

# Sutter Bypass Two-Dimensional (2D) Hydraulic Model



## Informational Briefing

Presented By Board Staff and CH2MHill Consultants  
Model Funded by CVFPB, DWR, USF&WS

March 22, 2013



# Key Points to Discuss

- Board Resolutions in 2008 and 2009 established initial goals
  - Analysis of carrying capacity of the “1957 design flow”
  - What capacity existed in 1950’s?
  - What capacity exists today?
  - Impact of the Sutter National Wildlife Refuge (SNWR) on capacity
- Model type, geographic extent, boundary conditions
- Development, calibration and verification
- Initial conveyance and freeboard results for “1957 design” flows
- How has available freeboard at 1957 flows changed since the 1950s?
- Sensitivity runs demonstrate capabilities for CVFPP Regional and Basinwide planning analyses
- Final reviews to publish a User Manual, Final Report, and Technical Memo
- Turnover to DWR FloodSAFE Library of Models

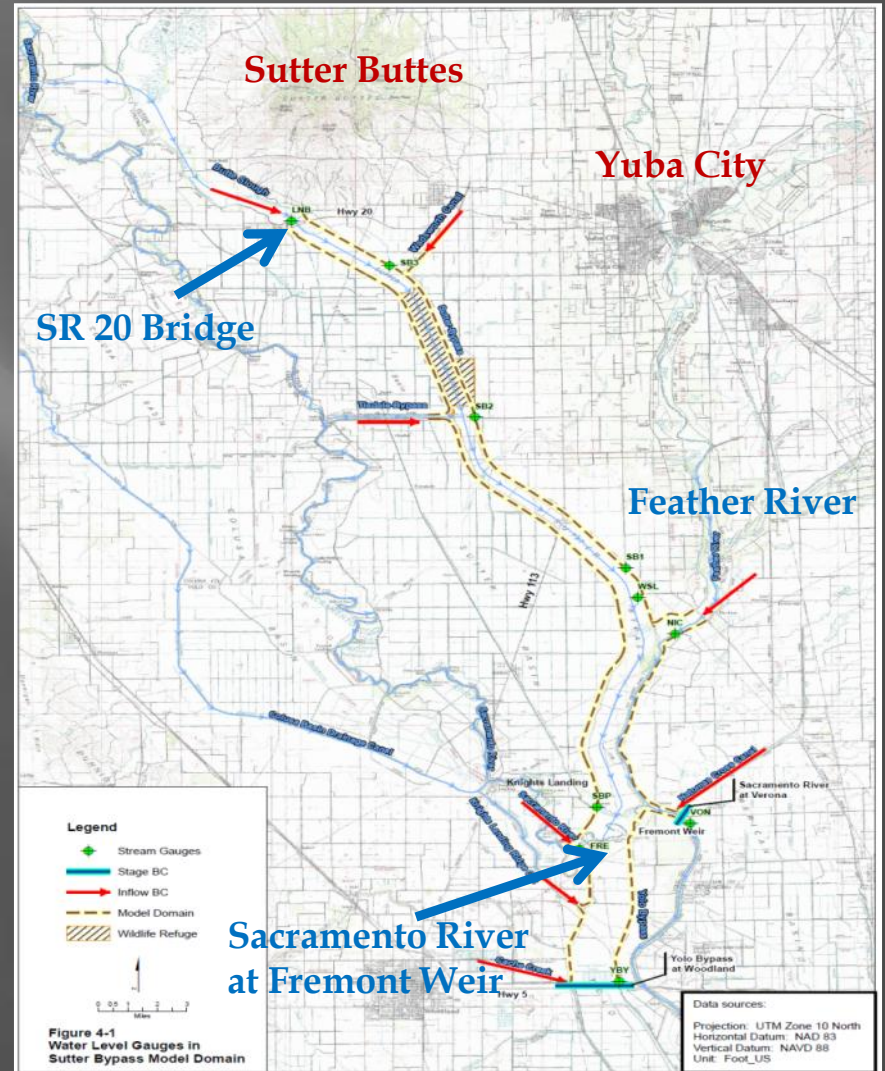
# Board Directions / Model Objectives



- Resolution 2008-19:
  - Work with DWR and USACE to develop model to ascertain impacts of vegetation and structures on carrying capacity
  - Confer with DWR and USACE to determine applicable design flows
- Resolution 2009-11:
  - Coordinate with DWR, USACE and USFWS to assess effect of SNWR on carrying capacity
- Determine if stated goals of flood management and stakeholder interests are achievable in the Bypass
  - How does vegetation impact capacity?
  - Do bridges and other structures impact capacity?
  - Are there areas of compromised flood protection? If so what?

# Project Development / Study Area

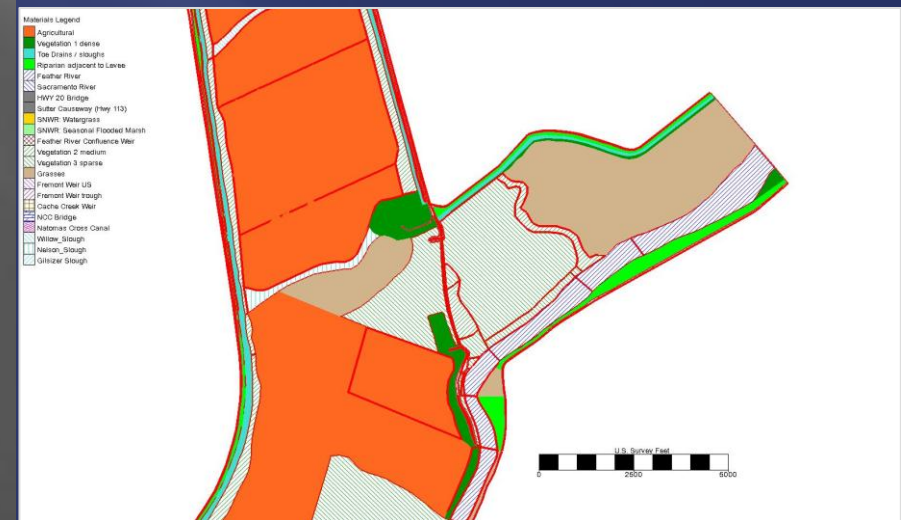
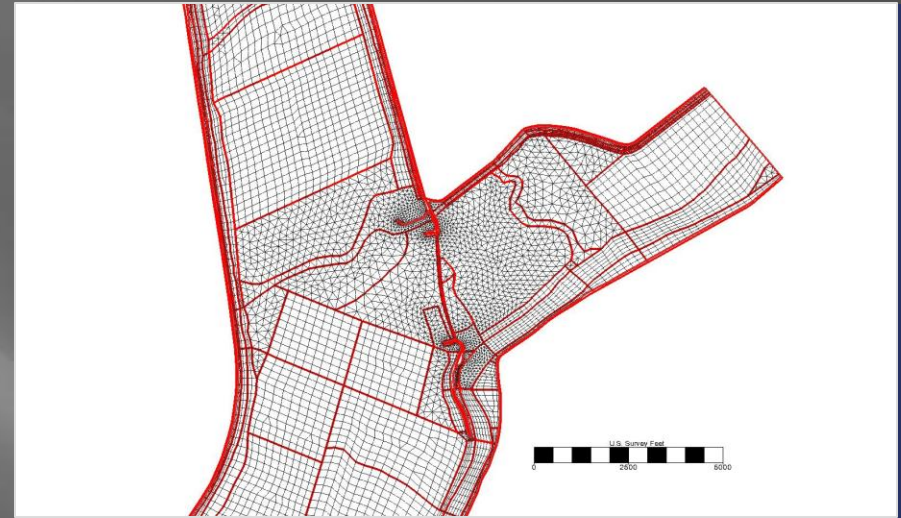
- Hired CH2M HILL consultants
  - Assisted by MBK Engineers
  - Peer reviewed by David Ford Engineers
- Use RMA2 2D model (USACE)
- Calibrated to 2006 event
- Verified against 1997 event
- Evaluate capacity for a range of design conditions
  - 1957 design profile
  - O&M manual flows
  - 100-year event
  - 200-year event
- Conduct sensitivity runs to determine capabilities to evaluate a variety of potential management practices and remedial measures



