

Wetland Restoration Design

A Project Manager's Perspective

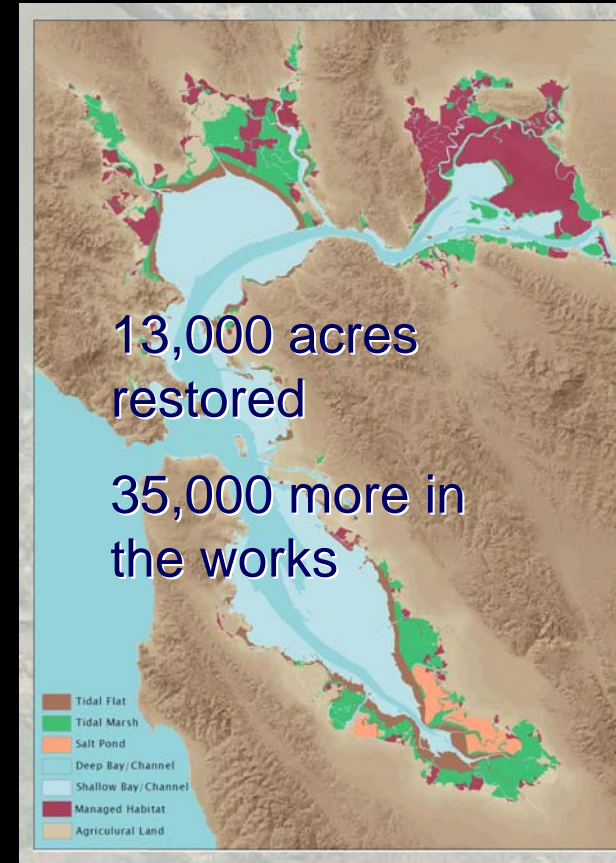
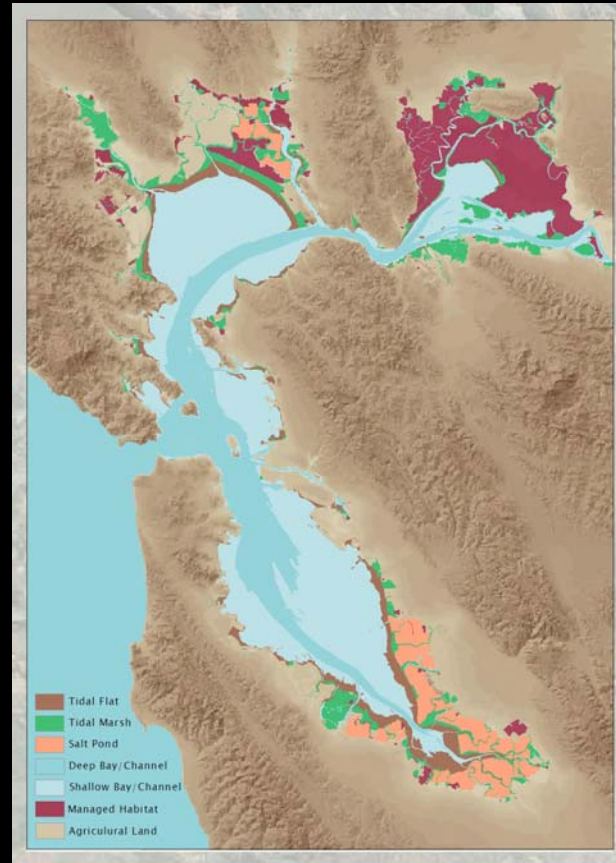
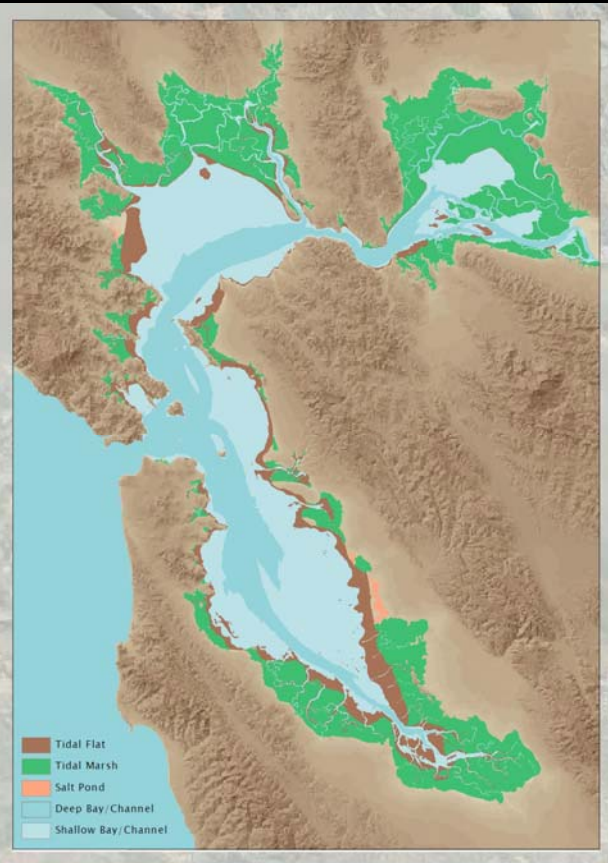
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Random Thoughts...

