



Meeting Summary

Levee Performance Scope

Definition Work Group Meeting #4

October 8, 2009, 9:00 am – 3:00 pm

**Location: MWH American River Room
3321 Power Inn Road, Suite 300
Sacramento, CA 95826**

WORK GROUP ATTENDANCE:

Name	Affiliation	Status
Peter Buck	SAFCA	Partner
Steve Chainey	CA Department of Water Resources (DWR)	Partner
Stuart Edell	Butte County Public Works, Sutter Butte Flood Control Agency	Partner
Les Harder	SAFCA, TRLIA	Partner
Ron Heinzen	SJAFCA	Partner
Gil Labrie	Brannan-Andrus LMD	Partner
Mary Perlea	U.S. Army Corps of Engineers	Partner
Jeff Twitchell	Sutter County	Partner
Mike Inamine	DWR	DWR Lead
Roger Lee	DWR	CVFPO*
Joseph Bartlett	DWR	CVFPO*
Mary Jimenez	MWH Americas Inc. (MWH)	Technical Lead
Scott Stewart	MWH	Team
Dorian Fougères	Center for Collaborative Policy (CCP)	Facilitator
Nicole Ugarte	CCP	Facilitation Support / Note-taker

*Central Valley Flood Planning Office

Absent:

Reggie Hill	Lower San Joaquin Levee District	Partner
Chris Neudeck	RD 17 & Sherman Island	Partner
Bill Darsie	RD 17 & Sherman Island	Alternate

ACTION ITEMS:

1. Review Draft Deliverable #2 and send suggestions to Mary Jimenez (mary.j.jimenez@us.mwhglobal.com) by the close of business Friday, October 16, 2009
 - Partners are asked to focus on the Key Factors identified as *Less Important*
2. Review Draft Deliverable #3 and send resources or citations to Mary Jimenez (email above) by the close of business Friday, October 16, 2009
 - Partners are asked to focus on the Reference Additions

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

3. Review Draft Deliverable #4 and send titles or information to Mary Jimenez (email above) by the close of business Friday, October 16, 2009

MEETING #4 OBJECTIVES:

- Detailed discussion of Deliverable #2
- Review Draft Deliverable #3

SUMMARY:

Welcome and Greetings

Dorian Fougères, Facilitator with CCP, opened the meeting and reviewed the agenda and meeting materials.

Timeline for Comment & Sharepoint Site

Mary Jimenez, MWH Technical Lead, explained that MWH is setting up a Sharepoint site for the Work Group to view CVFPP documents. All Partners will have the opportunity to comment on the Regional Conditions Summary Report by downloading the draft from the Sharepoint site, and submitting comments to Ms. Jimenez. Questions regarding the Sharepoint Site can be directed to Rachel Arendt at MWH. Her contact information is included in the Meetings 2 and 3 Q&A handout. The tentative deadlines are mid-November for Chapters 1-2, and early December for Chapters 3-4 (that include Problems and Opportunities). Ms. Jimenez clarified that the Levee Performance Scope Definition Work Group's deliverables would be published as a stand-alone document as well as integrated into the Regional Conditions Summary Report.

Ms. Jimenez also referred to the revised Glossary, last updated October 1, 2009. The Partners' comments were integrated in the previous draft. Additional revisions to the Glossary can be sent to Ms. Jimenez.

CVFPP General Questions and Answers

The CVFPP General Questions and Answers document was created in response to questions from Meetings 2 and 3 from the Regional Conditions Work Groups. Roger Lee, Central Valley Flood Planning Office, reviewed the major topics. The Regional Conditions Work Groups had been planning to meet every two weeks for ten meetings, but due to the content and transitions between meetings, the RCWGs will instead meet every three weeks for a total of seven meetings. There will also be a valley-wide forum next February for all the Work Groups to meet together. Mr. Lee reiterated that the Levee Performance Scope Definition Work Group's products will not be incorporated verbatim into the Summary Report, though there will be a stand alone document in addition to what gets incorporated.

Discussion of Deliverable #2

During Meeting #3, the group had developed a list of Existing Problems and Expected Future Challenges from the Key Factors Outline, and worked through the Key Factors identified as **Critical**. For Meeting #4, the group continued identifying Technical Risk Factors, Policy Issues, and Financial Constraints for Key Factors identified as **Important** as well as some Key Factors identified as **Less Important**. Due to the group's limited time, the remaining **Less Important** Factors were divided among the Partners to work through individually, to be followed by group comment on the corresponding information. Ms. Jimenez will revise the document based on the submitted individual work, and send the revised Draft Deliverable #2 out to the group via email for comment.

The revised Draft Deliverable #2 is attached below (see p. 9).

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

Final Review of Draft Deliverable #1

During Meeting #3, Partners modified the language of the Key Factors to address flagged issues and inconsistencies. During Meeting #4, the Partners were given time for a final review and discussion. A Partner raised concern over how Subsidence in the Delta was characterized. For clarification, the group agreed to make the following modifications:

- *Subsidence: Organic Soil Decomposition (Delta Specific)* was changed to *Delta Island Subsidence: Organic Soil Decomposition*
- *Subsidence: Levee Settlement* was changed to *Levee Settlement*
- *Delta – Consolidation* was changed to *Delta Specific Consolidation of Organic Foundation Materials*, adding the comment *The soft organic soils in the delta levee foundations that are responsible for major settlement also have complex low shear strengths that are associated with slope stability problems*

Other minor edits were incorporated to reflect consistency between the Draft Deliverables #1 and #2.

The revised Draft Deliverable #1 is attached below (see p. 4).

