SAN JOAQUIN RIVER RESTORATION PROGRAM

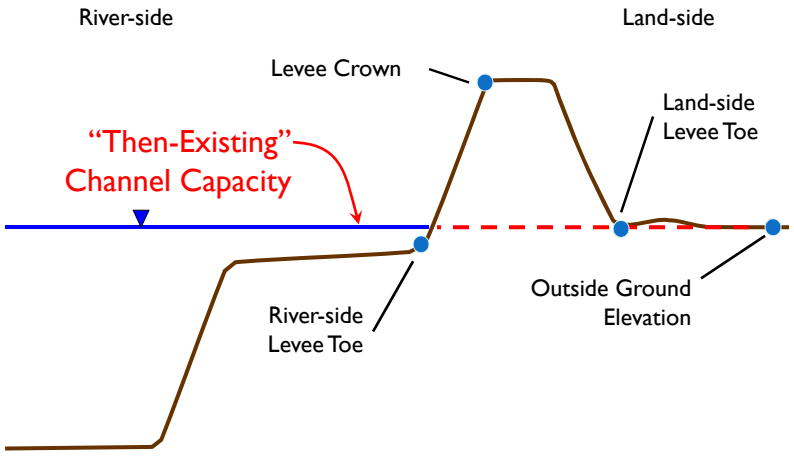
Geotechnical Stability Studies

September 20, 2012

Relationship between Geotechnical Integrity and Restoration Flows

- Restoration flows and SJRRP actions may impact flood system facilities, operations, and maintenance
- Current understanding of levee conditions in the Restoration Area is insufficient to accurately assess flood risk impacts
- Levee integrity is a component of establishing then-channel capacity
- Then-existing capacity currently limits Interim Flows

Limiting Capacity to Avoid Significantly Increasing Flood Risk



Note: Generalized cross section; actual landside levee toe may be above, at, or below river-side levee toe.

Assessing Geotechnical Integrity

- DWR Levee Evaluation Program
  - Study area includes entire Central Valley
    - Urban Levee Evaluation (ULE)
    - Non-Urban Levee Evaluation (NULE)
  - NULE serves as basis for initial assessment of levee integrity in the Restoration Area
- DWR Flood Risk Assessment Project
  - Specific to SJRRP Restoration Area

DWR NULE Project

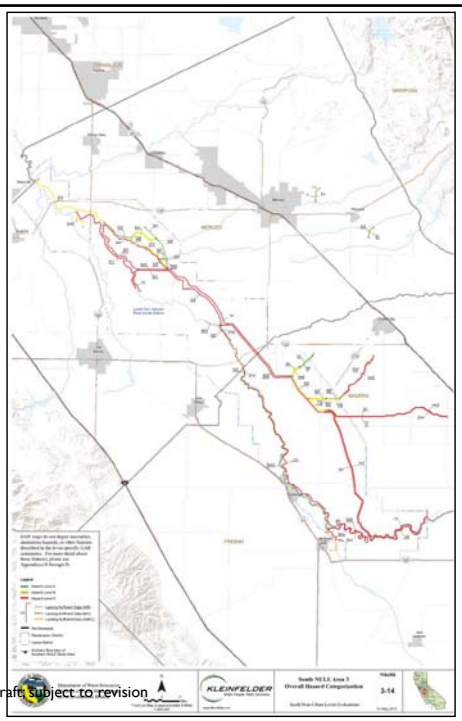
- Goals
  - Support CVFPP and federal/local flood projects
  - Provide geotechnical data, analysis and remedial alternatives to stakeholders
- Study area divided by major valleys
  - San Joaquin Study Area includes Restoration Area
- Two phases of Implementation
  - Phase 1 - Data compilation/past performance/ hazard rating (completed)
  - Phase 2 - Limited geotechnical drilling with detailed analyses (in progress - 2013 completion)

NULE Phase 1 - Findings

- Developed weighting scale for hazard indicators and rated levee segments based on potential for levee failure
- Compared scores to past performance to identify flood hazards
  - Hazard Level A – Low
  - Hazard Level B – Moderate
  - Hazard Level C – High
  - Category LD – Lacking sufficient data regarding past performance or hazard indicators

NULE Phase 1 - Findings

South NULE (Area 3 including Restoration Area)



