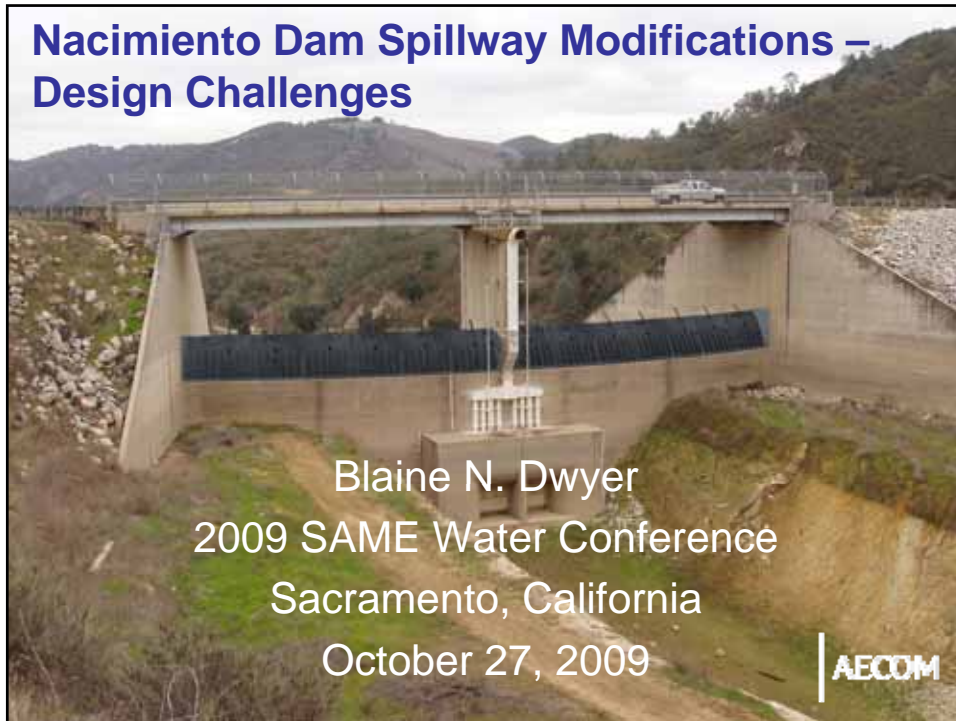


Nacimiento Dam Spillway Modifications – Design Challenges



Project Purpose

- Implementation of the Salinas Valley Water Project EIR/EIS provisions
- Meet Salinas Valley water supply goals
 - Restrict seawater intrusion
 - Provide flood protection
 - Supply water needs through 2030
- Salinas River Diversion Facility
- Nacimiento Dam Spillway modifications

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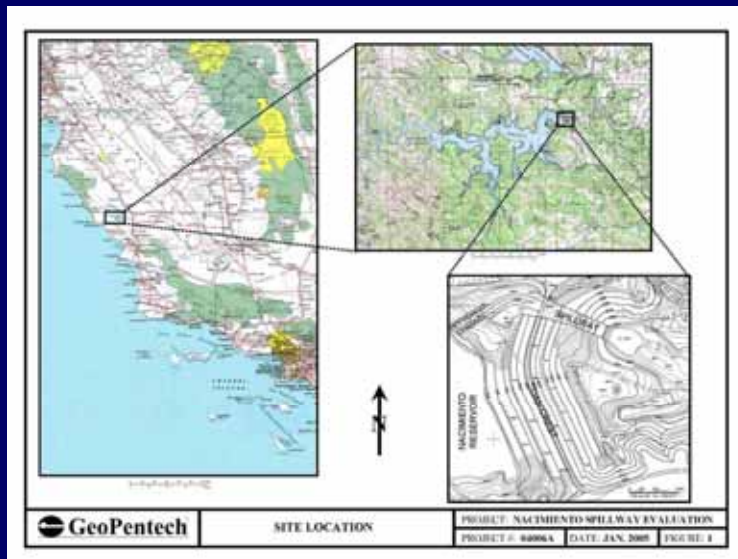
Acknowledgements

