and if seepage and slope stability criteria are met (for both deep and shallow failure surfaces). Further, for extremely wide levees, seepage and slope stability criteria do not need to be met for the outer levee slopes as long as certain criteria are met.

ULDC 7.8.2 requires a patrol road along the crown of the levee for inspection, maintenance, and flood-fighting. The patrol road must be designed, constructed, and maintained to provide "all-weather" support of maintenance and patrolling vehicles.

Perimeter Levee

As described above, River Islands constructed a non-Project setback levee landward of the federally authorized San Joaquin River left bank levee in 2005. The non-Project setback levee crown width is approximately 40 feet with side slopes of 2H:1V landside and 3H:1V waterside (CBG, 2005). The Perimeter levee (i.e., the total embankment) has a crown width varying between 60 and 400 feet with landside slopes ranging from 2H:1V to nearly 20V:1V and waterside slopes ranging from approximately 2H:1V to 5H:1V. The ULDC minimum theoretical levee prism is contained within the existing levee section along its entire alignment.

In 2005, a patrol road was installed on the levee crown as part of construction of the non-Project setback levee (CBG, 2005).. The patrol road is 12 feet wide, consisting of 6-inch Class 2 aggregate base. Five access ramps And six turnabouts were also installed. The Perimeter Levee **meets** ULDC 7.8.1.

Interior Levee

The Interior Levee crown width is approximately 40 feet with side slopes of 2:1 landside and 3:1 waterside. The minimum required levee crown is provided within the existing levee section along its entire alignment. A patrol road, 12 feet wide and consisting of 6-inch Class 2 aggregate base, with three access ramps and two turnabouts was also installed in 2005 on the levee crown (CBG, 2005). The Interior Levee **meets** ULDC 7.8.1.

Cross Levee

The Cross Levee crown width is 50 feet with side slopes of 3:1 for both the waterside and landside. The minimum required levee crown is provided within the existing levee section along its entire alignment. A patrol road, 12 feet wide and consisting of 6-inch Class 2 aggregate base, with three access ramps and two turnabouts was also installed in 2005 on the levee crown (CBG, 2005). The Cross Levee **meets** ULDC 7.8.1.

ULDC 7.9: Interfaces and Transitions

ULDC 7.9 highlights the need to ensure that the levee system functions holistically, such that no levee reach is more susceptible to problems than an adjacent reach due to gaps in features, loading/demand concentrations, or other three-dimensional effects when designing interfaces, transitions, and connections that commonly occur at the ends of seepage berms, seepage cutoff walls, revetments, and floodwalls. Design and construction of the Cross and Interior Levees, as well as the initial landside portion of the Perimeter Levee, were performed at the same time. As a result, there are no interfaces and/or transition features such as seepage berms or cutoff walls associated with the levee system.

Boundary conditions at each of the intersections of the three levee segments were evaluated to consider the most critical loading scenario with respect to underseepage and stability. The cross section at the Perimeter Levee and Interior Levee intersection was extended to include the influence of the San Joaquin River, in addition to the DWSE and HTOL conditions behind the Interior Levee. The results of this analysis are included in the Stage 1 ULDC Evaluation (ENGEO, 2016a).

This condition was also considered at the intersection of the Perimeter and the Cross Levee. Based on the site topography, we determined that the most critical location along the Cross Levee to be subject to seepage pressures from the San Joaquin River would be at the low elevation west of Stewart Road, adjacent to approximately Station 65+80 of the Cross Levee. To evaluate the underseepage conditions at this location, we measured the total head from the model at Station 150+00 on the Perimeter Levee at approximately 600 feet, or the approximate distance to the San Joaquin River from Station 65+80. We then estimated the dimensions of the clay blanket based on site topography and adjacent explorations. These values were then used to calculate the average exit gradient, shown in Table 11 below. Based on

our analysis, the exit gradients from the San Joaquin River water surface elevations are within the ULDC specifications.

Table 11. Perimeter and Cross Levee Interface - Cross Levee STA 65+80

Hydraulic Loading Condition	Top of Blanket Elevation (feet)	Bottom of Blanket Elevation (feet)	Total Head (feet)	Average Exit Gradient
200-Year WSE	17	4	22.34	0.41
HTOL	17	4	23.15	0.47

Perimeter Levee

Based on the analysis of seepage and slope stability, there is not a need for additional mitigation measures at interfaces and transitions within the Perimeter Levee. Cross sections were selected at the most critical locations identified within each reach of the Perimeter Levee, and no locations were identified to be in excess of the ULDC requirements. There are minimal transitions between the revetted and non-revetted slopes or lower waterside berms. Therefore, the Perimeter Levee **meets** ULDC 7.9.

