Environmental and Regulatory Implications of the Diminishing Gold-Rush Era Sediment Deposits in San Francisco Bay

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Overview

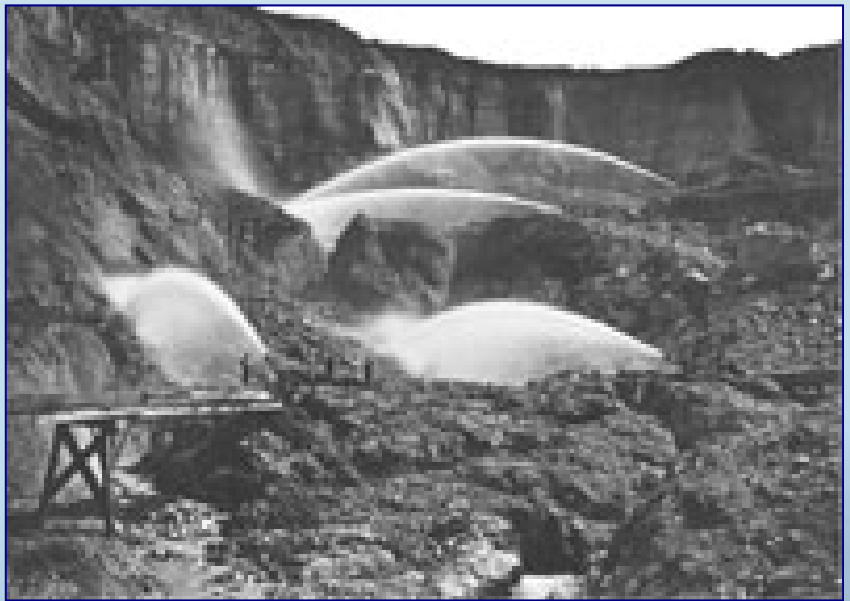
- Gold Rush era sedimentation and resulting mercury contamination in SF Bay
- Historic SF Bay sediment transportation and current trends
- Regulatory issues related to sediment mercury levels
- Environmental and economic considerations

Background

- Mercury (quicksilver) used to recover gold from placer and hardrock mining
- Most of the mercury lost to the environment from placer mines
- Hydraulic mine slurry flowed into sluices where gold particles combined with liquid mercury to form gold–mercury amalgam
- Loss of mercury in this process was 10 to 30 percent per year

Background

- Hydraulic mining washed away entire hillsides
- Deposited approximately 210 million cubic yards of sediment per year in the basins of the Yuba, American, and Bear Rivers alone
- Hydraulic mining banned in 1884