- Monterey County Water Resources Agency (MCWRA) – Owner – Curtis Weeks, General Manager; Brent Buche, Chief Engineer; & Manuel Quezada, PM
- DSOD and the FERC
- AECOM (Boyle Engineering) subconsultants:
 - GeoPentech
 - Bestor Surveying
 - Utah State University
- Granite Construction
- E2 – Construction management
- Other MCWRA support: GEI, Downey Brand, Entrix, Hagar Environmental, Harrington and Orrick, John Freshman, Ludorff and Scalmanini, Morgan Stanley, RMC, WRIME

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Location



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Salinas River Flows



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Main Design Components

- Geotechnical Issues
- Structural Modifications
- Gate Design
- Flip Bucket and Plunge Pool
- High-Level Outlet
- Physical Hydraulic Model



MCWRA photo



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Nacimiento Dam and Spillway



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Project Features



- Zoned earthfill embankment
 - 210 feet high
 - 1,630 feet long
 - Impounds 377,900 acre feet at the spillway crest



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Spillway

- Trapezoidal, unlined approach channel
- 150-foot wide, un-gated concrete ogee crest weir
- 60-foot high walls flank the ogee



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Spillway, cont.

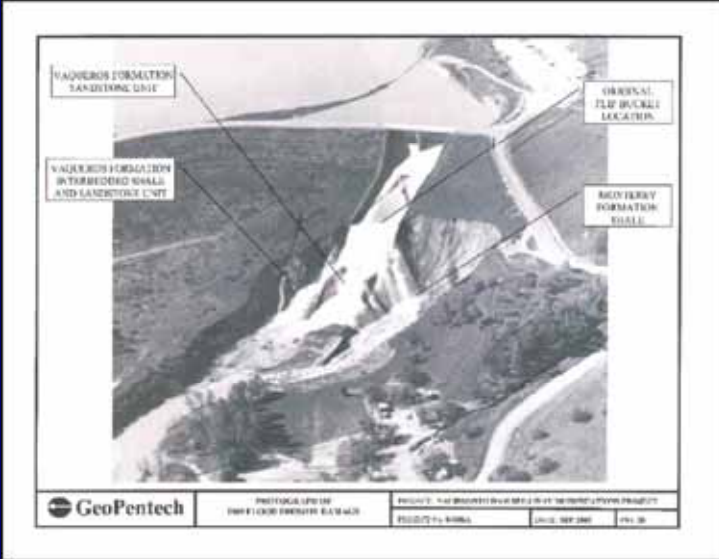


- 540-foot long rectangular concrete chute
- Terminates in a flip bucket

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Spillway History



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High-level Outlet



- Two 8-foot by 8-foot flood control slide gates
- Discharge into the chute

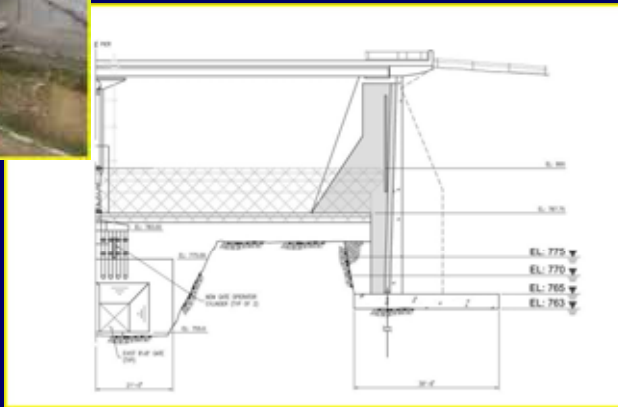


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Approach Channel



Design Challenges



MCWRA Photo

- Geotechnical Issues
- Structural Modifications
- Gate Design
- Physical Hydraulic Model