Interior Levee

Based on the analysis of seepage and slope stability, there is not a need for additional mitigation measures at interfaces and transitions within the Interior Levee. Cross sections were selected at the most critical locations identified within each reach of the Interior Levee, and no locations were identified to be in excess of the ULDC requirements. Therefore, the Interior Levee **meets** ULDC 7.9.

Cross Levee

Based on the analysis of seepage and slope stability, there is not a need for additional mitigation measures at interfaces and transitions within the Cross Levee. Cross sections were selected at the most critical locations identified within each reach of the Cross Levee, and no locations were identified to be in excess of the ULDC requirements. Therefore, the Cross Levee **meets** ULDC 7.9.

ULDC 7.10: Erosion

Levees that pose an immediate erosional breaching hazard during either a flood or normal flow condition need to be repaired to meet ULDC. Similarly, levees that are likely to be significantly damaged during either a flood or normal flow condition should be protected with appropriate slope treatments. Erosion hazards are evaluated for the following conditions: 1) high-velocity flows coupled with erosive levee materials and/or poor hydraulic conditions; 2) large waves developed by wind over large, open bodies of water; and 3) boat wakes. An evaluation, documented in *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Erosion Evaluation* (MBK, 2016d) of the levees considered potential factors such as existing erosion, geomorphologic trends, streamflow velocity and inundation depths during high water, wind-wave shear stress, levee materials, encroachments and anomalies, bank protection and vegetation.

Perimeter Levee

There is the potential for erosion damage due to high-velocity flows and erosive levee materials along the Perimeter Levee. However, the Perimeter Levee has performed well in past flood events with minimal maintenance. Based on past performance and an evaluation of velocities in the project reach, it is not anticipated that there would be significant erosion during a 200-year event. Because of the width of the levee, even significant erosion will not jeopardize the integrity of the levee.

There is minimal potential for boat wakes to generate erosion at typical WSEs, where adequate bank protection exists along the Project Levee. There is also minimal potential for wind-generated waves to form due to the meander of the river and short fetch distances along the Project Levee.

The Perimeter Levee does not pose an immediate erosional breaching hazard during either a flood or normal flow condition, nor is there likely to be significant damage during either a flood or normal flow. The Perimeter Levee **meets** ULDC 7.10.

Interior Levee

There is no potential for erosion damage due to high-velocity flows and erosive materials or boat wakes along the Interior Levee, as it is a dry-land levee and there is therefore no adjacent river channel for high velocities or boat access.

There is potential for wind-generated waves due to the long fetch within the flooded RD 2062 lands, but this erosion is not expected to impact the performance of the levee due to the levee width, soil type, and vegetative cover. The levee crown width is 40 feet, with 3:1 waterside slopes and 2:1 landside slopes. The vegetation cover is primarily annual grasses and ruderal vegetation. RD 2062 also has a stockpile of flood fight supplies in the event that a problem develops. The Interior Levee **meets** ULDC 7.10.

Cross Levee

There is no potential for erosion damage; this is because high-velocity flows and erosive materials, large-wave damage, and boat wakes are nonexistent along the Cross Levee because it is abutted by the railroad embankment that is on the waterside of the levee. The Cross Levee **meets** ULDC 7.10 requirements.

ULDC 7.11: Right-of-Way

Per ULDC, right-of-way criteria for levees and floodwalls in urban and urbanizing areas need to allow adequate room for maintenance, inspection, patrolling during high water, and flood-fighting; allow additional room to expand facilities in the future; and prohibit excavations and land modifications that would endanger the integrity of the levee or floodwall.

Specifically, the ULDC requires fee title or an easement for the entire levee prism extending to a minimum of 20 feet beyond the landside toe of the flood protection system for access and inspection. Further, waterward of the levee prism, where there is sufficient area to do so without resulting in the loss of sensitive riparian habitat, consideration should be given to acquiring a 15-foot-wide zone.

In addition to the minimums required by the ULDC for access and inspection, the ULDC recommends acquiring right-of-way that has a width equal to at least four times the levee height or 50 feet, whichever is greater, on the landside of the 20-foot clear zone for longer-term flood protection.