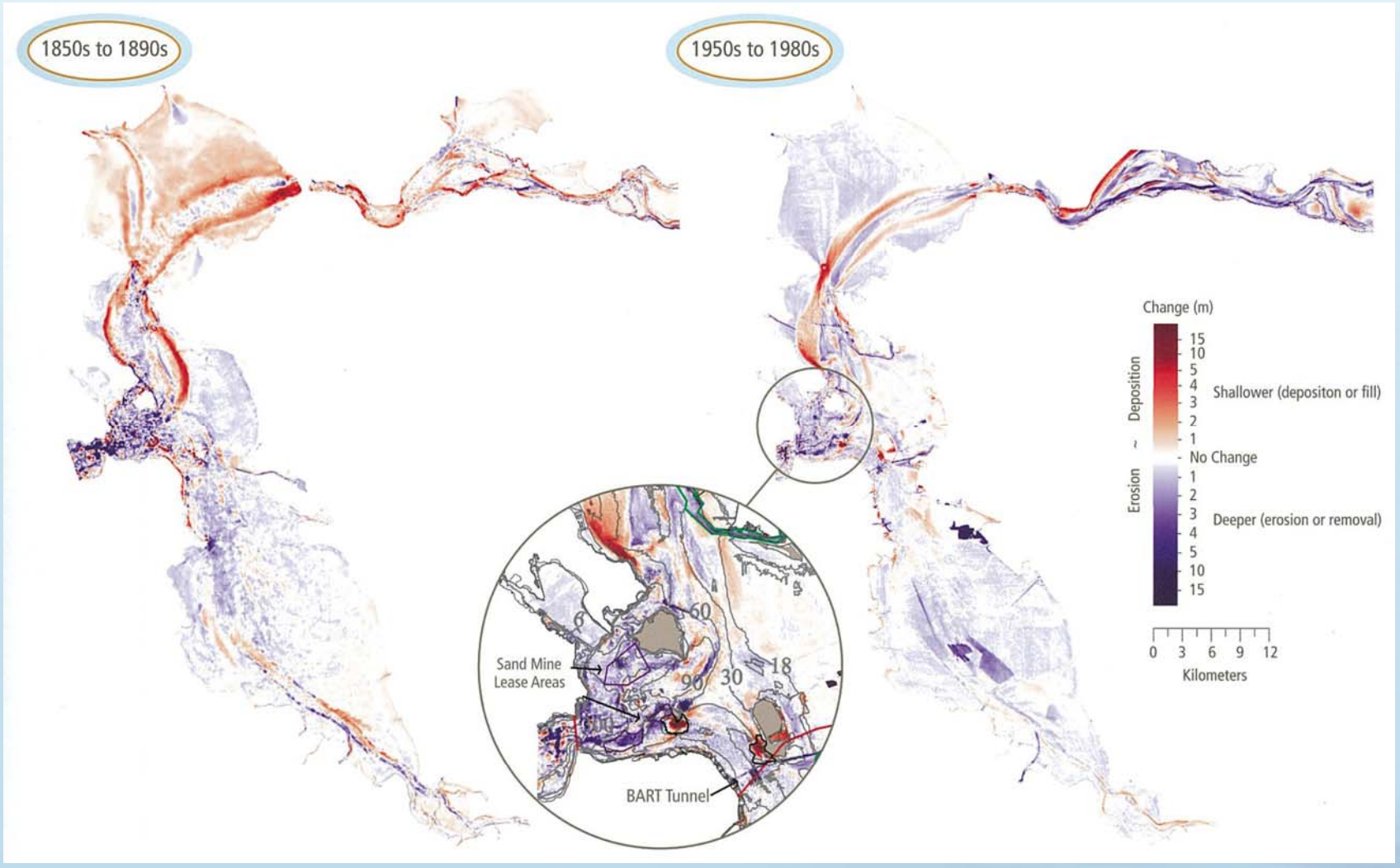


Changing Sediment Flux

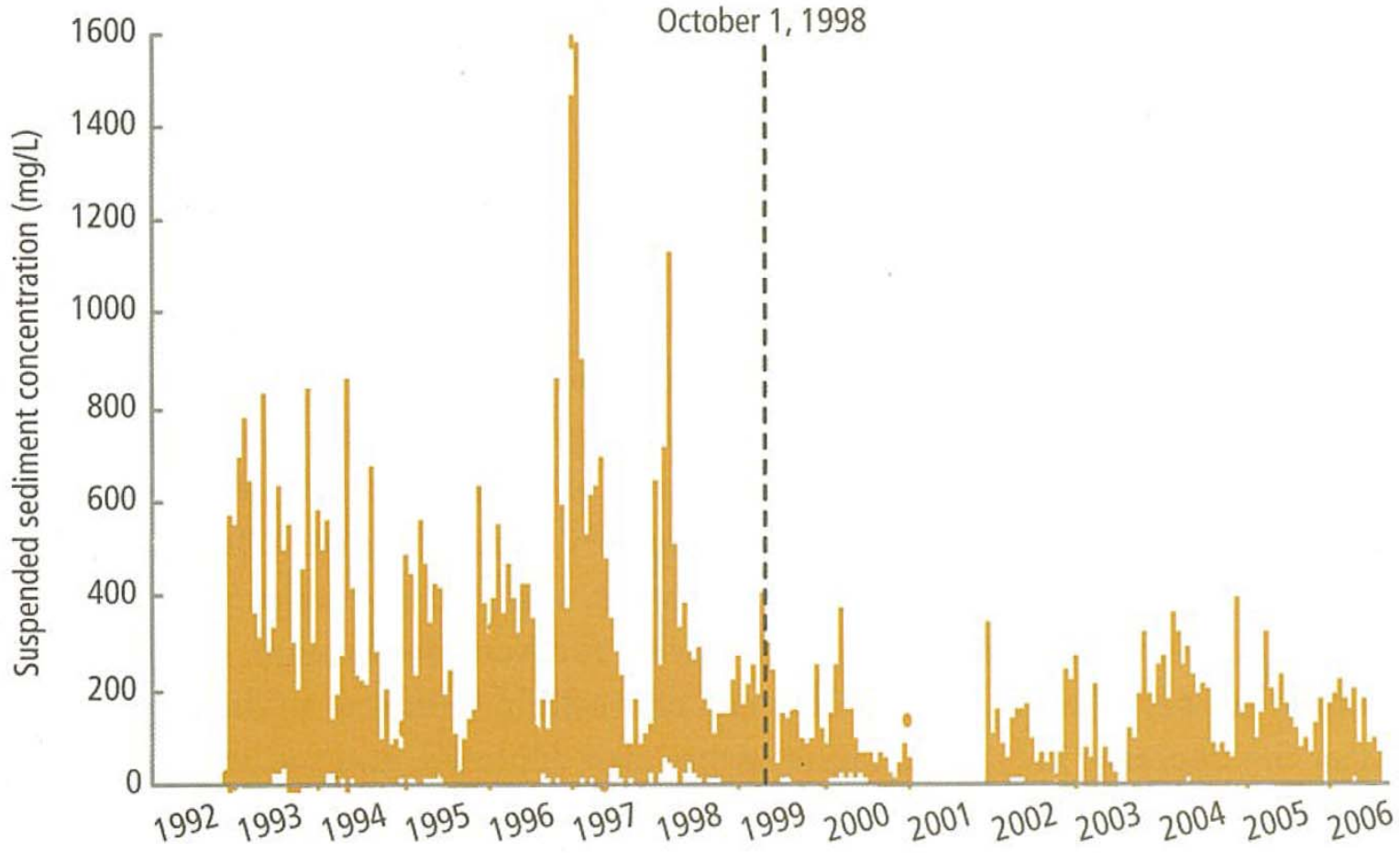
- Early studies of sediment flux from the Delta show annual deposits to the Bay of >6 MCY during first half of the 20th century
- USGS review of regularly monitored TSS data suggests watershed-side sediment supply *and* store attributed to gold-rush era mining has significantly subsided (SFEI 2009).
- Other studies of the sediment flux into the Bay appear to support this claim.