Final Review of Draft Deliverable #3

The group reviewed the revised Reference List, and offered final suggestions. A Partner further suggested that the Deliverable identify the conference where the paper was presented, when applicable.

The Draft Deliverable #3 is attached below (see p. 23).

Final Review of Draft Deliverable #4

The group reviewed the revised Levee Performance Evaluation Activities, and offered final suggestions for Ongoing and Completed Projects.

The Draft Deliverable #4 is attached below (see p. 31).

Next Steps

- **The Partners will review and finalize the draft deliverables via email by Friday, October 16, 2009**
- The MWH Team will check and finalize consistency between Draft Deliverable #1 and Draft Deliverable #2
- The MWH Team (Rachel Arendt) will send the Partners access to the Sharepoint site to review and comment on draft documents

CENTRAL VALLEY Central Valley Flood Protection Plan
FLOOD MANAGEMENT
PLANNING PROGRAM **Levee Performance Scope Definition Work Group**
DRAFT Deliverable 1 – Key Factors



DRAFT Deliverable 1 – Key Factors

Review and update the list of key factors that affect levee performance and should be covered in the 2012 Central Valley Flood Protection Plan to create a successful plan. Prioritize the list into 3 levels of importance (critical (C), important (I), less important (LI)).

Table 1. List of Key Factors and Recommended Prioritization

Factors	Internal Erosion	External Erosion	Slope Stability	Notes/Clarification
Levee Foundation	C	C	C	
Levee Geometry	C	C	C	
Encroachments	I	LI	I	
Lack of Vegetation Cover	LI	C	I	
Vegetation Roots and Treefall	LI	LI	LI	
Land Use Practices Outside of Easement	I	LI	I	
Burrowing Rodents	C	LI	LI	
Hydrology and Hydraulics (Hydraulic Head)	C	C	C	
Impediments to Flood Fighting, Inspection and Maintenance	I	I	I	
Structure Outside Levee Right of Way	C	LI	LI	
Construction & Other Manmade Activities	I	LI	LI	
Unremediated Past Seepage Distress	C	LI	LI	
Levee Soil Material	C	C	C	
Waterside Erosion	C	C	C	
Penetrations Through or Under Levee	C	LI	LI	
Closure Structures and Embankments	LI	LI	LI	
Earthquakes	LI	LI	LI	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

Delta Specific	C	LI	C	
Delta Island Subsidence: Organic Soil Decomposition	LI	LI	LI	Does not mean that it doesn't happen, just less important
Levee Settlement	LI	LI	LI	
Delta Specific Consolidation of Organic Foundation Materials	LI	I	LI	The soft organic soils in the delta levee foundations that are responsible for major settlement also has complex low shear strengths that are associated with slope stability problems
Upper San Joaquin Specific Groundwater and Oil Extraction	I	I	LI	
Substandard Levee Modifications	I	LI	I	
Delta Specific	I	LI	C	
Rainfall Duration and Intensity	LI	I	I	
Key: C = critical; I = important; LI – less important				

Outline of Failure Mechanisms for Key Factor Prioritization

1. INTERNAL EROSION
 - a. Underseepage
 - i. Levee Foundation
 1. Historical Channel Fill And Mining Deposits
 2. Past Levee Breaches and Sand Boils
 3. Levee Modifications
 4. Pre-Existing Geomorphology
 5. General geotechnical stratigraphy
 - ii. Levee Geometry
 - iii. Waterside Erosion
 - iv. Encroachments
 1. Swimming Pools
 2. Ditches
 - v. Vegetation Roots and Treefall
 1. Treefall
 2. Root Penetration/Piping
 - vi. Land Use Practices
 1. Excavations Outside Of Levee Footprint
 2. Agriculture

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

- 3. Burrowing Rodent Habitat
 - 4. Visual & Physical Obstructions For Inspection And Flood Fighting
 - vii. Penetrations
 - 1. Pipes
 - 2. Utilities
 - 3. Foundations
 - 4. Power Poles
 - 5. Wells (water wells, gas wells)
 - viii. Burrowing Rodents
 - ix. Hydraulic Head: Peak And Duration
 - 1. Climate Change
 - 2. Reservoir Operations
 - 3. Flood Relief Structures
 - 4. Upstream/Downstream Levee Failures
 - 5. Different Levels Of Protection
 - 6. Maintaining Channel Capacities
 - x. Impediments to Flood Fighting, Inspection, and Maintenance
 - xi. Structures Outside Levee Footprint
 - xii. Construction and Other Manmade Activities
 - 1. Hydraulic Fracturing
 - 2. Vibrations
 - 3. Excavations
 - 4. Dredging
 - xiii. Unremediated Past Seepage Distress
- b. Through Seepage
 - i. Levee Soil Material
 - ii. Waterside Erosion
 - iii. Land Use Practices
 - 1. Visual And Physical Obstructions For Inspection And Flood Fighting
 - 2. Burrowing Rodent Habitat
 - iv. Levee Geometry
 - v. Encroachments
 - 1. Gardens
 - 2. Irrigations
 - 3. Posts
 - 4. Fences
 - 5. Gates
 - 6. Residential Structures
 - 7. Retaining Walls & Pump Stations
 - 8. Swimming pools in levee slopes