Lastly, the ULDC recommends that the city or county adopt restrictions on excavations within 200 to 400 feet depending on the levee height.

Perimeter Levee

As discussed in the levee geometry section and elsewhere in this report, the Perimeter Levee is oversized and is subject to the easement zones identified in Encroachment Permit No. 18018-2 BD issued by the CVFPB. Zone A, which begins at the centerline of the Federal Project levee and extends landward fifty feet, including an area 10 feet wide at the theoretical Federal Project levee toe, and Zone B, which begins at the edge of Zone A and extends landward 15 feet, provide a total minimum width of 65 feet of easement area. This easement is granted to the Sacramento San Joaquin Drainage District (SSJDD) by River Islands[2] as the landowner. The levee embankment waterward of the centerline is also owned by River Islands, and an easement is granted to the SSJDD. Zone A is regulated by the CVFPB. Zone B is an excavation zone that is not regulated by the CVFPB, unless the CVFPB determines the action could be injurious or interfere with the operation and function of the levee. In addition, the City of Lathrop has adopted a grading ordinance that will restrict any excavation within 500 feet of the physical waterside hingepoint of the levee. The Perimeter Levee **meets** ULDC 7.11.

Interior Levee

As discussed in the levee geometry section and elsewhere in this report, the Interior Levee is oversized. As has been indicated in the past, the Interior Levee is intended to serve a flood control function for a short time frame (no more than 5 years) andthen become decommissioned as a levee feature upon completion of improvements to the remainder of the levees surrounding Stewart Tract. Future plans for the Interior Levee include degradation in some areas and expansion in others. Regardless of their eventual purpose and uses, an easement provides rights to RD 2062 to operate and maintain the levee and encompasses the entire oversized embankment plus 10 feet landward of the embankment toe (CBG, 2005X). In addition, the City of Lathrop has adopted a grading ordinance that will restrict any excavation within 500 feet of the physical waterside hingepoint of the levee. The guidelines and restrictions governing the levee embankment easement and excavation zone will ensure that activities proposed near the levee will not adversely affect the integrity of the structure or impair O&M of the levee. The Interior Levee **meets** ULDC 7.11.

Cross Levee

As discussed in the levee geometry section and elsewhere in this report, the Cross Levee is oversized. An easement provides rights to RD 2062 to operate and maintain the levee and encompasses the entire oversized embankment plus 10 feet landward of the embankment toe (CBG, 2005X. In addition, the City of Lathrop has adopted a grading ordinance that will restrict any excavation within 500 feet of the physical waterside hingepoint of the levee. The guidelines and restrictions governing the easement area and excavation zone sufficiently provide that activities proposed near the levee will be reviewed to ensure

[2] These lands are owned by Califia, LLC and River Islands Development, LLC which ae collectively responsible for and implementing the River Islands at Lathrop development.

they will not adversely affect the integrity of the structure or impair O&M of the levee. The Cross Levee **meets** ULDC 7.11.

ULDC 7.12: ENCROACHMENTS

ULDC 7.12 requires a hazard assessment of each existing encroachment, permitted or not, to determine the encroachment's impact on the reliability of levee performance. The evaluation of encroachments considers the following: age, type, condition, performance history, impacts on the levee structural integrity, impacts on the hydraulic effect of the channel, and impacts on the O&M of the levee. If encroachments are considered high-hazard, additional evaluation and action is required.

The evaluation of encroachments is found in River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Encroachment and Penetration Evaluation (MBK, 2016e).

Perimeter Levee

There is one permitted encroachment on the Perimeter Levee: Bradshaw's Crossing Bridge, at approximately Levee Mile (LM) 0.90. The eastbound crossing of the bridge was completed in September 2012 under CVFPB Encroachment Permit No. 17919 GM. A bike/pedestrian overcrossing embankment is being constructed, as part of the Bradshaw's Crossing/River Islands Parkway. This embankment abuts the Perimeter levee alignment. This section of Perimeter Levee is elevated above the entire system to provide a smooth transition to the bridge deck and abutment. This encroachment is not considered a penetrating encroachment. There was rip rap placed on the waterside slope under the bridge abutment and two piers are in the river channel. This encroachment is not considered a high hazard and will not affect the performance of the flood protection system during a design event. The Perimeter Levee **meets** ULDC 7.12.