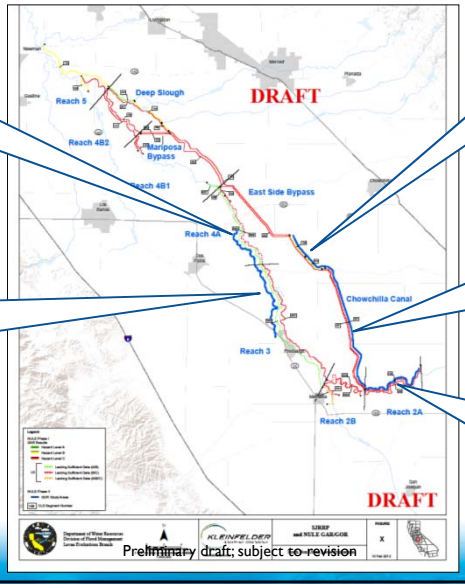
NULE Phase 2 - Summary

- Limited Field Explorations
  - Levees protecting populations > 1,000
- Field explorations generally consisted of:
  - CPT on crest every 1,000 feet
  - Rotary borings on crest every 5,000 feet
  - Select borings and CPTs at landside levee toe
- Documentation
  - GDR (Geotechnical Data Report) - Fall 2012
  - GOR (Geotechnical Overview Report) – Spring 2013

Phase 2 - Explorations

Reach 4A
45 CPTs
10 Borings

Reach 3A
69 CPTs
12 Borings



Eastside Bypass
35 CPTs
11 Borings

Chowchilla Canal
90 CPTs
35 Borings

Reach 2A
40 CPTs
18 Borings

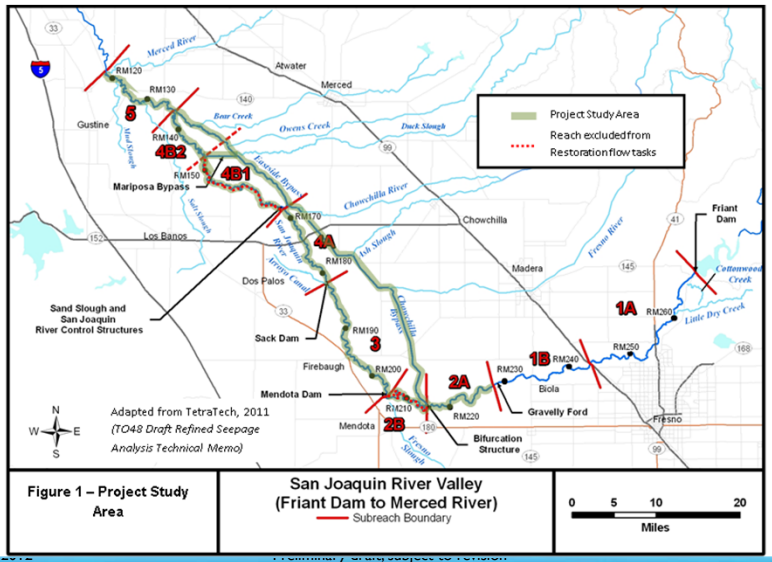
Preliminary draft; subject to revision

Flood Risk Assessment Project

- Goal: Assist SJRRP in assessing flood control system integrity associated with seepage and stability with respect to Corps criteria
- Primary Tasks
  - Preliminary assessment of levee integrity
  - Prioritization of levees based on hydraulic capacity
  - Geotechnical explorations
  - Geotechnical analyses with respect to Corps criteria
- Limitations
  - Analyses limited to seepage and stability
  - Study area excludes Reaches 2B and 4B1

Preliminary draft; subject to revision

FRAP – Study Area

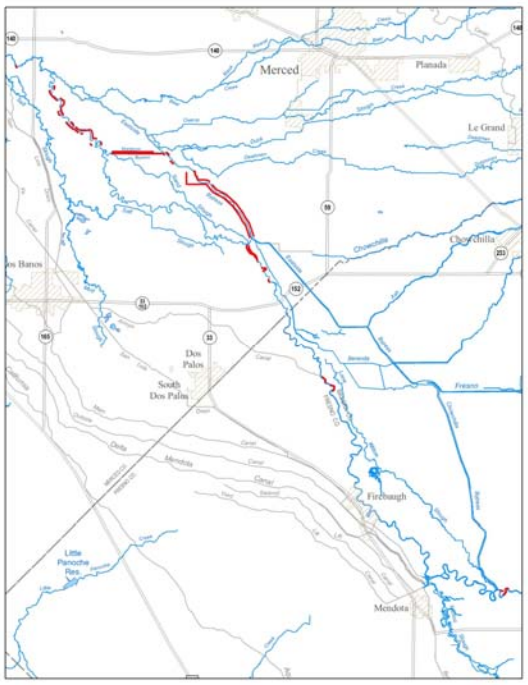


Assessment and Prioritization

- NULE GAR data indicate Study Area levees have high flood hazards
- Performed hydraulic analyses to assess areas with highest hydraulic impacts
- Prioritized areas for geotechnical exploration
  - Hydraulic impacts
  - Current channel capacity limitations
  - Relationship to NULE explorations
  - Anticipated Restoration Flow routing