# Model Details (CH2M)



- Surface represented by a grid
  - Over 43,000 elements
  - Average size 1/2 acre (about 150 x 150 square feet)
- Each element assigned unique characteristics
  - Ground cover/land use (assigned to unique friction “n” values)
  - Current elevation data based on 2010-11 CVFED LiDAR surveys (accuracy of +/- 0.3 feet)
- Can modify element characteristics to evaluate change in land use, vegetation type, elevation, etc.



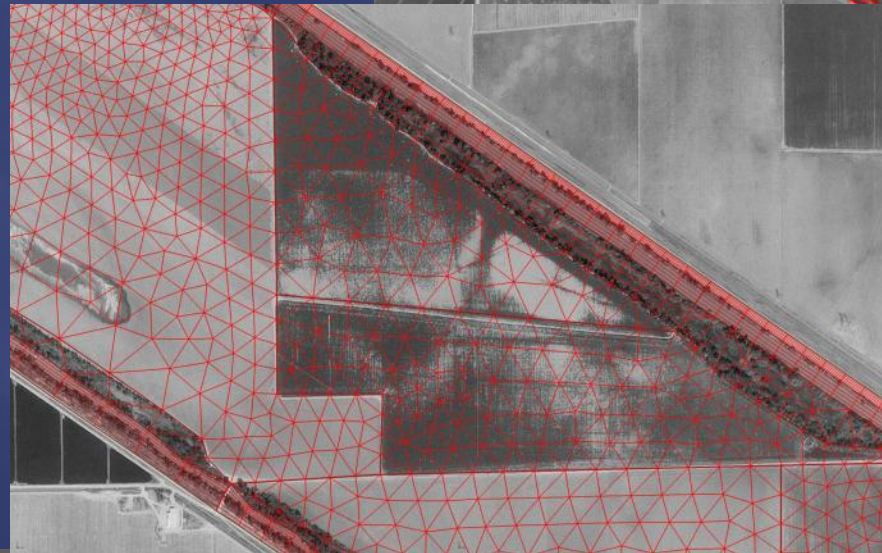
# RMA2 Model Answers Complex Questions (1/3)

- Allows us to simulate impacts of vegetation, land forms and structures in considerable detail



# RMA2 Model Answers Complex Questions (2/3)

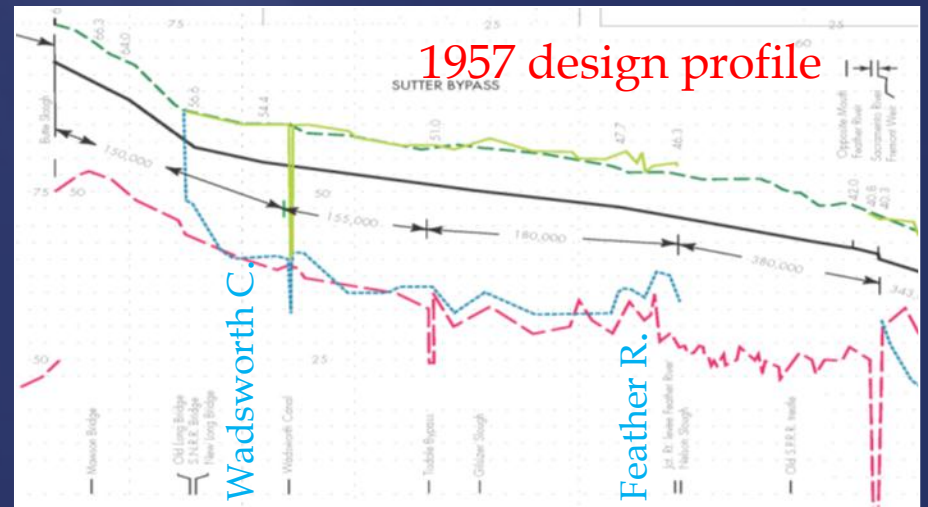
- Allows us to simulate impacts of vegetation, land forms and structures in considerable detail
- Model resolution allows assignment of site-specific features to determine localized impacts



# RMA2 Model Answers Complex Questions (3/3)

- Allows us to simulate impacts of vegetation, land forms and structures in considerable detail
- Model resolution allows assignment of site-specific features to determine localized impacts
- Can the goals of flood protection and public safety, environmental stewardship, and economic stability be met along with other stakeholder interests?