Author	Year of Publication	Period of Study	Annual Flux (MCY)
Porterfield	1980	1909 - 1966	6.6
Beeman	1992	1955 - 1990	5.9
Wright & Shoellhamer	2005	1995 - 2002	2.6
McKee et al.	2006	1994 - 2003	3.0

Changing Deposition Rates

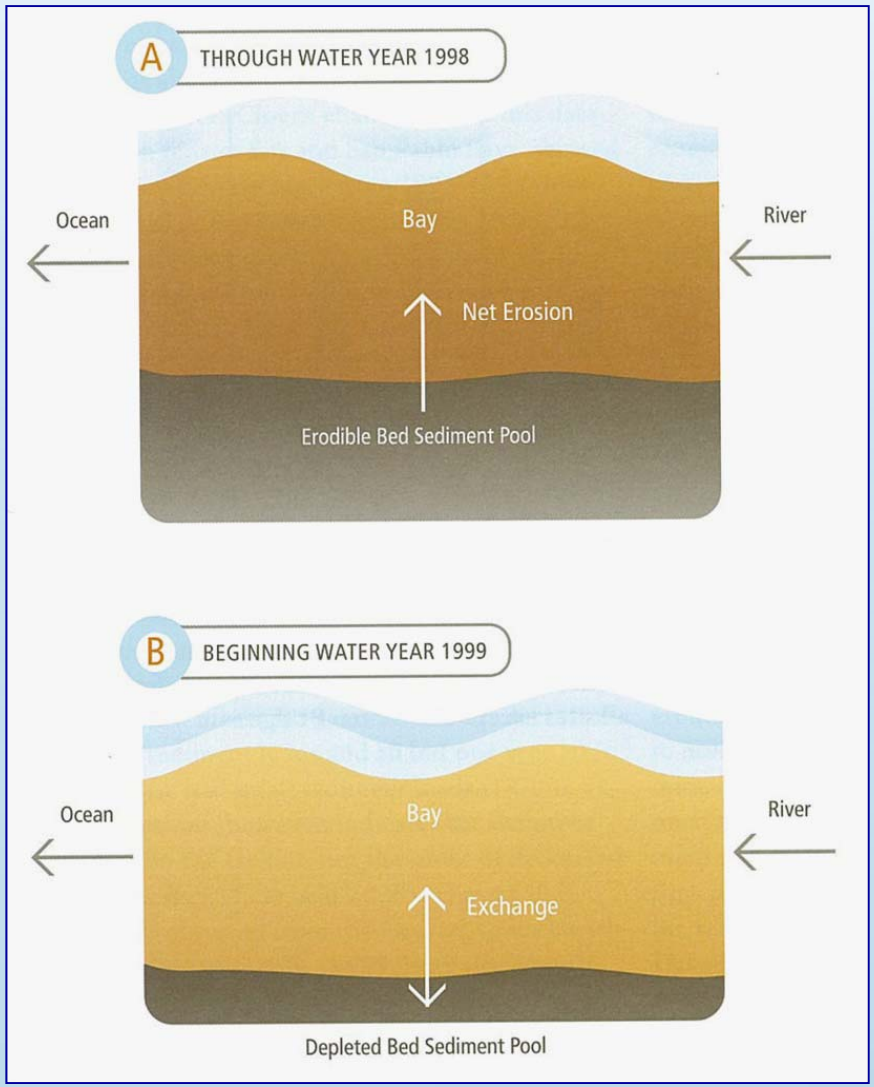


Changing Resuspension Rates



Footnote: Suspended sediment concentration, mid-depth, Point San Pablo. In 2001 the station was temporarily closed while the pier supporting the instruments was repaired.

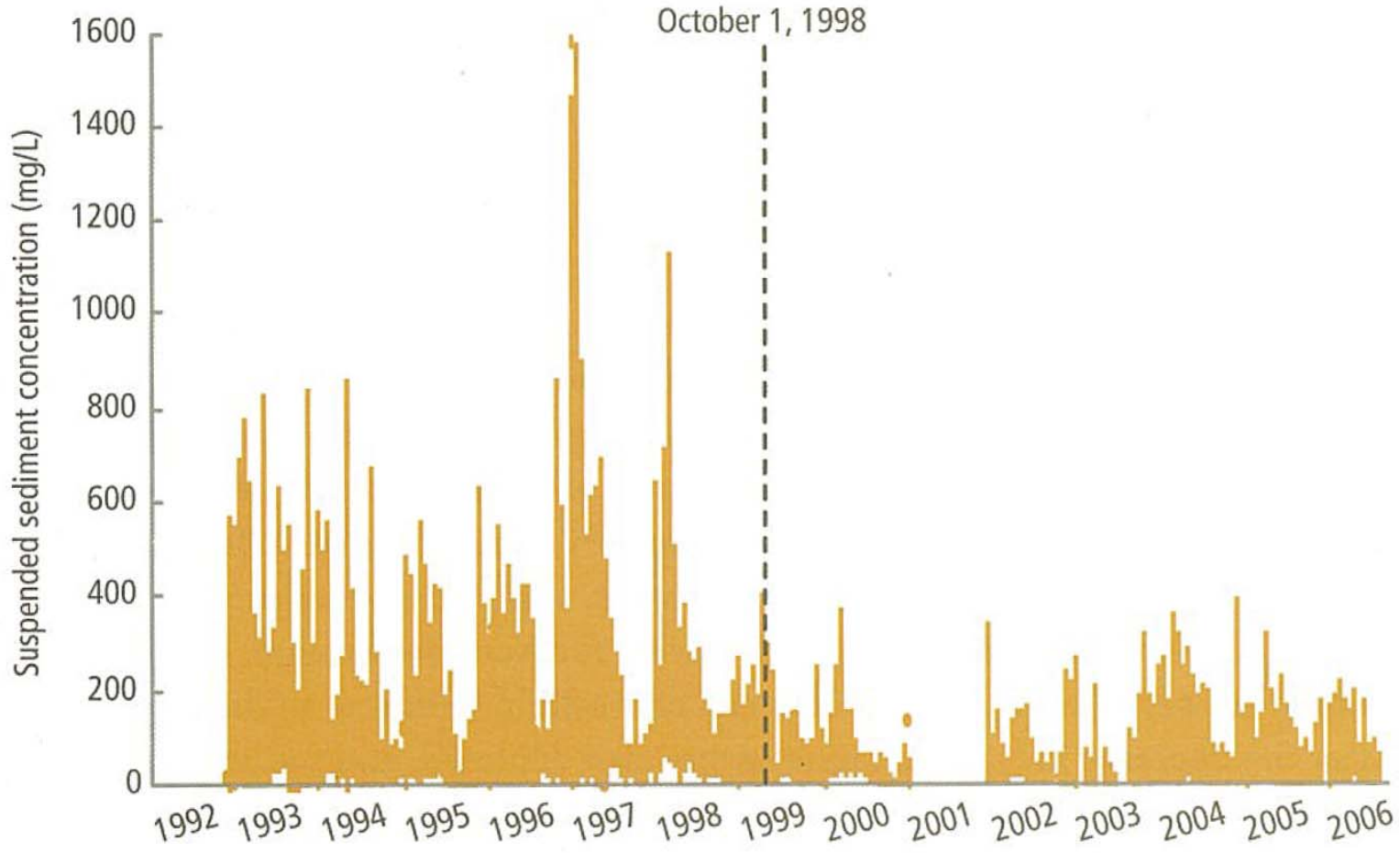
Depletion of Bedded Sediment Pool



Ramifications to Dredging

- Erosion most notable in areas of higher energy flow and adjacent shallows and flats.
- Eroded areas generally coincide with Regional Monitoring Program (RMP) sample locations
- Mercury concentrations at these locations lowering over time to pre-mining era levels