Interior Levee

There are no encroachments other than penetrations listed in 7.13 that are adjacent to the Interior Levee. The Interior Levee **meets** ULDC 7.12.

Cross Levee

There are no encroachments other than penetrations listed in 7.13 that are adjacent to the Cross Levee. The Cross Levee **meets** ULDC 7.12.

ULDC 7.13: PENETRATIONS

ULDC 7.13 requires a hazard assessment of each existing penetration, permitted or not, to determine the penetration's impact on the reliability of levee performance. If penetrations are considered high-hazard, additional evaluation and action are required. For other existing penetrations that are not considered to

be high-hazard, but have not been permitted, the city or county is required to have a remediation plan in place, or reference such a plan, for the entire length of levee that the finding is to cover.

The evaluation of penetrations is found in the *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Encroachment and Penetration Evaluation* technical memorandum (MBK, 2016e). There are no transportation penetrations to evaluate that pass through or under the levee crown or adjacent to the levee system for the Stage 1 development area.

Perimeter Levee

There are three intake pipes and one small electrical conduit connected to existing pumps located on the waterside of the Perimeter Levee near LM 1.60. These facilities penetrate the Perimeter Levee above the DWSE, although not above the HTOL. All four penetrations have appropriate permits and are in compliance with their CVFPB permit (18018-1). No high-hazard penetrations were identified. These penetrations will be video inspected prior to making the ULOP Finding.

Based on review of the O&M Manual and the efforts conducted as part of the 2005 and subsequent levee projects, there is low risk associated with any unknown penetrations in the Perimeter Levee (MBK, 2016e).

There are no unacceptable penetration hazards; the Perimeter Levee **meets** ULDC 7.13.

Interior Levee

There are two pipes penetrating through the Interior Levee. These two 16-inch-diameter recycled water pressure pipelines were installed in accordance with the standards listed within Title 23, although they are not subject to permitting by the CVFPB. The penetrations were installed through the levee with a bottom trench elevation of 22.0 feet NAVD88 and a pipe invert elevation of 22.2 feet; this is below the HTOL elevation of 22.9 feet NAVD88 but above the DWSE of 20.5 feet NAVD88. These penetrations will be video inspected prior to making the ULOP Finding. Any future encroachments will be installed over the top of the existing levee crown.

At the time of construction, the Interior Levee was over-excavated along the alignment prior to placement of new levee fill along the existing grade of the land. Any pipelines, drainage ditches, and roadways were demolished prior to construction of the new levee. It is therefore unlikely that there are any unknown penetrations under the Interior Levee.

There are no unacceptable penetration hazards; the Interior Levee **meets** ULDC 7.13.

Cross Levee

There are seven pressurized pipes and 18 municipal utility lines penetrating through the Cross Levee above the DWSE, and the HTOL. These coupled pipes provide utilities (e.g., stormwater, drainage, electrical, gas, municipal water, sewer, recycled water, phone, etc.) for the Stage 1 development area. These pipes were placed in accordance with the standards listed within Title 23 in 2013. The only pipe not installed and tested prior to the 2102 installation of 24 penetrations was a 16-inch recycled water line. This penetration will be video inspected prior to making the ULOP Finding. Penetration backfill was existing levee fill material.

At the time of construction, the Cross Levee was over-excavated along the alignment prior to placement of new levee fill along the existing grade of the land. There is low risk associated with any unknown penetrations under the Cross Levee.

There are no unacceptable penetration hazards; the Cross Levee **meets** ULDC 7.13.

ULDC 7.14: Floodwalls, Retaining Walls, and Closure Structures

ULDC 7.14 presents requirements for design of special features such as floodwalls, retaining walls, and closure structures. None of these features are present in the levee system protecting the Stage 1 area and therefore this criterion is not applicable

ULDC 7.15: Animal Burrows

Borrowing animals can present a significant threat to levee integrity and therefore proactive animal control and damage repair are required levee maintenance practices.

Perimeter Levee

RD 2062 has an annual rodent abatement program. The program uses two primary modes to control rodent populations and one primary method to repair rodent holes and burrows. The District uses bait stations to administer chemicals at active rodent areas to control populations, as well as traps at areas where excessive rodent activity is present. The District also administers a grouting program to backfill rodent holes identified within the levee; the grouting is performed on the waterside and landside of the levee, as necessary. The Perimeter Levee **meets** ULDC 7.15.