**Nelson Slough rock weir at Feather River outlet looking south**

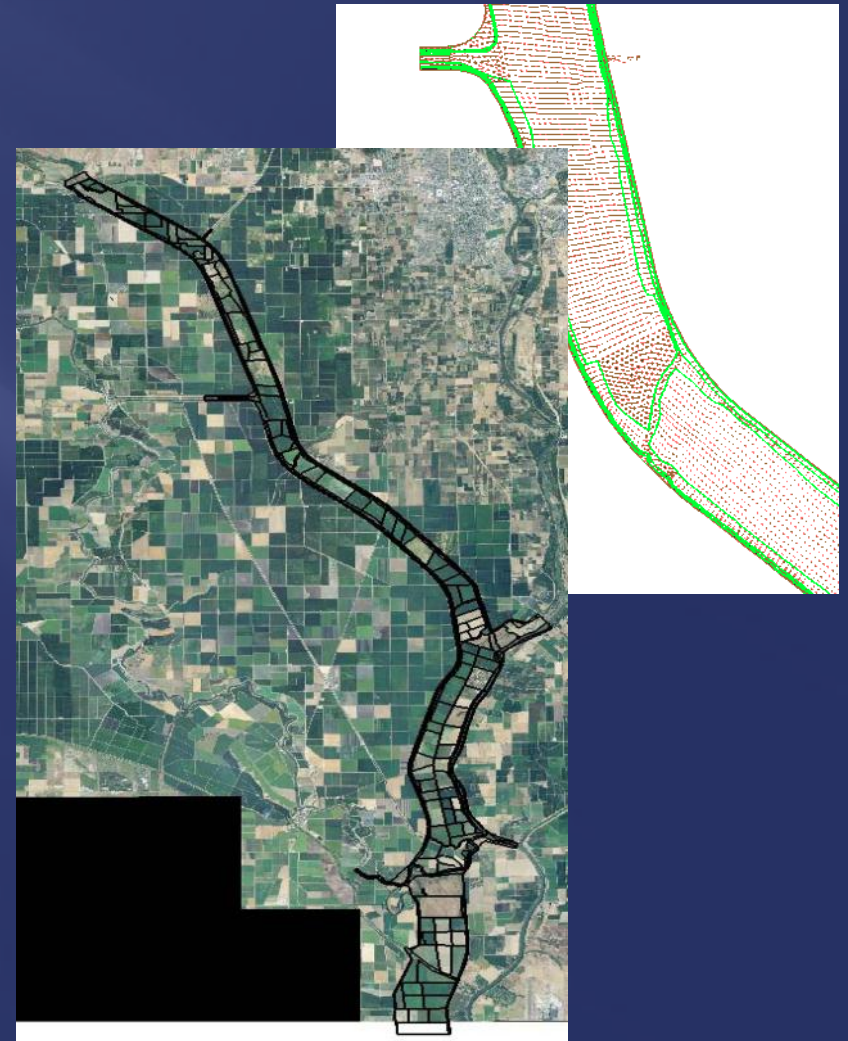




# The Model Provides an Important Tool



- Once delivered to DWR's FloodSAFE Library of Models, it will provide a common platform to support the Basin-wide and Regional planning studies for the 2017 CVFPP update
  - Assess impacts of potential management actions including changes in land use, vegetation type and pattern, sediment removal, structural changes, etc.
  - Assess impacts of future maintenance practices
  - Determine if existing top of levee profiles are sufficient to achieve current and future design standards



# Flow Comparison



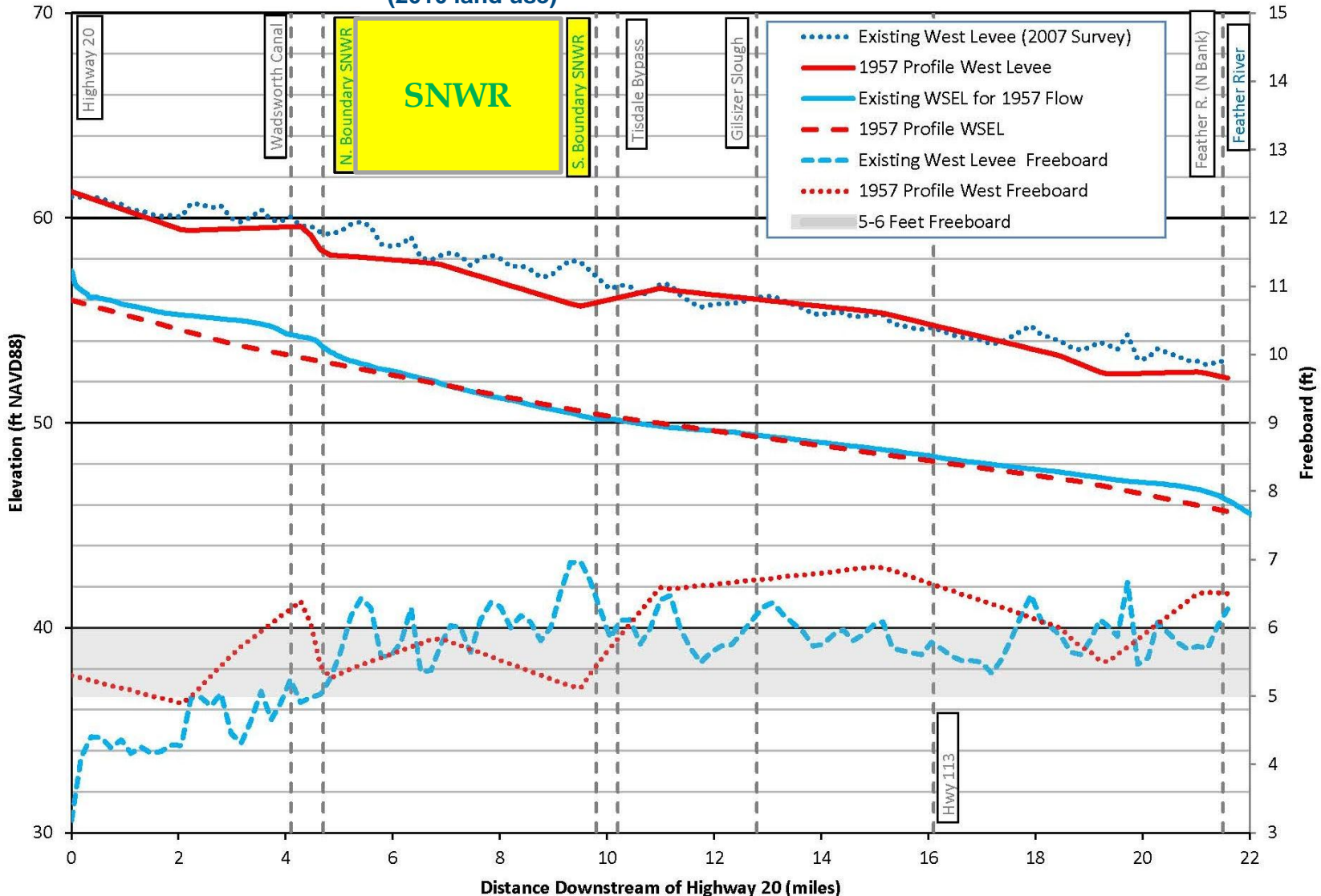
TABLE 3-3  
Peak Flows and Stages at Sutter Bypass RMA2 Model Boundaries

	1957 Design Flow (Sacramento Centering) Flow (cfs)	O&M Manual Flow (Sacramento Centering) Flow (cfs)	100-yr Flood (Common Features HEC-RAS; Sacramento Centering) Flow (cfs)	200-yr Flood (Common Features HEC-RAS; Sacramento Centering) Flow (cfs)	January 2006 (Calibration) Flow (cfs)	January 1997 (Verification) Flow (cfs)
Long Bridge	150,000	178,000	184,002	227,157	109,310	127,444
Wadsworth Canal	1,500	1,500	1,572	1,501	1,500	1,500
Tisdale Bypass	28,500	37,000	16,551	16,705	20,375	21,609
Feather River	200,000	200,000	323,826	377,289	183,612	317,716
Knights Landing/Sacramento River	30,000	30,000	39,564	40,337	29,455	34,572
Natomas Cross Canal	22,000	3,500	24,871	27,877	11,043	8,491
Knights Landing Ridge Cut	19,000	19,000	304	340	8,803	4,158
Cache Creek	15,000	15,000	39,154	40,568	27,915	25,466
	<b>Stage (ft NAVD88)</b>	<b>Stage (ft NAVD88)</b>	<b>Stage (ft NAVD88)</b>	<b>Stage (ft NAVD88)</b>	<b>Stage (ft NAVD88)</b>	<b>Stage (ft NAVD88)</b>
Sacramento River at Verona (VON)	41.31	41.31	42.33	43.65	37.94	41.31
Yolo Bypass Woodland Gauge (YBY)	32.52	32.70	35.20	36.55	30.73	32.86