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

- vi. Vegetation Roots
 - vii. Penetrations
 - 1. Pipes
 - 2. Power poles
 - viii. Closure Structures
 - 1. Railroad/Highway Crossing
 - ix. Burrowing Rodents
 - x. Hydraulic Head: Peak and Duration
 - 1. (All included under 1.a. ix.)
 - xi. Impediments to Flood Fighting, Inspection, and Maintenance
 - xii. Construction and Other Manmade Activities
 - 1. Hydraulic Fracturing
 - 2. Vibrations
 - 3. Levee Excavations
 - xiii. Unremediated Past Seepage Distress
 - c. Earthquakes
 - i. Liquefaction
 - ii. Cracking
 - iii. Differential Movement
 - iv. Differential Settlement
 - d. Non-Earthquake Differential Settlement
 - i. Organic Soil Decomposition (Delta)
 - ii. Subsidence: Consolidation (Delta) and Groundwater and Oil Extraction (Upper San Joaquin)
 - iii. Construction
2. EXTERNAL EROSION
- a. Overtopping
 - i. Geometry
 - ii. Levee Soil Material and Vegetation Cover
 - b. Wave Wash
 - i. Geometry
 - ii. Levee Soil Material and Vegetation Cover
 - c. Fluvial/Bank Erosion
 - i. Geomorphology
 - d. Rainfall Duration and Intensity
 - e. Vegetation Cover, Roots, and Treefall
 - i. Erosion
 - 1. Reduce Scour Velocity
 - 2. Wave Attenuation
 - 3. Soil Reinforcement

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

4. Treefall
5. Local Hydraulic Scour
6. Channel Meandering

3. SLOPE STABILITY (EARTHQUAKES, RAPID DRAWDOWN, SEEPAGE)

- a. All Factors For Under Seepage
- b. All Factors For Through Seepage
- c. All Factors For External Erosion
- d. Construction and Other Manmade Activities
 - i. Roads/Highways
 - ii. All included under 1.b. xii.

Note:

- *Where topics are repeated they are meant to include all the factors listed in the first explanation. In some cases additional factors were added to subsequent explanations.*
- ** The asterisk indicates that there was disagreement among the Partners on its effect, and that more discussion would be needed to determine how vegetation related to the other factors.*

Version date: 10/09/09



Draft Deliverable 2 – Existing Problems and Expected Future Challenges

Deliverable 2 – Existing Problems and Expected Future Challenges

Review and update the list of existing problems and expected future challenges related to levee performance within the CVFPP project area. Additional details about the identified problems and future challenges will be developed and captured in the Regional Conditions Summary Work Groups.

<u>CRITICAL</u>	
LEVEE FOUNDATION	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Underseepage • Slope stability • Seismic
2. Policy	<ul style="list-style-type: none"> • Variable design flood elevation • Variable safety factors • Engineering standards change over time • New regulations • New government priorities • New legislation
3. Financial Constraints	<ul style="list-style-type: none"> • Corps benefits/cost ratio • Limited Fed/state/local funding
LEVEE GEOMETRY	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Inability to access for flood fighting • Slope stability • Internal erosion to through seepage • Erosion below and above levee toe • Hydraulic constraints to waterside improvements

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

2. Policy	<ul style="list-style-type: none"> • Insufficient, inconsistent minimum state or federal standards for existing and new levees • Regulatory constraints to waterside improvements and repairs
3. Financial Constraints	<ul style="list-style-type: none"> • High cost to bring existing levees to new standards
HYDROLOGY AND HYDRAULICS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Overtopping • Landside erosion by overtopping • Climate change affecting watershed hydrology and hydraulics • Upstream/downstream levee failures • Development in the watershed that increases peak runoff • Development in the bypasses and overflow that decreases flow conveyance • Structural weakening due extended time of high stage and rapid drawdown
2. Policy	<ul style="list-style-type: none"> • Reservoir operations • Flood relief structures • Different levels of protection • Maintaining channel capacities • Operation of closure structures • Inconsistent freeboard standards among Federal and State agencies** • Unresolved risk, uncertainty and confidence level criteria*
3. Financial Constraints	<ul style="list-style-type: none"> • Corps benefits/cost ratio • Limited Fed/state/local funding
LEVEE SOIL MATERIAL	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Availability of borrow material • Through seepage • Stability • Material quality and soil contamination • Tension cracks • Embankment erosion
2. Policy	<ul style="list-style-type: none"> • Environmental restrictions on use of dredge materials and work periods • Environmental and cultural restrictions on use of borrow material • Variable acceptance criteria by different agencies

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Surface Mining and Reclamation Act regulations and constraints • Air quality restrictions on use of aged equipment
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of material sources and transportation • Cost of material placement • Cost of permitting
WATERSIDE EROSION	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Levee slope failure • Seepage through the levee and foundation • Loss of waterside berm • Loss of critical sections • Impact of geomorphology • Source of sediment deposition downstream • River meander • Weak composition of levee and foundation • Loss of vegetation and natural habitat
2. Policy	<ul style="list-style-type: none"> • Environmental constraints • Corps policy on vegetation
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of bank protection • Cost of mitigation • Limited locations available for bank habitat mitigation • Limited Federal and State funding
EARTHQUAKE (IN DELTA)	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability • Settlement due to liquefaction • Increased salinity of water supply • Interruption of water deliveries south of the Delta • Loss of islands • Wave erosion of flooded islands • Loss of lives • Sea level rise • Loss or interruption of transportation and infrastructure
2. Policy	<ul style="list-style-type: none"> • Inconsistency in analytical methods and lack of regulation thereof