Interior Levee

RD 2062 has an annual rodent abatement program as described above. The Interior Levee **meets** ULDC 7.15.

Cross Levee

RD 2062 has an annual rodent abatement program as described above. The Cross Levee **meets** ULDC 7.15.

ULDC 7.16: Vegetation Evaluation

ULDC 7.16.1 requires an engineering inspection and evaluation to identify trees and other woody vegetation on the levee and within 15 feet of the levee toe that pose an unacceptable threat to the

integrity of the levee. Those posing an unacceptable threat are to be removed; those not posing an unacceptable threat need not be removed.

Perimeter Levee

The Perimeter Levee **meets** ULDC 7.16, as described in River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Vegetation Evaluation (MBK, 2016f).

There is no woody vegetation present with the ULDC vegetation management zone, although woody vegetation is present on the waterside slope beyond the vegetation management zone. This vegetation do not pose a threat to levee integrity and will be maintained in accordance with ULDC 7.16.5, *Levee with Existing Vegetation* to allow visibility and access and as defined under section 7.16.7, *Life Cycle Vegetation Management* to determine if they are an unacceptable threat.

Interior Levee

The Interior Levee **meets** ULDC 7.16. There are no trees within the vegetation management zone, or along the lower waterside slope of the Interior Levee (MBK, 2016f).

Cross Levee

The Cross Levee **meets** the ULDC 7.16 requirements. There are no trees within the vegetation management zone, or along the lower waterside slope of the Cross Levee (MBK, 2016f).

ULDC 7.17: Wind Setup and Wave Runup

ULDC 7.17 requires a wind-wave analysis. The wind setup and wave runup distances must be computed and added to the median 200-year still WSE to determine the required elevation of the MTOL.

The formation and magnitude of wind-generated waves against shoreline structures is controlled by the physical conditions present on and near the shore such as slope and roughness of the structure, wind speed, and distance over which wind blows (fetch length). An evaluation, documented in the Wind Wave Analysis Report (ENGEO, 2015), determined the wind setup and the runup for the 2 percent exceedance wave (wave runup, which is exceeded by 2 percent of waves on average). For the Perimeter and Cross levees, the analysis was performed at the location on the levee expected to generate the largest wind setup and wave runup. Multiple analysis locations were chosen for the Interior Levee, as the varying wind directions and fetch locations made it difficult to easily locate a "worst case scenario."

If the MTOL determined from the wind setup plus 2 percent exceedance runup was greater than the existing levee height, an overtopping rate calculation was performed in accordance with the guidance provided in the Automated Coastal Engineering System (ACES) Technical Reference (USACE, 1992, Section 5-2). ULDC states that per USACE guidance, a limited amount of levee overtopping may be allowed without armoring, typically ranging between 0.01 cubic feet per second per foot (cfs/ft) and 0.1 cfs/ft.

Perimeter Levee

The Perimeter levee has a combined 2 percent exceedance runup and wind setup of 2.93 feet, which is less than the minimum required freeboard of 3 feet. This value is considered to be conservative, as it was calculated using an extreme fetch length and assuming no reductions would be made due to an oblique angle of wave incidence. The wind-wave analysis for the Perimeter Levee **meets** the ULDC 7.17 requirements.

Interior Levee

The results of the Interior Levee evaluation are presented in Table 12 below.

Table 12. Interior Levee Evaluation Results

Site Number	Interior Levee 1	Interior Levee 2	Interior Levee 3	Interior Levee 4	Interior Levee 5	Interior Levee 6
Approximate Station	105+00	90+00	75+00	60+00	45+00	32+00
Wind Setup + R2 (feet)	4.97	4.74	4.50	4.67	4.14	5.55

Analysis point six (Interior Levee 6) was the only location that had the wind setup plus 2 percent exceedance runup greater than the minimum required freeboard of 3 feet. An overtopping rate of 0.0036 cfs/ft-ft was calculated in accordance with the guidance provided in the ACES Technical Reference (USACE, 1992, Section 5-2), for point six. This overtopping is within allowable ranges per USACE guidance, and does not require armoring of the levee, especially given the widened embankment. The wind-wave analysis for the Interior Levee **meets** the ULDC 7.17 requirements.