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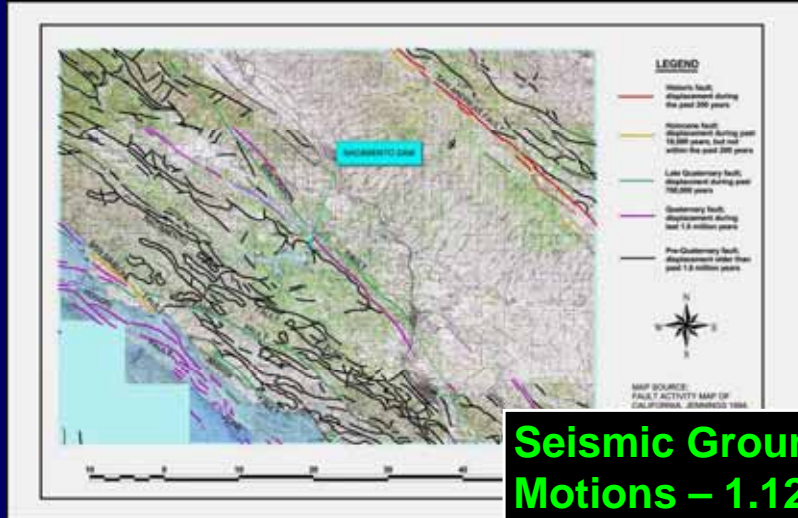
Main Project Components

- **Geotechnical Issues**
- Structural Modifications
- Gate Design
- Physical Hydraulic Model

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Geotechnical Considerations

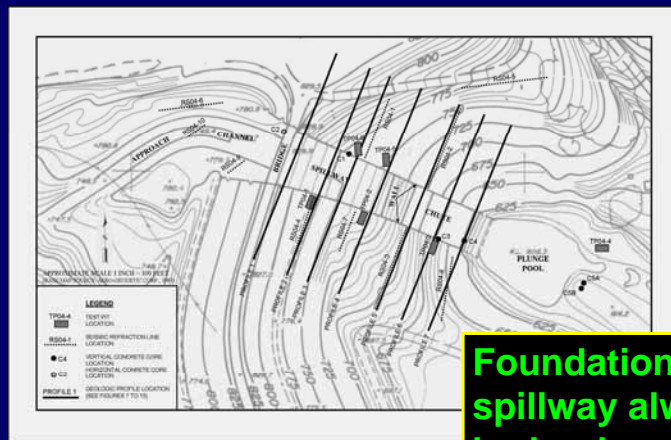


Seismic Ground Motions – 1.12g

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Geotechnical Considerations

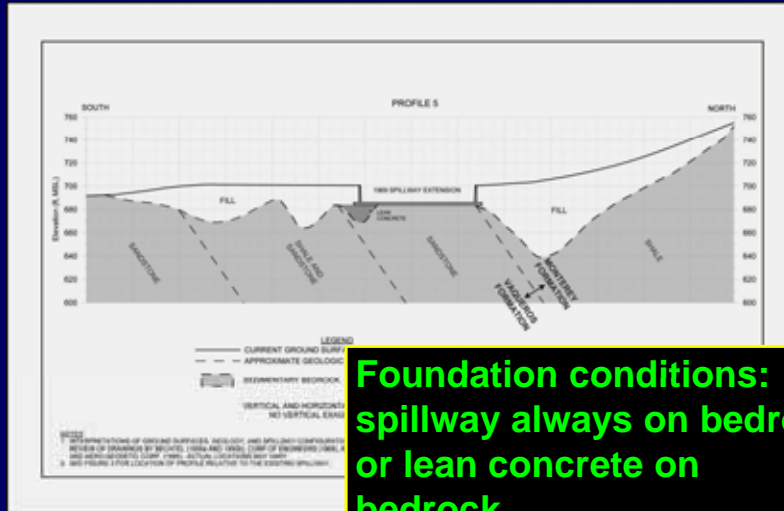


Foundation conditions: spillway always on bedrock or lean concrete on bedrock.

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Geotechnical Considerations



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Main Project Components

- Geotechnical Issues
- **Structural Modifications**
- Gate Design
- Physical Hydraulic Model

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Structural Modifications

- Modifications controlled by both seismic and hydraulic loadings
- Spillway walls had to be strengthened and raised

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Structural Modifications

- Approach Walls
 - Would not withstand current seismic loads
 - Footers and walls needed modifications



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Structural Modifications

- **Ogee Crest Area**
Abutments and pier strengthened -- thicker and anchored together



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Structural Modifications

- **Chute Walls**
 - 20 to 45 feet high
 - 18-inch-thick “sister walls” inside the existing walls
 - Extensive anchoring to tie everything together



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Main Project Components

- Geotechnical Issues
- Structural Modifications
- Gate Design
- Physical Hydraulic Model