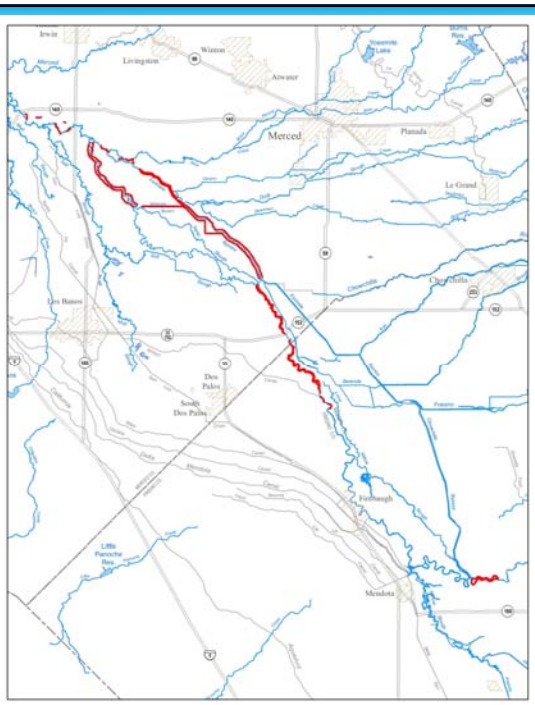
Preliminary Hydraulic Impacts at 2,000 cfs

(i.e. levee segments where WSE > elevation of landside levee toe)



Preliminary Hydraulic Impacts at 4,500 cfs

(i.e. levee segments where WSE > elevation of landside levee toe)



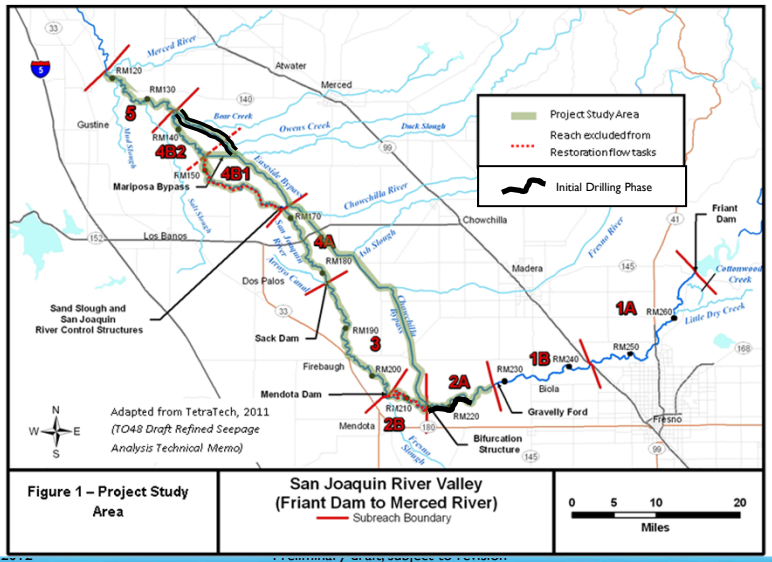
Current Flow Limitations

Reach	Design Capacity (cfs)	Restoration Flows (cfs)	Current Capacity Limitation – Levee Stability (cfs)
1A/1B	8,000	~ 4,000	None
2A	8,000	3,850	1,060
2B	2,500	~ 3,850	810
3	4,500	3,655	2,140
4A	4,500	3,655	630
4B1	1,500	TBD	Not Analyzed
4B2	10,000	3,655	990
5	26,000	4,055	1,690
Eastside Bypass	13,500 to 18,500	TBD	600

FRAP – Geotechnical Explorations

- Scope - Phased geotechnical evaluation of levee segments that would be contacted under Restoration flows
  - Drilling program generally consistent with NULE protocol
  - Geotechnical analyses of seepage and stability against USACE levee performance criteria
- Schedule
  - Initial Phase
    - Planning and permitting currently underway (Eastside Bypass and Reach 2A)
    - Drilling anticipated late 2012/early 2013
    - Geotechnical analyses mid 2013
  - Subsequent phases (tbd)

FRAP – Study Area



FRAP – Next Steps

- Complete initial phase
- Continue coordination with SJRRP and Bureau on prioritization of subsequent phases
- Implement additional phases prioritized to 2,000 cfs
- Identify future funding availability for further priorities to 4,500 cfs

USACE Levee Performance Criteria

Type of Slope	Applicable Stability Conditions and Required Factors of Safety		
	End of Construction	Long-Term (Steady Seepage)	Rapid Drawdown
New Levees	1.3	1.4	1.0 to1.2
Existing Levees	---	1.4	1.0 to1.2
Other Embankments and Dikes	1.3	1.4	1.0 to1.2

Source:
U.S. Army Corps of Engineers. 2000. Design and Construction of Levees Engineering and Design Manual. Manual No. 1110-2-1913. April. Table 6-1b, page 6-5