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Low benefit/construction cost ratio • Whether to protect all Delta islands (DRMS)
3. Financial Constraints	<ul style="list-style-type: none"> • High cost of seismic mitigation and reclaiming flooded islands • Low benefit/construction cost ratio
SUBSTANDARD LEVEE MODIFICATIONS AND REPAIRS (IN DELTA)	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability • Seepage through the levee • Seepage through the foundation • Settlement • Wave and wake erosion • Loss of critical section
2. Policy	<ul style="list-style-type: none"> • Lack of oversight • Time required for environmental permitting
3. Financial Constraints	<ul style="list-style-type: none"> • Inadequate resources of local levee maintaining agencies • Liability for regulatory penalties • Cost of environmental mitigation • Loss of Federal funding for flood repair • Liability for inadequate modifications and repairs resulting in failure
<u>IMPORTANT</u>	
ENCROACHMENTS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Inability to access for flood fighting, maintenance, repairs, and inspection • Slope stability • Internal erosion to through seepage • Hydraulic constraints to waterside improvements • Lack of information regarding existing structures • Waterside encroachments that exacerbate the erosion of the slope • Inability to remediate past seepage distress
2. Policy	<ul style="list-style-type: none"> • Insufficient, inconsistent minimum state or federal standards for existing and new levees • Regulatory constraints to waterside improvements and repairs

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Difficulty of policy enforcement • Constraints of private property, history, and local jurisdiction
3. Financial Constraints	<ul style="list-style-type: none"> • High cost to bring existing levees to new standards • High cost to analyze encroachments • High cost and duration of litigation
IMPEDIMENTS TO FLOOD FIGHTING	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Lack of access for inspection, flood fighting, and maintenance • Availability of materials • Availability of personnel • Safety of personnel and equipment
2. Policy	<ul style="list-style-type: none"> • Hazardous materials constraints • Environmental and cultural restrictions on use of borrow material • Timely resource agency consultation process • Criteria for emergency relief breaches • Surface Mining and Reclamation Act regulations and constraints • Confused command structure before Incident Command System is triggered • Government endorsement of a levee breach or flood diversion • Lack of specificity in local emergency response plans and communication • Lack of evacuation plans • Inconsistent policy for government involvement in non-project levees
3. Financial Constraints	<ul style="list-style-type: none"> • Availability of government resources • High cost of materials and transportation • High cost of post-project mitigation • High cost of pumping • High cost of loss of land use
LACK OF VEGETATION COVER	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Loss of waterside berm and critical sections due to erosion • Impact of geomorphology • Source of sediment deposition downstream • River meander

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Loss of natural habitat due to erosion • Progressive slope failure due to erosion of the bottom of the slope • Soil conditions not conducive to vegetation • Grazing practices
2. Policy	<ul style="list-style-type: none"> • Corps policy on vegetation • Environmental constraints • Variable acceptance criteria by different agencies
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of bank protection • Cost of mitigation • Limited locations available for bank habitat mitigation
LAND USE PRACTICES OUTSIDE RIGHT OF WAY	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Rodent food supply • Excavations, including irrigation and drainage ditches • Lack of access for flood fighting, maintenance, repair, and inspection* • Waterworks, irrigation, and groundwater recharge • Adjoining infrastructure • Urbanization and development outside of the levee right of way • Limitation of underseepage mitigation alternatives and levee setbacks
2. Policy	<ul style="list-style-type: none"> • Lack of complete policy for control for areas outside levees • Lack of permitting authority and policy outside the right of way • Inconsistent and emerging right of way width standards
3. Financial Constraints	<ul style="list-style-type: none"> • Cost and duration of condemnation • Cost of mitigating landside practices • High cost of real estate acquisition
BURROWING RODENTS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Through seepage • Underseepage • Slope stability • Potential impacts on flood fighting • Difficulty identifying seepage paths • Progressive slope failures

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Lack of understanding of how vegetation affects rodent populations and activity
2. Policy	<ul style="list-style-type: none"> • Environmental constraints • Inconsistent grouting policies • Inability to control rodent food sources and habitat within and beyond levee right of way, including channels and floodways • Conflicting environmental constraints, such as habitat restoration, and levee safety practices
3. Financial Constraints	<ul style="list-style-type: none"> • Increased cost for rodent control • Increased cost for mitigation
STRUCTURES OUTSIDE LEVEE RIGHT OF WAY	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Excavations, including irrigation and drainage ditches • Lack of access for flood fighting, maintenance, repair, and inspection* • Waterworks, irrigation, and groundwater recharge • Adjoining infrastructure • Urbanization and development outside of the levee right of way • Limitation of underseepage mitigation alternatives and levee setbacks • Lack of technical information regarding existing structures • Impact of owner modification of existing structures • Lack of owner maintenance of existing structures
2. Policy	<ul style="list-style-type: none"> • Lack of complete policy for control for areas outside levees • Lack of permitting authority and policy outside the right of way • Inconsistent and emerging right of way width standards
3. Financial Constraints	<ul style="list-style-type: none"> • Cost and duration of condemnation • Cost of mitigating outside structures • High cost of real estate acquisition • High cost of investigating structures
UNREMIEDIATED PAST SEEPAGE DISTRESS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Inconsistent or lack of information (for example, location, geotechnical information) • Challenge of analyzing progressive degradation of levee and foundation • Poor records • Inconsistent assessment, reporting and repair

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Improper repair
2. Policy	<ul style="list-style-type: none"> • Lack of standard reporting policy • Lack of standard repair policy • Lack of policy to prevent temporary repairs from becoming permanent repairs
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of remediation • Cost of reporting • Cost of removal of past temporary repairs and replacement with permanent repairs • Potential cost of right of way for permanent repairs
PENETRATIONS THROUGH OR UNDER LEVEE	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability • Internal erosion • Lack of information regarding existing penetrations • Inability to remediate past seepage distress • Inability to properly remediate seepage • Longevity of penetration materials • Inadequate closure devices • Hidden deficiencies
2. Policy	<ul style="list-style-type: none"> • Inconsistency among and between Local, State, and Federal agencies regarding penetration policy • Regulatory constraints to waterside improvements and repairs • Difficulty of enforcing encroachment policies • Existence of penetrations impedes levee repairs and improvements (<i>also Technical issue</i>)* • Inconsistent welding standards for steel pipes • Title 23 needs to be updated**
3. Financial Constraints	<ul style="list-style-type: none"> • High cost to bring existing penetrations to new standards • High cost to analyze, modify, or remove penetrations • High cost and duration of litigation
LEVEE SETTLEMENT: UPPER SAN JOAQUIN SPECIFIC GROUNDWATER & OIL EXTRACTION	EXISTING PROBLEMS & FUTURE CHALLENGES