# West Levee Freeboard Profiles (1957 design flow)

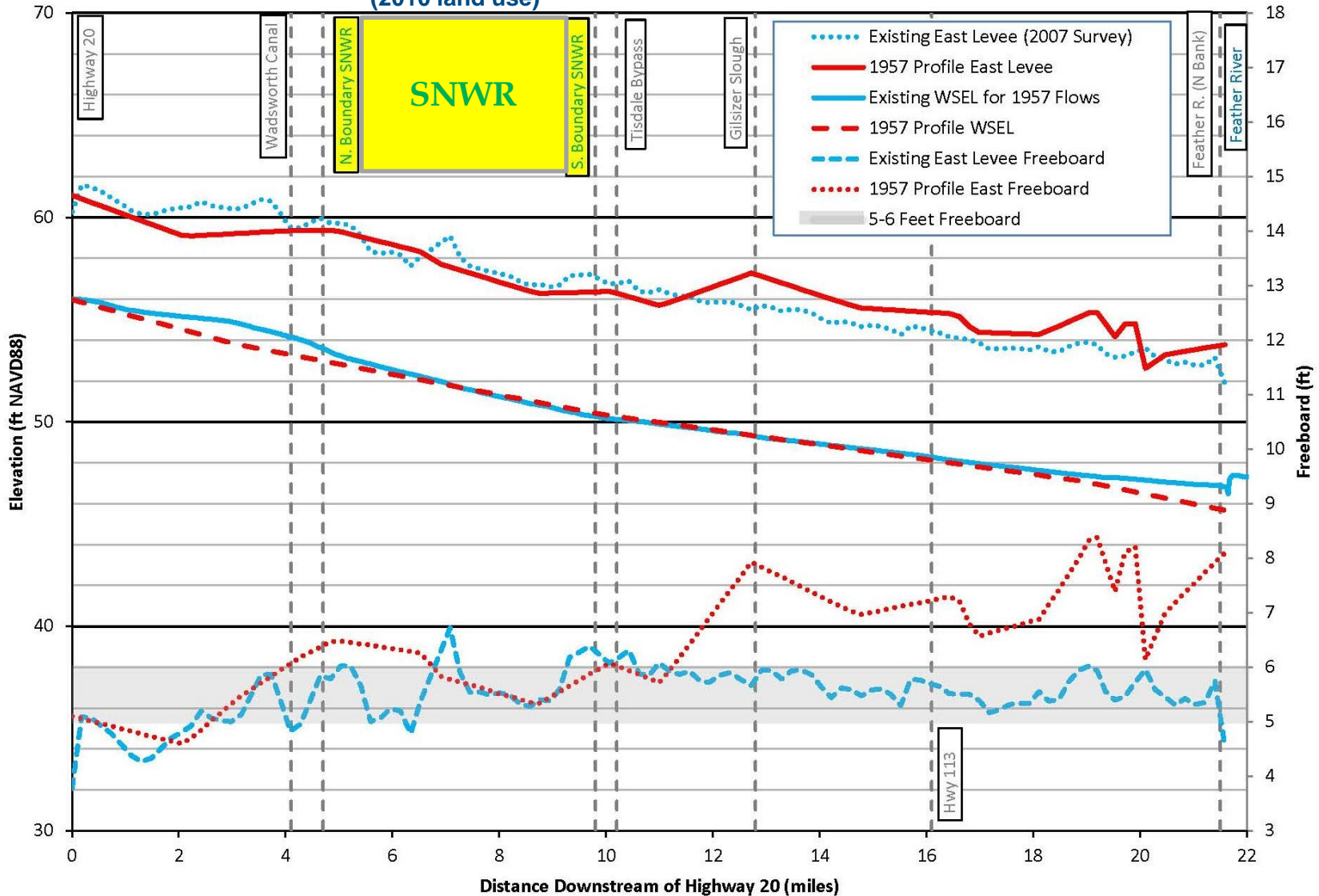


West Freeboard for Existing and 1957 Design Flow Condition (NAVD88 datum)  
(2010 land use)