Cross Levee

The Cross levee has a combined 2 percent exceedance runup and wind setup of 0.42 foot. The wind-wave analysis for the Cross Levee **meets** the ULDC 7.17 requirements.

ULDC 7.18: Security

ULDC criterion 7.18 requires a security plan to protect urban and urbanizing area levee systems from acts of terrorism and other malicious or negligent acts. The security plan is to identify security personnel, responsibilities, resources, and measures. In developing the security plan, the agency/agencies responsible for levee maintenance must consider and prioritize vulnerabilities and employ an array of security measures from four basic categories to address vulnerabilities: networked detection (criterion 7.18.1); deterrence (criterion 7.18.2); physical security (criterion 7.18.3); and intrusion interdiction (criterion 7.18.4) during high-threat periods.

Perimeter Levee

RD 2062 has prepared a Levee Security Plan (RD 2062, 2016a) which identifies assets and vulnerabilities and measures to protect the levee system from terrorism or other malicious or negligent acts. The security plan and program includes activities and measures traditionally taken in urban areas, such as law enforcement patrols, as well as more modern measures including the use of cameras and microphones as

part of a "virtual policeman" program. The activities and measures are scalable so that as River Islands is developed, the security program's scope and intensity continues to be effective. As required by the ULDC, RD 2062 will review, and update, as appropriate, its security plan on an annual basis. This annual review will be used to determine when and how to adjust the scope and intensity of the security plan. Based on the current population and threat, RD 2062 will continue to implement its current security measures to mitigate any vulnerability for malicious or negligent acts on the flood system including regular levee patrols by a private security agency and RD 2062 staff; access controls, including gates and fences; and visible deterrents, including signage, gates, and patrols. The Stage 1 Levee System **meets** ULDC 7.18.

Interior Levee

As indicated above, RD 2062 has prepared a Levee Security Plan (RD 2062, 2016a) for the Stage 1 Levee System. The Stage 1 Levee System **meets** ULDC 7.18.

Cross Levee

As indicated above, RD 2062 has prepared a Levee Security Plan (RD 2062, 2016a) for the Stage 1 Levee System. The Stage 1 Levee System **meets** ULDC 7.18.

ULDC 7.19: Sea Level Rise

ULDC 7.19 requires that the effects of sea level rise be estimated and addressed for the duration during which a ULOP Finding may be valid. The sea level rise guidance adopted by the State of California Ocean Protection Council, *State of California Sea-Level Rise Guidance Document* dated March 2013, was used for this evaluation as recommended by the ULDC. The guidance provides sea level rise projection ranges for durations of 30 years, 50 years, and 100 years, using the year 2000 as the baseline. The projections are shown in Table 13. The effects of the sea level rise were considered by increasing the stages at the hydraulic model downstream boundaries, which are located far enough into the Delta to be primarily tidally driven, by the sea level rise projection.

Table 13. Sea Level Rise Projection Ranges

Time Period	Sea Level Rise Projection (feet)
2000–2030	0.13 to 0.98
2000–2050	0.39 to 2.00
2000–2100	1.38 to 5.48

Perimeter Levee

The Perimeter Levee is part of the final build-out vision for the River Islands at Lathrop Project, therefore sea level rise effect for it was determined using the 2000–2100 projection. Under the worst-case scenario of a 5.48-foot sea level rise, the DWSE for the Perimeter levee increases 0.44 foot at the downstream end and 0.23 foot at the upstream end (MBK, 2016b). Estimation and consideration of sea level rise for the Stage 1 Levee System **meets** ULDC 7.19 for sea level rise.

Interior Levee

The Interior Levee is a temporary levee with an expected ULOP Finding duration of less than 30 years, therefore the 2000–2030 time period sea level rise projection was used to estimate the sea level rise effects on the Interior Levee. Under the worst-case scenario of a 0.98-foot sea level rise, the DWSE for the Interior Levee sees an increase of 0.01 foot (MBK, 2016b). Estimation and consideration of sea level rise for the Stage 1 Levee System **meets** ULDC 7.19 for sea level rise.

Cross Levee

The Cross Levee, while a part of the current River Islands levee system, will be modified in the future once the Phase 2 project is constructed. as part of future River Islands levee work. As such, the same ULOP Finding duration assigned to the Interior Levee was used for the Cross Levee, therefore the same worst-case sea level rise effect of 0.01-foot DWSE increase (MBK, 2016b). Estimation and consideration of sea level rise for the Stage 1 Levee System **meets** ULDC 7.19 for sea level rise.