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

1. Technical Risk Factor	<ul style="list-style-type: none"> • Underseepage • Slope stability • Overtopping
2. Policy	<ul style="list-style-type: none"> • Lack of groundwater regulation • Lack of surface water availability • Environmental constraints • Lack of regulation for oil extraction impacts (?) • Unclear agency responsibility for repairing deficient levee geometry (not maintenance issue or original design flaw)
3. Financial Constraints	<ul style="list-style-type: none"> • Limited Fed/State/Local funding • Lack of identified funding mechanism
SUBSTANDARD LEVEE MODIFICATIONS AND REPAIRS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability • Seepage through the levee • Seepage through the foundation • Settlement • Wave and wake erosion • Loss of critical section
2. Policy	<ul style="list-style-type: none"> • Lack of oversight • Time required for environmental permitting • Lack of policy to prevent temporary repairs from becoming permanent repairs
3. Financial Constraints	<ul style="list-style-type: none"> • Inadequate resources of local levee maintaining agencies • Liability for regulatory penalties • Cost of environmental mitigation • Loss of Federal funding for flood repair • Cost of removal of past temporary repairs and replacement with permanent repairs • Liability for inadequate modifications and repairs resulting in failure
RAINFALL DURATION & INTENSITY	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability • Weathering effects

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Saturation of levee slope and foundation • External erosion of the levee slope • Naturally occurring artesian conditions • Improper internal drainage control • Impacts to flood fighting, maintenance, repairs, and inspection
2. Policy	<ul style="list-style-type: none"> • Title 23 • Access requirements for maintenance, repairs, inspections, and emergency response and emergency action plans • Private property constraints • Interior drainage requirements, including development and hardscaping
3. Financial Constraints	<ul style="list-style-type: none"> • -
<i><u>LESS IMPORTANT</u></i>	
VEGETATION ROOTS & TREEFALL	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Killing trees on the landside due to too much water • Sudden large-scale mortality of woody vegetation – slope stability • Waterside treefall – large individual tree at top of levee, leading to overtopping/failure • Horizontal versus vertical roots – one may be harmful and one may be beneficial • Lack of inspection access for flood fighting • Difficulty identifying seepage impacts associated with tree roots • The windfalls are important inputs to fish habitat (i.e., Instream Woody Material) • Erosion • Inability to inspect or repair
2. Policy	<ul style="list-style-type: none"> • Title 23 • Compensate/mitigate for impacts to flood conveyance, jeopardy opinion on waterside • Environmental regulations (e.g., Corps) • Corps policy; lack of maintenance • Lack of policy enforcement
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of remediating levee system if roots need to be removed • Cost of mitigation and natural habitat restoration • Cost of erosion repair

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Cost of seepage mitigation
CONSTRUCTION & MANMADE ACTIVITIES	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Construction traffic and loading • Temporary levee degradation • Erosion control • Cofferdams and other temporary barriers • Post-construction stability • Changed conditions resulting in design changes • Hydrologic risk of high water • Wavewash protection • Loss of vegetation and habitat • Working hours in urban areas
2. Policy	<ul style="list-style-type: none"> • Criteria for post-construction stability • Environmental constraints • Variable regulatory requirements
3. Financial Constraints	<ul style="list-style-type: none"> • Cost of environmental mitigation • Construction materials availability • Local funding availability
CLOSURE STRUCTURES AND EMBANKMENTS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Stability and seepage • Underseepage • Variable design considerations • Erosion around or beneath existing or new closure structures • Operation responsibility • Impacts to adjacent properties
2. Policy	<ul style="list-style-type: none"> • Inconsistent minimum State or Federal Standards • Environmental constraints
3. Financial Constraints	<ul style="list-style-type: none"> • High cost to bring existing closure structures and embankments to new standards • High initial cost for new structures • Construction materials availability

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Environmental mitigation costs
EARTHQUAKES	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Liquifaction • Slope stability • Inability to access for flood fighting • Potential for internal erosion • Potential for external erosion • Through seepage • Structural failures • Settlement • Cracking • Quick repair needs, prior to flood season
2. Policy	<ul style="list-style-type: none"> • Lack of clear seismic design criteria • Do not design for earthquakes as cost is prohibitive and earthquakes are rare events and levees unlikely to be holding water at the time of earthquake • Need to develop an emergency action plan to manage seismic risk, including estimate of potential damage, identification of borrow areas and haul routes in advance, development of plan assuming Corps in lead of quick interim repair and state to provide lands, easements, borrow, and right of way with updates every few years.
3. Financial Constraints	<ul style="list-style-type: none"> • High cost to analyze levees for stability • Funding necessary to assess seismic vulnerability • Funding necessary to develop emergency action plan • Assumes federal emergency funding available for interim emergency repair
DELTA ISLAND SUBSIDENCE: ORGANIC SOIL DECOMPOSITION	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Slope stability
2. Policy	<ul style="list-style-type: none"> • Variable safety factors • Changing engineering standards • New government priorities • New legislation
3. Financial Constraints	<ul style="list-style-type: none"> • Limited funding abilities