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Gate Design

- Design Requirements
 - Gates closed/raised for summer; opened/lowered for winter
 - Gate crest at existing ogee crest elevation of 800 feet
 - Safely pass the Supplemental Probable Maximum Flood
 - Minimize capital and O&M costs
- Required Spillway Capacity
 - Existing design discharge is 72,000 cfs
 - New required design flow is about 100,000 cfs

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Gate Design

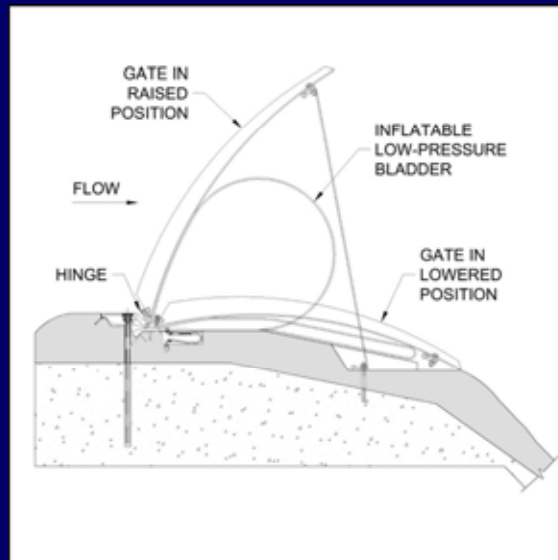
- 12.25-foot gate height
- Spillway crest at elevation 787.75 feet
- Two feet of residual freeboard to dam crest



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“Obermeyer” Inflatable Gate



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Main Project Components

- Geotechnical Issues
- Structural Modifications
- Gate Design
- **Physical Hydraulic Model**

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Physical Hydraulic Model

- Obermeyer Gate
- Chute wall height
- Flip Bucket



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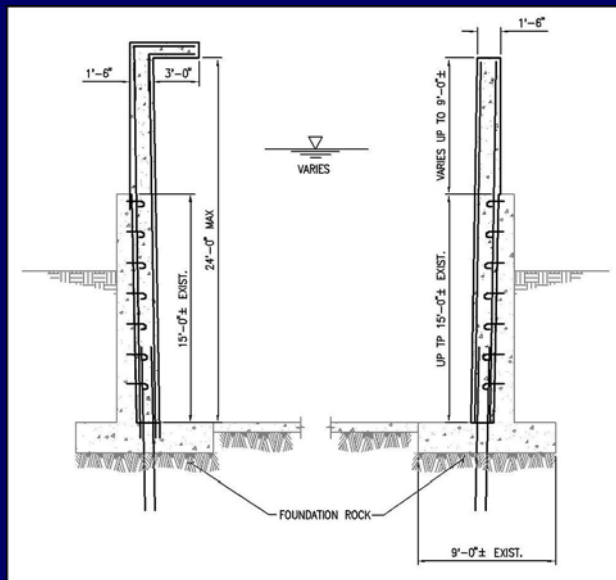
Physical Model



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Non-uniform Flow

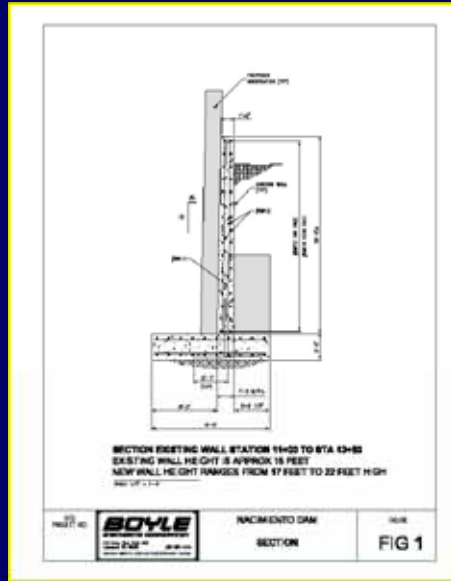


...means asymmetric walls

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Wall Completion



MCWRA photo

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Project Design Summary

- **“Obermeyer” Gate**
 - Gate height of 12.25 feet
 - No concrete wall will be required on dam crest
- **Bridge pier thickened and anchored**
- **Chute walls raised & strengthened**
- **Physical model defined the design parameters**
- **Plunge pool to be armored in future**

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Nacimiento Dam Spillway Modifications



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Sacramento, California
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