ULDC 7.20: Emergency Actions and Flood Safety Plans

ULDC 7.20 includes requirements for preparing flood safety plans, as it is important that local maintaining agencies and communities understand the responsibilities of flood risk management within their jurisdictions. Specifically, the ULDC requires each public agency with the responsibility for public safety for residents protected by levees and floodwalls to have a plan for flood events and other natural or man-made flood-related incidents that could result in human casualties, property destruction, and economic losses. The components of the RD 2062 flood safety plan includes an Emergency Operations Plan (RD2062, 2015), a Flood Contingency Map (SJ County 2016), and corresponding Evacuation Maps and Brochures. The District has engaged with both City of Lathrop and San Joaquin County Office of Emergency Services to have regularly scheduled exercises to rehearse the plan.

Perimeter Levee

River Islands, RD 2062, and RD 2107 have each developed a flood safety plan (Reclamation District No. 2062 and No. 2107 Emergency Operations Plans and a shared Flood Contingency Map and Evacuation Maps) for the entirety of Stewart Tract. These documents include actions specific to flood events and inundation, as well as general emergency operations. RD 2062's emergency operations plan (RD 2062, 2015) and associated documents include all items the ULDC deems necessary as part of a flood safety plan, as defined by *California Water Code* section 9650, Safety Plan. The Stage 1 Levee System **meets** ULDC 7.20.

Interior Levee

As indicated above, RD 2062 has developed a flood safety plan (RD 2062, 2015), and in conjunction with RD 2107 and River Islands, a shared flood contingency map. These documents include actions specific to flood events as well as general emergency operations, and this plan and its associated documents include all necessary flood safety plan items per the ULDC.

The plan includes triggers and protocols for making relief cuts identified in River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Exception to the Urban Levee Design Criteria for Emergency Actions (MBK, 2016g).. The Stage 1 Levee System **meets** ULDC 7.20.

Cross Levee

As indicated above, RD 2062 has developed a flood safety plan (RD 2062, 2015), and in conjunction with RD 2107 and River Islands, a shared flood contingency map. These documents include actions specific to flood events as well as general emergency operations, and this plan and its associated documents include all necessary flood safety plan items per the ULDC.

The plan includes triggers and protocols for making relief cuts identified in River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Exception to the Urban Levee Design Criteria for Emergency Actions (MBK, 2016g). The Stage 1 Levee System **meets** ULDC 7.20.

INDEPENDENT EXPERT REVIEW AND RESPONSES

The evaluation documented in this Engineer's Report was reviewed by an independent panel of experts (Panel). Per the ULOP Criteria, the Panel was comprised of three technical experts. Dr. David Williams is an expert in hydrology and hydraulic engineering. Mr. Ray Costa and Dr. Les Harder are experts in geotechnical engineering, levee safety, and levee construction. The Panel's comments are provided in the *Independent Panel of Experts' Review Report,* included as Appendix B

REFERENCES

Several documents supported the evaluation documented in this Engineer's Report. Those included in this report as appendices are in **bold.**

CBG, 2005. *Reclamation District 2062 Interior, Cross and Perimeter Levee Grading Plan, City of Lathrop, San Joaquin County, Californi*a, *As-Builts.* December.

CBG, 2006. *River Islands – Tract 3491 Perimeter Levee Fill Grading and Erosion Plan, City of Lathrop, San Joaquin County, California, Per Independent As-Builts. December.*CVFPB, 2008. CVFPB Encroachment Permit No. 18018-2 BD, issued January 25, 2008.

DWR, 2012. *Urban Levee Design Criteria*. May.

ENGEO, 2005a. *Geotechnical Exploration, River Islands Stage 1, Lathrop, California*. Project No. 5044.5.001.01. July 29.

ENGEO, 2005b. *Reclamation District 2062 Levee Testing and Observation Services during Grading, River Islands, Lathrop, California*. Project No. 5044.4.100.01. December 20.

ENGEO, 2015. *River Islands at Lathrop Stage 1 Project Wind-Wave Analysis.* March 13.

ENGEO, 2016a. *Urban Levee Design Criteria Evaluation, River Islands Stage 1 Levees, Lathrop, California*. Project No. 5044.410.001. March 18.