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none"> • Availability and cost of material delivery and placement
LEVEE SETTLEMENT	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Underseepage • Slope stability • Overtopping • Landside erosion from overtopping • Loss of critical section • Lack of technical information regarding existing structures
2. Policy	<ul style="list-style-type: none"> • Lack of groundwater regulation • Lack of surface water availability • Environmental constraints • Lack of regulation for oil extraction impacts (?) • Unclear agency responsibility for repairing deficient levee geometry (not maintenance issue or original design flaw) • Variable safety factors and design flood elevations • Changing engineering standards • New regulations • New legislation • New government priorities
3. Financial Constraints	<ul style="list-style-type: none"> • Limited Fed/State/Local funding • Lack of identified funding mechanism • High cost of mitigation for repairs • Corps benefit/cost ratio • High construction costs
LEVEE SETTLEMENT: DELTA SPECIFIC CONSOLIDATION OF ORGANIC FOUNDATION MATERIALS	EXISTING PROBLEMS & FUTURE CHALLENGES
1. Technical Risk Factor	<ul style="list-style-type: none"> • Loss of freeboard or overtopping • Potential for slope instability as material is added to maintain freeboard • Potential for cracking/piping due to differential settlement, particularly as material is added to restore freeboard

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

	<ul style="list-style-type: none">• Potential for inadequate levee width following settlement
2. Policy	<ul style="list-style-type: none">• Eligibility for HMP• Eligibility for PL 84-99• Unclear responsibilities• Environmental regulatory policies
3. Financial Constraints	<ul style="list-style-type: none">• Lack of funding for levee freeboard/cross section restoration• Benefit/cost ratios• Cost of ground stabilization• Cost of levee rehabilitation• Limited federal/state funding



Draft Deliverable 3 – Reference List

Deliverable #3 – Reference List

Considering material provided previously to DWR for the levee evaluations programs, create a list of most applicable documents to use as reference material related to levee performance problems, opportunities, and standards during development of the CVFPP. For the list of documents developed, comment on applicability or usefulness of the document from your perspective.

Reference	Comment
1. California Department of Water Resources, "Delta Risk Management Strategy Phase 1, Final Risk Analysis Report," December 2008	
2. California Department of Water Resources, "Draft Guidance Document for Geotechnical Analyses, Urban Levee Geotechnical Evaluation Program, Revision 7", February 2009	
3. California Department of Water Resources, "Flood Warnings: Responding to California's Flood Crisis," January 2005	
4. California Department of Water Resources, "Memorandum Report After-Action Report February 1998 Floods," July 1998	
5. California Department of Water Resources, "Third Draft Interim Levee Design Criteria for Urban and Urbanizing Area State-Federal Project Levees," May 15, 2009 (http://www.water.ca.gov/floodsafe/docs/Third_Draft_Interim_Levee_Design_Criteria_(May_15,_2009).)	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

pdf)	
6. California Levee Roundtable, "California's Central Valley Flood System Improvement Framework," March 2009	
7. National Committee on Levee Safety, "Draft: Recommendations For a National Levee Safety Program, A Report to Congress from the National Committee on Levee Safety," January 15, 2009	
8. State of California Code of Regulations, "Title 23. Waters" April 1, 1990 (the most updated will be included, August 2009)	
9. State of California, Governor's Delta Vision Blue Ribbon Task Force, "Delta Vision Strategic Plan," October 2008	
10. State of California, Governor's Delta Vision Blue Ribbon Task Force, "Our Vision for the California Delta," January 29, 2008	
11. State of California, Sixth District Court of Appeal, "JAMES ARREOLA et al., Plaintiffs and Respondents, v. COUNTY OF MONTEREY et al., Defendants and Appellants, No. H021339," June 25, 2002.	
12. State of California, Third District Court of Appeal, "Peter PATERNO et al., Plaintiffs and Appellants, v. STATE of California et al., Defendants and Respondents No. C040553," November 26, 2003	
13. U.S. Army Corps of Engineers CECW-HS, "Interim Vegetation Guidance for Control of Vegetation on Levees," June 12, 2007	
14. U.S. Army Corps of Engineers Sacramento District, "Sacramento and San Joaquin River Basins California	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

Comprehensive Study Interim Report," December 20, 2002	
15. U.S. Army Corps of Engineers Sacramento District, "Sacramento and San Joaquin River Basins California Comprehensive Study Technical Studies Documentation," December 2002	
16. U.S. Army Corps of Engineers, "EM1110-2-1619, Risk-Based Analysis for Flood Damage Reduction Studies," August 1, 1996	
17. U.S. Army Corps of Engineers, "EM1110-2-1913, Design & Construction of Levees," April 30, 2000	
18. U.S. Army Corps of Engineers, "EM1110-2-1914, Design, Construction and Maintenance of Relief Wells," May 29, 1992	
19. U.S. Army Corps of Engineers, "EM1110-2-301, Guidelines for Landscape Planting on Floodwalls, Levees & Embankment Dams," January 01, 2000	
20. U.S. Army Corps of Engineers, "ETL 1110-2-569, Engineering and Design, Guidance for Levee Underseepage," May 01, 2005	
21. U.S. Army Corps of Engineers, "ETL 1110-2-570 (Draft) Certification of Levee Systems for the National Flood Insurance Program," April 10, 2009	
22. U.S. Army Corps of Engineers, "Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System Final Report of the Interagency Performance Evaluation Task Force," June 2009	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