- >35,000 acres of wetland restoration planned
- Significant cost associated with these projects
- Costs vary due to existing conditions and design
- Large number of issues to be considered in planning, many more contentious than wind-wave energy attenuation
- Managers/funders want to know what they are “buying”, but may be more flexible than restoration designers, engineers, regulators, etc.

Wetland Loss and Restoration



Past (~1850)

Present (~2000)

Future (~2030)

“Large” tidal projects	Acres	Rough Cost
Napa-Sonoma Marsh	3,000	\$5m
Hamilton/Bel Marin Keys	2,400	\$175m
Eden Landing	722	\$5m
Napa Plant Site	1,400	\$7m
Bair Island	1,400	\$11m
Bahia	418	\$4.2m
South Bay Salt Ponds	13,000	\$980m
Sears Point	970	\$21m
Dutch Slough	1,166	\$35m
Cullinan Ranch	1,564	\$22m

A Tale of Two Projects

	Napa Salt Ponds \$2k/acre	Hamilton \$75k/acre
Site	<ul style="list-style-type: none">• Former Salt Ponds• Within 3' of Marsh Plain Elevation• Historical Channels• Remote Location	<ul style="list-style-type: none">• Former Airfield• Subsided up to 10' below Marsh Plain• No Antecedent Topography• Adjacent to Development

Tidal Design	<ul style="list-style-type: none">✓ Natural Sedimentation✓ Historical Template✓ Minor Earthmoving	<ul style="list-style-type: none">✓ Haz Mat Removal✓ Dredge Material Reuse✓ "New" Template✓ Flood Control Levee
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Significant Challenges

- Site conditions (haz mats, deteriorating infrastructure)
- Tidal and fluvial flood management
- Subsidence and sediment supply
- Mercury methylation
- Existing infrastructure, e.g. PG&E towers
- Neighboring properties, e.g. airports
- Vector concerns
- Invasive species, e.g. *Spartina*
- Conflicts regarding public use
- Conflicting habitat needs of wildlife

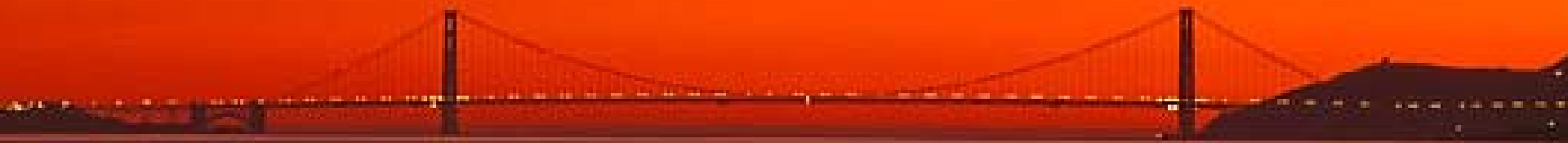




"Gentlemen, it's time we gave some serious thought to the effects of global warming."

Significant Project Costs

- Flood management levees
- Public access amenities
- Restoration design features
- Site clean-up
- Protection of existing infrastructure (power lines, etc.)
- Monitoring, applied studies, and adaptive management
- O&M

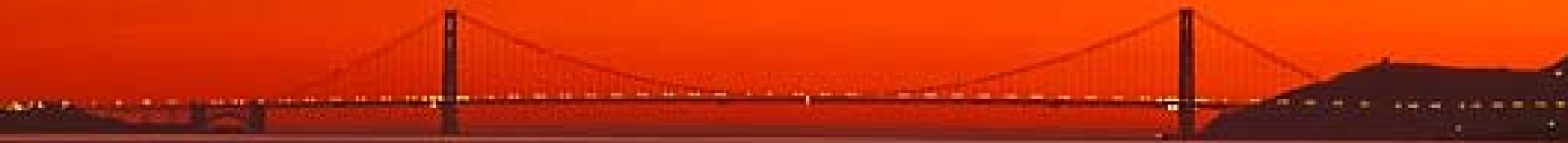


Significant Investments

Investments over past decade:

- Bayland acquisitions ~ \$200m
- Restoration planning ~ \$50m
- Restoration ~ \$50m

Anticipated investment in next decade ~ \$400m



Great Expectations

- Options at variety of price points
- Cost/Benefit analysis: acreage and timing of various tidal habitats
- Some security in investment: persistence of habitats in face of sea level rise
- Flexibility: goal may not be insta-marsh



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