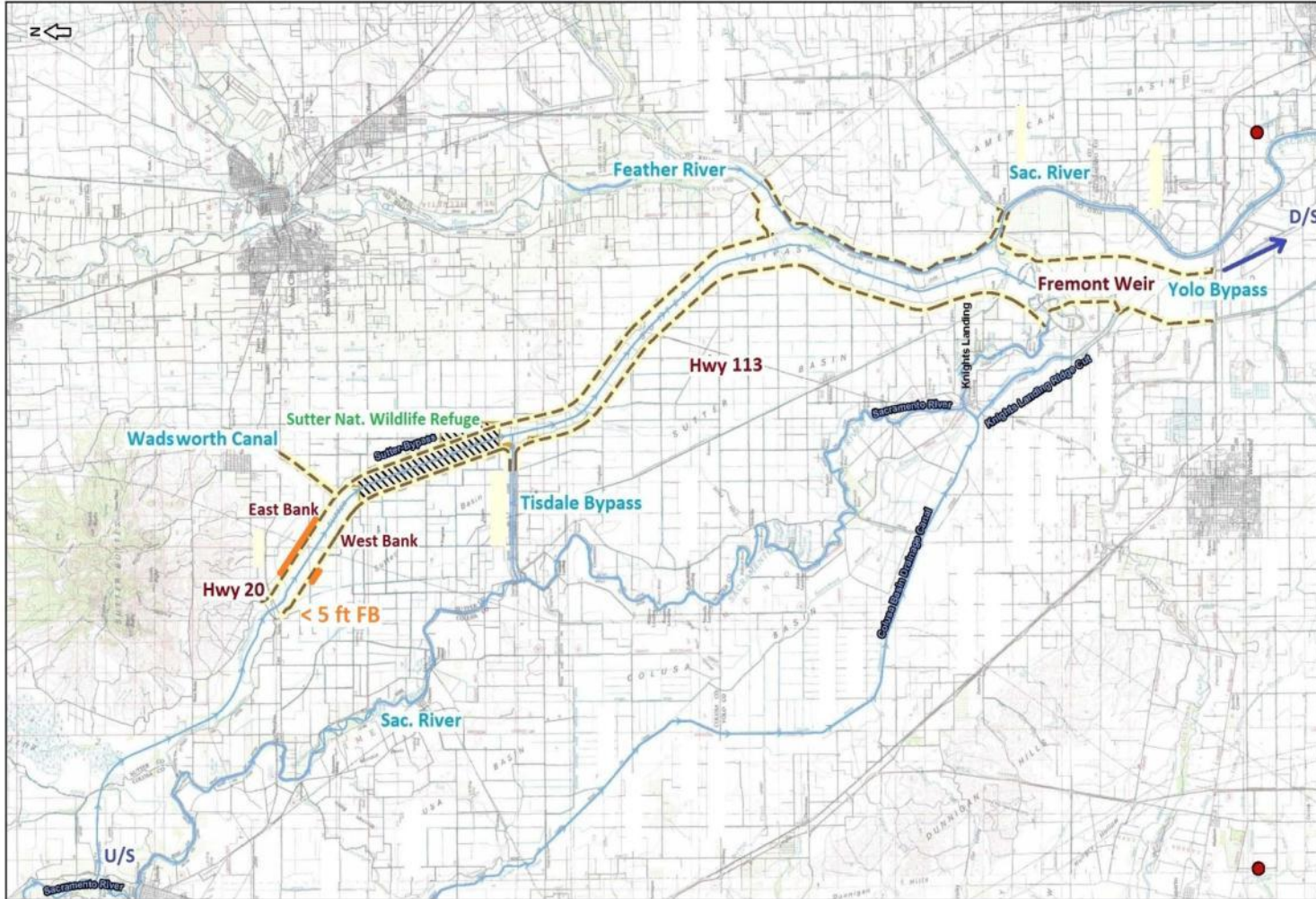


# East Level Freeboard Profiles (1957 design flow)

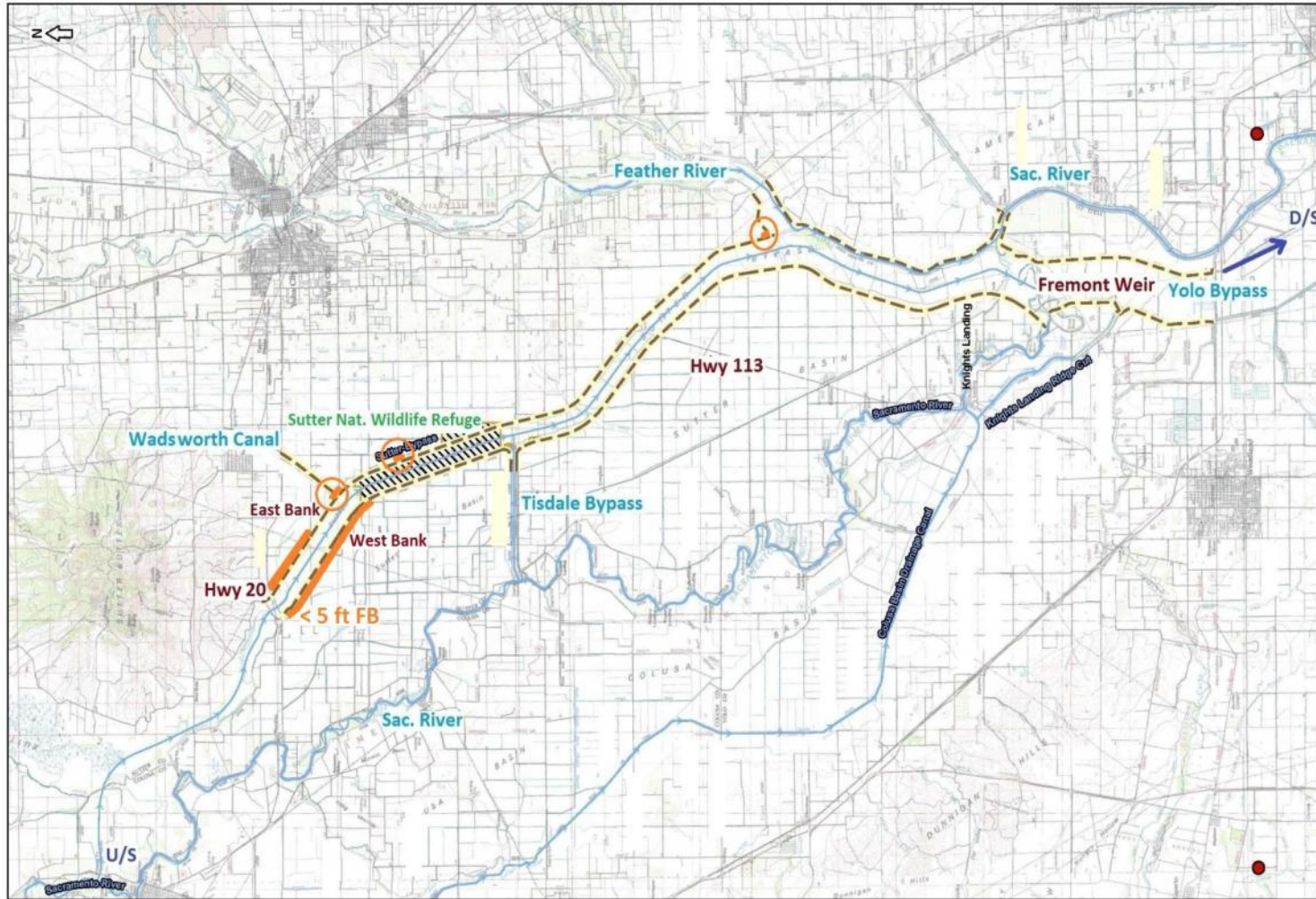
East Freeboard for Existing and 1957 Design Flow Condition (NAVD88 datum)  
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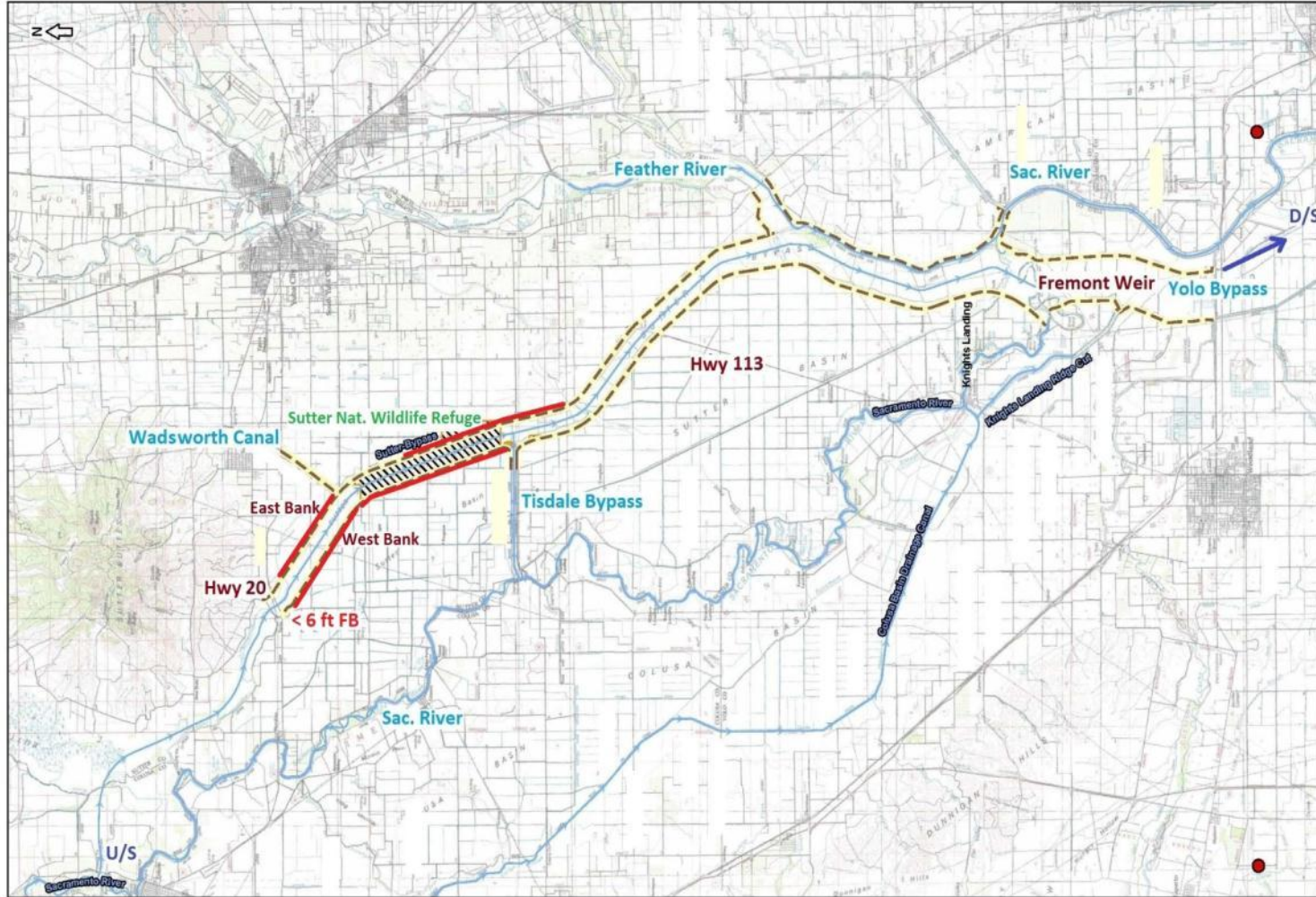
# Areas of Freeboard < 5 feet with 1957 flows and 1950's Top of Levee (design) profiles