<p>23. U.S. Army Corps of Engineers, Engineer Research and Development Center, "ERDC TR-01-16, Environmental Considerations for Vegetation in Flood Control Channels," J. Craig Fischenich, Ronald R. Copeland, December 2001</p>	
<p>24. U.S. Department of Homeland Security - Federal Emergency Management Agency, "Procedure Memorandum 34 - Interim Guidance for Studies Including Levees," August 22, 2005</p>	
<p>25. U.S. Department of Homeland Security - Federal Emergency Management Agency, "Revised Procedure Memorandum 43 - Guidelines for Identifying Provisionally Accredited Levees," March 16, 2007</p>	
<p>26. U.S. Department of Homeland Security - Federal Emergency Management Agency, Title 44 CFR Section 65.10 Nation Flood Insurance Program, "Mapping of Areas Protected by Levees," October 1, 2000</p>	
<p>27. United States Army Corps of Engineers, Sacramento District, "Sacramento and San Joaquin River Basins, California, Post-Flood Assessment," March 1999</p>	
<p>28. Resources Agency of California, "Final Report – Governor’s Flood Emergency Action Team," May 10, 1997</p>	
<p>29. Galloway G., Boland, J. Burby, R. J., Groves, C. B., Longville S., Link, L. E., Mount, J. F., Opperman, J., Seed, R.B., Sills, G. L., Smyth, J. J., Stork, R., Thomas, E., "A California Challenge--Flooding in the Central Valley," A Report to the Department of Water Resources, State of California, October 15, 2007</p>	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

<p>30. Seed, R., Bea, R., Abdelmalak, R., Athanasopoulos, A., Boutwell, G., Bray, J., Briaud, J.-L., Cheung, C., Cohen-Waeber, J., Collins, B., Cobos-Roa, D., Farber, D., Hanenmann, M., Harder, L., Inkabi, K., Kammerer, A., Karadeniz, D., Kayen, R., Moss, R., Nicks, J., Nimala, S., Pestana, J., Porter, J., Rhee, K., Riemer, M., Roberts, K., Rogers, J., Storesund, Govindasamy, A., Vera-Grunauer, X., Wartman, J., Watkins, C., Wenk, E., Yim, S. (2006) "Investigation of the Performance of the New Orleans Flood Protection Systems in Hurricane Katrina on August 29, 2005, Volume I: Main Text and Executive Summary, Final Report July 31, 2006," Independent Levee Investigation Team, Center for Information Technology Research in the Interests of Society (CITRIS), University of California, Berkeley</p>	
<p>31. California Department of Water Resources, "DRAFT FloodSAFE Strategic Plan," December 2008</p>	
<p>32. State of California, "The Disaster Preparedness and Flood Protection Bond Act of 2006 (Proposition 1E)," 2006</p>	
<p>33. State of California, "The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84)," 2006</p>	
<p>34. State of California, "Senate Bill 5/Assembly Bill 5 (Machado/Wolk)", 2007</p>	
<p>35. Leslie F. Harder, Jr. etc, "Improving Flood Protection Understanding How levees are Different From Dams," (year)</p>	
<p>36. U.S. Army Corps of Engineers, "Final Report: The Spring 2008 Midwest Flood," 2009</p>	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

37. George L. Sills and Leslie F. Harder, Jr., "Flood Fighting for Levees and Failures," 2009	
38. "Assembly Bill 156", 2008	http://www.water.ca.gov/deltainit/docs/ab156-factsheet.pdf
39. DWR, 2008. AB 156, Local Agency Annual Report 2008 for Project Levees of the State Plan of Flood Control.	
40. Flood Emergency Action Team (FEAT). Final Report of the Flood Emergency Action Team – 1997, 1997.	
41. Mussetter Engineering, Inc. and Jones & Stokes Associates, Inc., 2000. Evaluation of Roughness Effects of Increased Vegetation Associated with 1999 Pilot Project Flow Releases, prepared for the Friant Water Users Authority and the Natural Resources Defense Council, May	
42. San Joaquin River Restoration Program (SJRRP) Team. Preliminary Draft Initial Program Alternatives Report, June 2008.	Preliminary draft document, subject to revision as the SJRRP proceeds.
43. DWR, 1995. Sacramento-San Joaquin Delta Atlas. July.	Document available online at: http://baydeltaoffice.water.ca.gov/DeltaAtlas/index.cfm
44. National Marine Fisheries Service, "Public Draft Central Valley Salmon and Steelhead Recovery Plan," 2009	
45. Basham, Donald L., Harder, Leslie F., Verigin, Steve W., and Williams, Warren D., "Engineering Perspectives for a National Levee Safety Program," 2009	
46. Groves, Chris, Harder, Les, Kelley, Julie R., Sills, George, and Vroman, Noah, "The Spring 2008 Midwest Flood, Observations of Missouri and Iowa Levee Breaches, 21-23 July 2008," 2009	
47. Groves, Chris, Harder, Les, Kelley, Julie R., Sills, George, and Vroman, Noah, "Inspection of Levee Distress and Breaches During	

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

the Spring 2008 Midwest Flood,” 2009	
48. Northwest Hydraulic Consultants, “Final Work Products for Paradise Cut 1997 Flood Case,” 2000	
49. Amendment #5 to the FEMA-State Agreement for FEMA-758-DR	
50. Corps, 1992. Sacramento River Flood Control System Evaluation Phase IV	
51. Sacramento River Corridor Forum, Sacramento River Corridor Planning Forum Floodway Management Plan, 2007	Draft (2006)