ENGEO, 2016b. *River Islands Stage 1A Geotechnical Data Report, River Islands, Lathrop, California*. Project No. 5044.410.001. March 16.

ENGEO, 2016c. *Levee Inspection Trench Observation Summary, Lathrop, California*. Project No. 5044.410.001. February 3.

ENGEO, 2016d. *Internal Lake slope Stability Technical Memorandum, Lathrop, California*. Project No. 5044.410.001. March 15.

ENGEO, 2016e. *Pedestrian Bridge Slope Stability Technical Memorandum, Lathrop, California*. Project No. 5044.410.001. March 17.

MBK, 2016a. *MBK River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Levee Loading Evaluation*. Technical memorandum. March.

MBK, 2016b. *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Hydraulic Analysis*. Technical memorandum. March.

MBK, 2016c. *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Minimum Top of Levee Compliance Evaluation*. Technical memorandum. March.

MBK, 2016d. *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Erosion Evaluation*. Technical memorandum. March.

MBK, 2016e. *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Encroachment and Penetration Evaluation*. Technical memorandum. March.

MBK, 2016f *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Vegetation Evaluation*. Technical memorandum. March.

MBK, 2016g. *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Exception to the* Urban Levee Design Criteria *for Emergency Actions*. Technical memorandum. March.

RD 2062, 2015. *Reclamation District 2062 Emergency Operations Plan*. December.

RD 2062, 2016a. Levee Security Plan, Island Reclamation District No. 2062, Lathrop, California. March.

RD 2062, 2016b. District Operation and Maintenance Manual.

SJ County, 2016. San Joaquin County Flood Contingency Map: RD 2062, 2107: Stewart Mossdale Tract. March 18, 2016.

USACE, 1992. *Automated Coastal Engineering System (ACES) Technical Reference* (version 1.07). September.

USACE, 2002. *Sacramento and San Joaquin River Basins Comprehensive Study*. Interim Report. December.

City of Lathrop Ordinance No. XX-XXXX,

APPENDICES

Appendix A – Engineers' Certifications

Appendix B – Independent Panel of Experts' Review Report on the Reclamation District 2062 River Islands at Lathrop Stage 1 Levee System Urban Level of Protection Engineer's Report

Appendix C – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Hydraulic Analysis*. Technical memorandum. . March 2016. (**MBK, 2016b.)**

Appendix D – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Minimum Top of Levee Compliance Evaluation*. Technical memorandum. March 2016. (**MBK, 2016c.)**

Appendix E – *River Islands Stage 1A Geotechnical Data Report, River Islands, Lathrop, California*. Project No. 5044.410.001. March 16. (**ENGEO, 2016b**.)

Appendix F – *Urban Levee Design Criteria Evaluation, River Islands Stage 1 Levees, Lathrop, California*. Project No. 5044.410.001. March18. (**ENGEO, 2016a**.)

Appendix G – *MBK River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Levee Loading Evaluation*. Technical memorandum. March 2016. (**MBK, 2016a.)**

Appendix H – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Erosion Evaluation*. Technical memorandum. March 2016. (**MBK, 2016d.)**

Appendix I – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Encroachment and Penetration Evaluation*. Technical memorandum. March 2016. (**MBK, 2016e.)**

Appendix J – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Vegetation Evaluation*. Technical memorandum. March 2016. (**MBK, 2016f.)**

Appendix K – *River Islands at Lathrop Stage 1 Project Wind-Wave Analysis.* March 13, 2015. (**ENGEO, 2015**.)

Appendix L – *River Islands at Lathrop Stage 1 Project, Urban Level of Flood Protection, Exception to the Urban Levee Design Criteria for Emergency Actions*. Technical memorandum. March 2016. (**MBK, 2016g.)**

Appendix M - *Levee Inspection Trench Observation Summary, Lathrop, California. Project No. 5044.410.001*. February 3, 2016. (ENGEO, 2016c.)

Appendix N - *Internal Lake slope Stability Technical Memorandum, Lathrop, California. Project No. 5044.410.001*. March 15, 2016. (ENGEO, 2016d.)

Appendix O - *Pedestrian Bridge Slope Stability Technical Memorandum, Lathrop, California. Project No. 5044.410.001*. March 17, 2016. (ENGEO, 2016e.)

Appendix P – [placeholder for Comment Response Memo Re: scour and failure]. March 2016. MBK Engineers.
