Hwy 37 Adaptation to Rising Seas

Steven Moore, P.E., Vice Chair
State Water Resources Control Board
www.waterboards.ca.gov

Fraser Shilling, Road Ecology Center
Department of Environmental Science & policy
University of California, Davis
@roadecology
Overview

• Hwy 37: State-wide Significance
• Transportation, Flood, Climate Adaptation, Ecosystem Restoration
• Existing Setting: Degradation of Tidal Marsh System and Public Ownership of Inland Marshes
• Regulatory Considerations
• Forward Thinking

Photo: Marin IJ
Existing Setting: Degradation of Water Resources

- Water Quality Effects of Current Highway
  - Stagnation, pH (and Ammonia Toxicity), Low DO, Harmful Algal Blooms, Odors, Methylation of Mercury, Toxics, Lost Opportunities for Productivity

- Ecological Effects of Current Highway
  - Corridor interruption, lack of channel complexity and evolution

- Flood Effects of the Current Highway – barrier to flood attenuation

- What would the Water Do without a Highway?
  - High point that periodically floods, refreshing adjacent systems that are now isolated and degraded.
  - How can we mimic this in the design?
  - "Let Nature do the Heavy Lifting"
Tidal Marshes have Value
In the news ... again & again

Highway 37 may finally stop flooding under new CHP plan
February 13, 2017

Highway 37 in Novato closed in both directions due to flooding
February 8, 2017

Highway 37 closed in Novato due to flooding
January 22, 2017

Section of Hwy. 37 in Novato reopens week after flooding
January 17, 2017

In demand but increasingly swamped, Highway 37 has no easy fixes
February 15, 2017
Critical infrastructure is eroding

Tolay Lagoon/Hwy 37

This shows the approximate movement of the erosion front on the Tolay Lagoon levee (E end of lagoon) between 2/2013 and 1/2017.
Mechanisms: Armoring Effects on Marsh Adaptation to Sea Level Rise

Physical Effects
- Increased inundation
- Increased channelization
- Increased reflective energy of waves
- Increased grain size of sediments

Biological Effects
- Decreased width of tidal zonation
- Decreased time for feeding by shorebirds
- Decreased connectivity of remaining marshes
Regulatory and Engineering Considerations

• Regulatory Requirements: Clean Water Act 404(b)1 Guidelines – Avoid Fill, then minimize, only then mitigate
  • Where would you get the Fill? Where would you mitigate?
  • Why not design a “self-mitigating” project?

• Engineering Considerations- Wetlands Fill Challenges
  • Bay mud environment, liquefaction
  • Culverts concentrate flows and cause scour, and eventually fail from sediment or erosion.
  • Backwaters along levee/berm with high residence time and WQ Problems, sediment accumulation
Forward-Thinking

Consider alternatives with approaches that maintain transportation function, not just the structure.

Focus on enhancing the environment of the North Bay through environmentally sensitive design.

Economic benefits of regional flood capacity enhancement – help fund this infrastructure package

Be ready with partners and funding packages when opportunities arise! (Measure AA – minor role, if any)
Developing Resilient Landscapes

Preserving structures

Preserving function

“keep the big picture in mind of the North Bay economies, communities, ecosystems”
Suggested Next Steps

• Consider a Broad Project Definition: *Transportation, Water Resources, Ecosystem Restoration, Regional Flood Management*

• Include Water Specialists on the Design Team
  • Design *with* Nature (bridge) vs. *against* (berm)
  • ASCE perspective: Project that “bridges” the transportation and water “tracks”

• Regional Partnership: Upfront Engagement of Regulatory & Resource Agencies