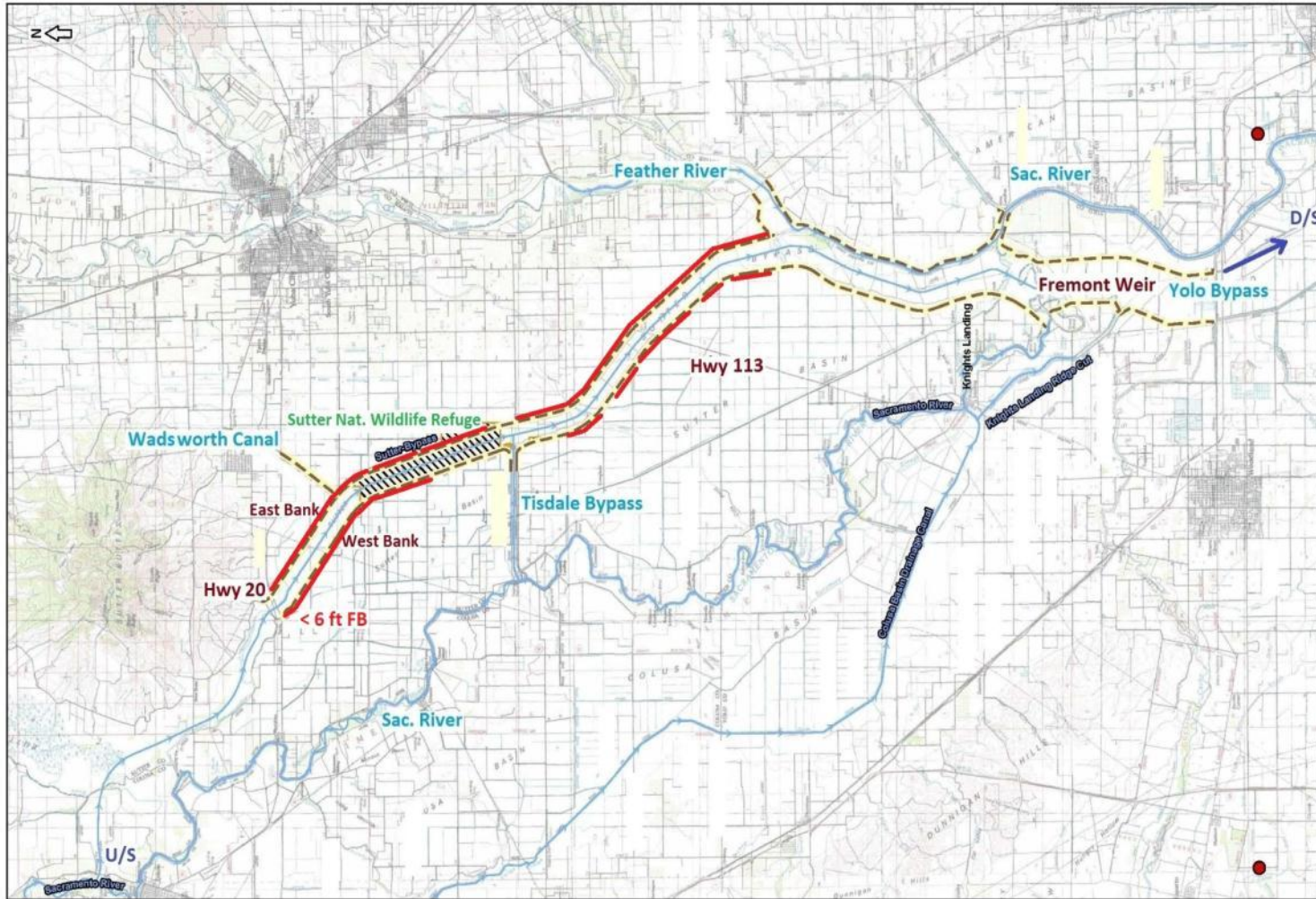
# Areas of Freeboard < 5 feet with 1957 flows and 2007 Top of Levee (DWR Survey) profile



# Areas of Freeboard < 6 feet with 1957 flows and 1950's Top of Levee (design) profiles



# Areas of Freeboard < 6 feet with 1957 flows and 2007 Top of Levee (DWR Survey) profile





# Multiple Sensitivity Runs Conducted

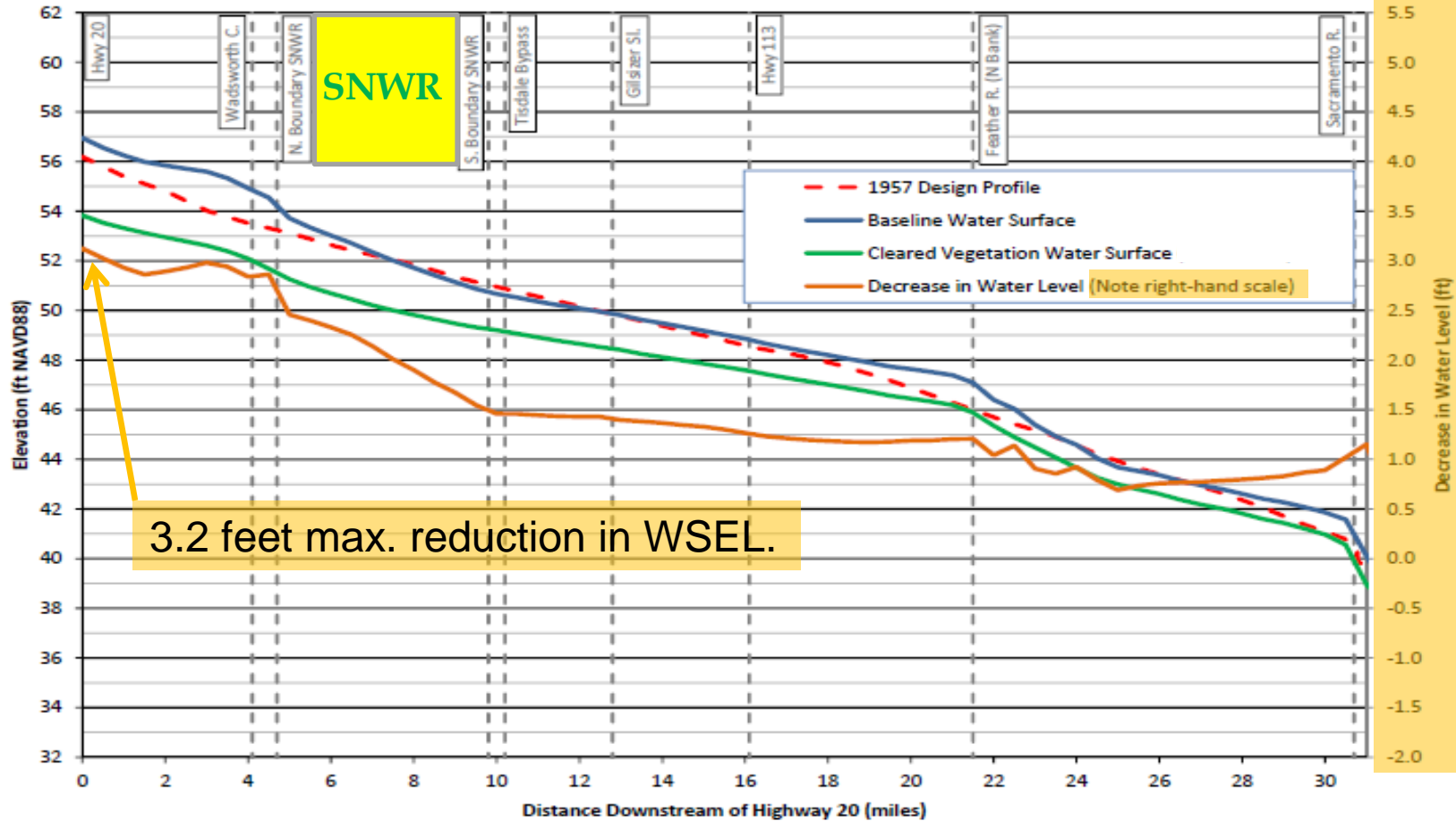
- Three Initial Vegetation Scenarios
  - 2006 vegetation (baseline)
  - 2010-11 vegetation after thinning of 25 acres in the SNWR (existing conditions)
  - Fully vegetated condition (120 % of baseline “n” values)
- A range of conditions representing various maintenance and management activities were simulated to determine model capabilities