Reference Additions	Comment or Detailed Reference Citation
52. Manuals from DHS, DWR, USACE	From DWR Levee Evaluations database
53. Standard Assessment Model (SAM)	Deborah Condon or Bill O’Leary of DWR
54. Levee Vegetation Studies Team: Federal ERDC/ California Science Team Interim Report	
55. CALFED ERP	Mike I to decide which document to include
56. Delta Smelt, FWS Recovery Plan	FWS Manager Doug Weinrich or his staff
57. SAFCA : Vegetation management plans for the American River Floodway	As Peter Buck if this is of importance
58. Sacramento Area Conservancy Forum	Look up the MOA or ask Burt Bundy or whoever is listed as the new director on the website for a broad mission statement. I believe Rod Mayer has the MOA with DWR

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

59. SAFCA Proposed Life Cycle Management Plan for Levee Vegetation	As Peter Buck if this is of importance
60. Rodents paper	DWR ground squirrel summary – from Flood Inspections?
61. State Designated Floodways Title 23	
62. SOP's from USACE, 4-11-08	
63. Geotechnical design guidance	
64. USACE Seepage Task Force	
65. Ayres and Associates – SRBPP Study (Draft)	
66. Safety Assurance Reviews Memo	
67. SOP, encroachment designs	
68. DWR Lower San Joaquin Hydraulics	
69. Corps criteria for PL 84-99 eligibility	
70. Delta: USACE 1985	
71. Yolo Bypass Management Plan	Contact Dave Feliz, DFG Wildlife Area Manager or Robin Kukalow, Yolo Basin Foundation



Draft Deliverable 4 – Levee Performance Evaluation Activities

Deliverable #4 – Levee Performance Evaluation Activities

Review and update a list of previously compiled levee performance evaluation activities to develop a comprehensive list of other levee performance evaluation activities that the CVFPP Plan Development Team should become familiar with and coordinate with regularly.

<u>DWR</u>
Ongoing Activities
Urban Levee Geotechnical Evaluation Program
Non-urban Geotechnical Levee Evaluation Program
USACE/SAFCA/DWR Levee Vegetation Research Collaborative
Construction inspections
CVFPB inspections, reviews, permitting activities
Assembly Bill 156 Levee Conditions Survey
Levee Maintenance Authority(ies) Inspection Reports (DWR; LDs; RDs,)
Urban Levee Geotechnical Evaluations – Geotechnical Data Reports (varies, 2008/09)
San Joaquin River Restoration Program
SB5: Requirements for Lower San Joaquin River Bypass Analysis
New EIP Guidelines
California Levee Vegetation Research Program
Central Valley Floodplain Evaluation and Delineation
Building Code Standards for Flood Management
Title 23 Revisions
Interim Levee Repairs Framework
Bay Delta Conservation Plan
Completed Activities
FloodSAFE Strategic Plan – Public Review Draft (June 2008)
Sacramento and San Joaquin River Basins California, Comprehensive Study – Interim Report (December 2002)

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

California Flood Management Task Force, Management Report (December 2002)
Delta Risk Management Strategy – Phase I Report (February 2009)
Sacramento and San Joaquin River Basins, California, Post-Flood Assessment (March 1999)
Final Report – Governor’s Flood Emergency Action Team (May 1997)
San Joaquin River System Levee Repair Prioritization Report (December 2007)
Flood Warnings: Responding to California’s Flood Crisis (2005 White Paper; January 2005)
California Levee Roundtable - California’s Central Valley Flood Control Improvement Framework (February 2009)
Third Draft Interim Levee Design Criteria for Urban and Urbanizing Area State-Federal Project Levees
Levee Flood Protection Zone maps (2008)
<u>U.S. Army Corps of Engineers</u>
Ongoing Activities
Annual Project levee inspections
System Analysis of State Plan of Flood Control
Sacramento River Bank Protection Program, California (Flood control system maintenance repairs construction authority)
Sacramento San Joaquin Delta CALFED Levee Stability Program
WRDA CALFED 2007 - Sacramento San Joaquin Delta – Delta Islands and Levees Feasibility Study
Sutter and Butte County Feasibility Study (with Sutter-Butte Flood Control Agency and DWR)
American River Common Features General Reevaluation Report
Sacramento River Bank Protection Program (Future maintenance authority projects)
West Sacramento General Reevaluation Report (Feasibility study; starting 2009)
Lower San Joaquin River Feasibility Study (with San Joaquin Area Flood Control Agency)
WRDA 2007 Periodic Inspections
Levee Assessment Pilot Study
Natomas Post-Authorization Change Report
Natomas GRR
Integrated Flood Management Study
Natomas Levee Improvement Program (NLIP)
Marysville Project Engineering Design Documentation
WRDA 96/99 Sacramento and American River Improvement Program

Meeting Summary: Levee Performance Scope Definition Work Group Meeting #4

Completed Activities
Lower Cache Creek Feasibility Study (March 2003)
Yuba River Basin Project, California (Feasibility Study, April 1998)
Sacramento River Flood Control Project, California, Mid-Valley Area, Phase III (August 2005)
San Joaquin River Restoration Program – Initial Program Alternatives Report (June 2008)
PL 84-99 for 2006 High Water Event
Mayhew Levee Improvement Project
<u>Regional/ Local Activities</u>
Ongoing Activities
Natomas Levee Improvement Program (NLIP)
Cache Creek Comprehensive Flood Management Program (as sponsored by Yolo County, not Corps)
West Sacramento Early Implementation Program
Sutter Butte Flood Control Agency Early Implementation Program
RD 17 Improvements/Repairs
TRLIA Levee Improvements on Feather River, Bear River, Yuba River, WPIC
Various Levee Improvement Projects (SJAFCA)
Hamilton City Flood Control and Environmental Restoration Project
RD 404 Improvement/Repairs
Development Fee Program, Erosion Studies, etc.
Completed Activities
Lower Cache Creek Bank Protection (recent projects by DWR)