# Sensitivity Run - Extensive Vegetation Management



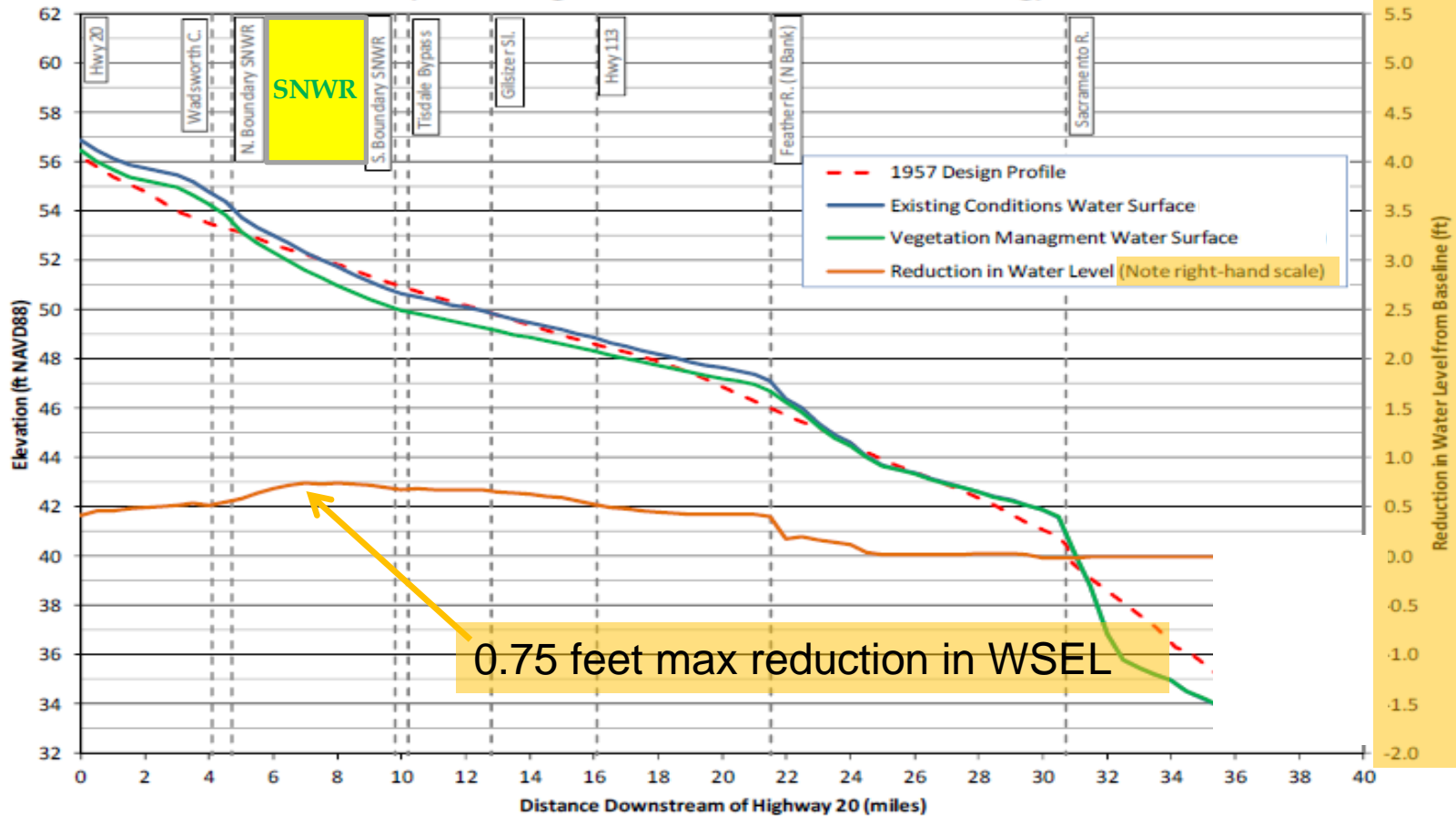
**Water Surface Profiles for Baseline (2006 Land Use) with Vegetation Management  
(1957 Design Flow with Sacramento Centering)**



# Sensitivity Run - Moderate Vegetation Management

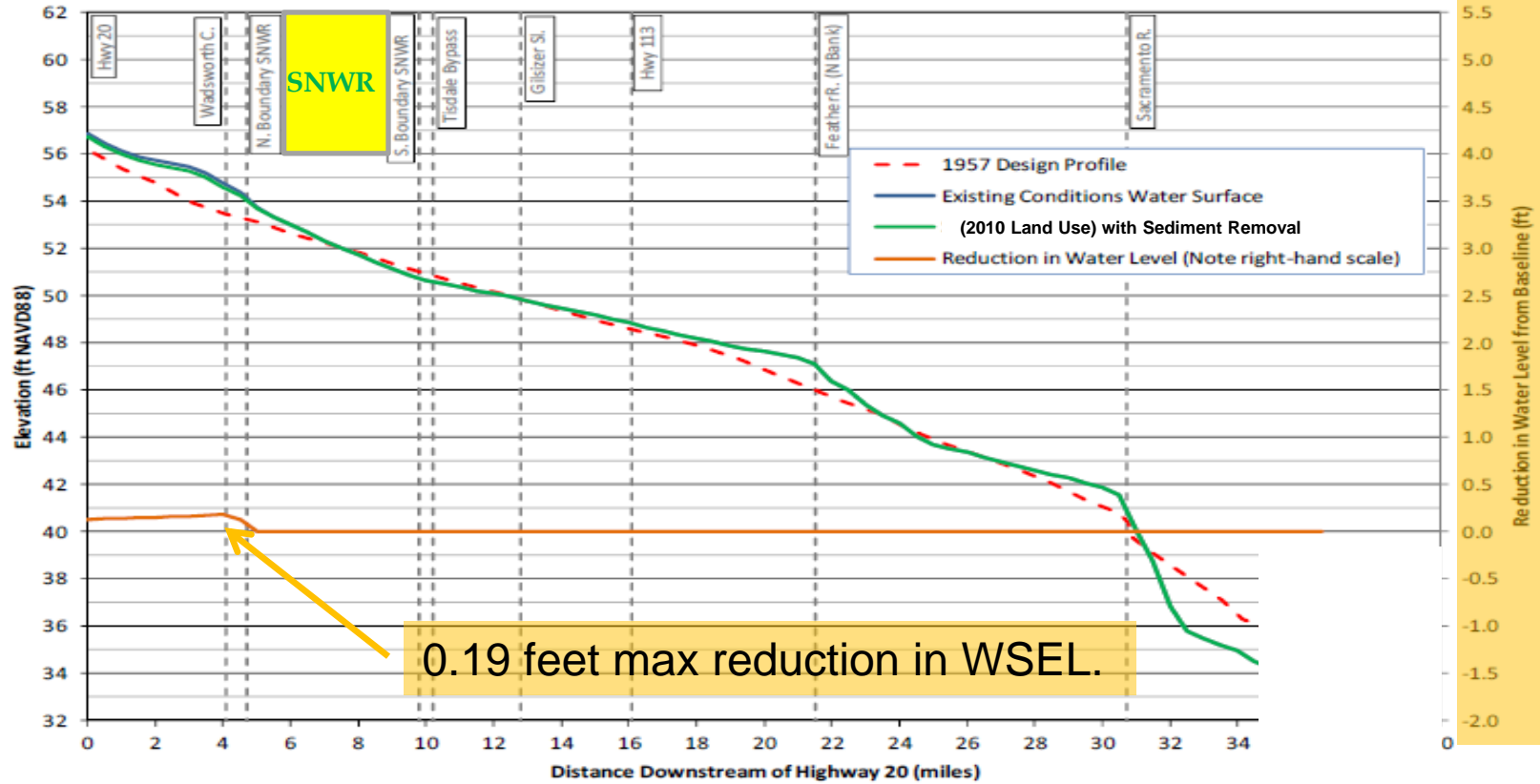


**Water Surface Profiles for Existing Conditions (2010 Land Use) with Vegetation Management (1957 Design Flow with Sacramento Centering)**



# Sensitivity of Moderate Sediment Removal

**Water Surface Profiles for Existing Condition: (2010 Land Use) with Sediment Removal  
(1957 Design Flow with Sacramento Centering)**

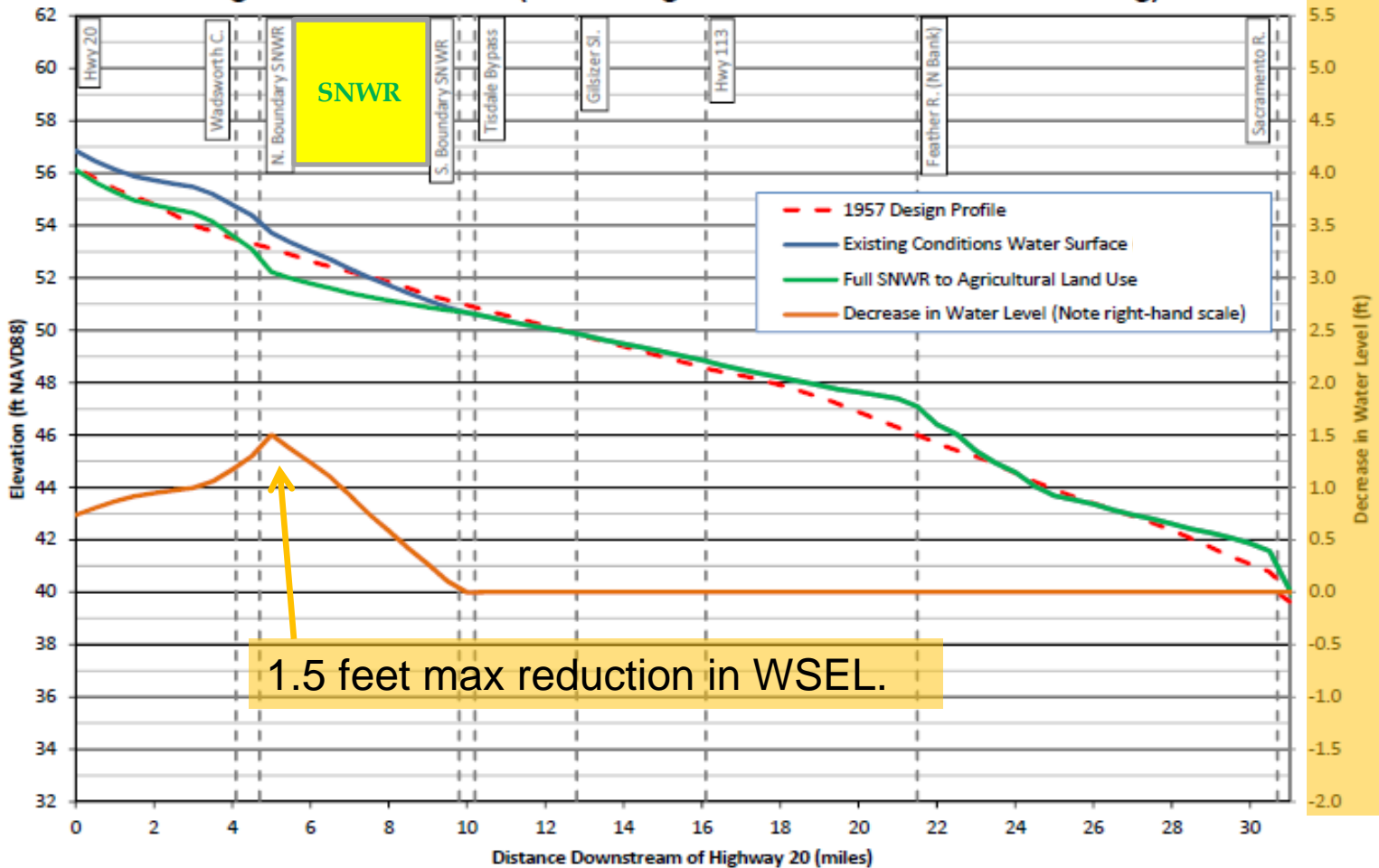


**Structural Modification: Removal of 575,000 Cubic Yards of Deposited Sediment in Sutter Bypass Downstream of Wadsworth Canal (Run12)**

# Conversion of SNWR to Ag use



Water Surface Profiles for Existing Conditions and Conversion of SNWR to Agricultural Land Use (1957 Design Flow with Sacramento Centering)



1.5 feet max reduction in WSEL.

# Summary and Next Steps



- A robust model has been developed
- Capable of evaluating changes in land use, vegetation type, sediment removal, levee and channel alignment, location and size of structures
- Model results indicate that flows equivalent to the 1957 design WSEL can be conveyed by the Bypass without overtopping, but with less than the original design target of 5 to 6 feet of freeboard
- Board staff will deliver the model and a final report, technical memo, and user guide to DWR's FloodSAFE Library of Models for use by agencies, organizations and consultants
- Board staff will also make documentation available on our website
- Model will support the Basin wide and Regional flood planning processes to support the 2017 Central Valley Flood Protection Plan update
- Board staff will inform Bypass landowners regarding the Board's existing flowage easements

# Questions & Discussion



Electronic copies of the Report and User Guide will soon be available via our website

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