Changing Resuspension Rates



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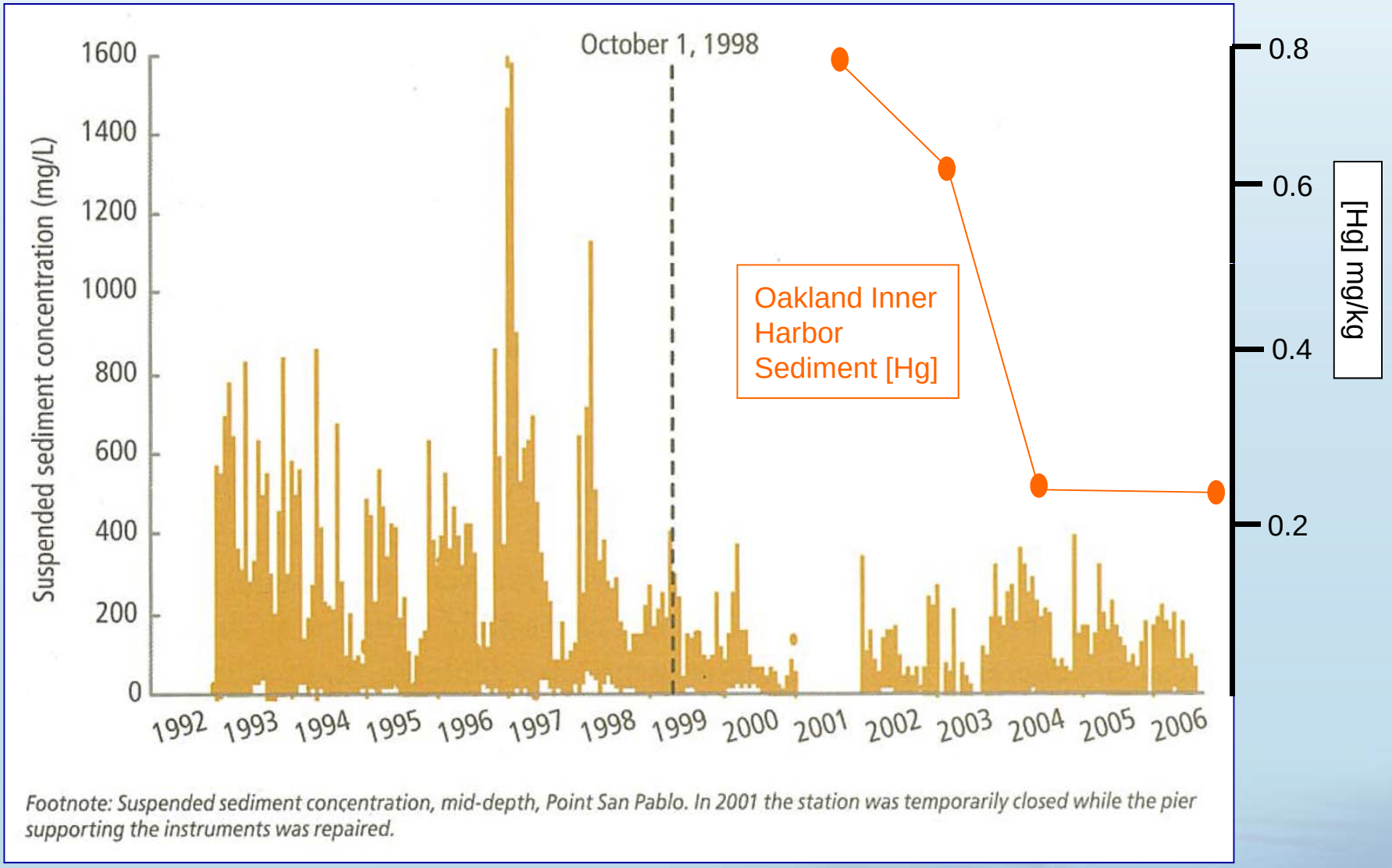

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Mercury TMDL

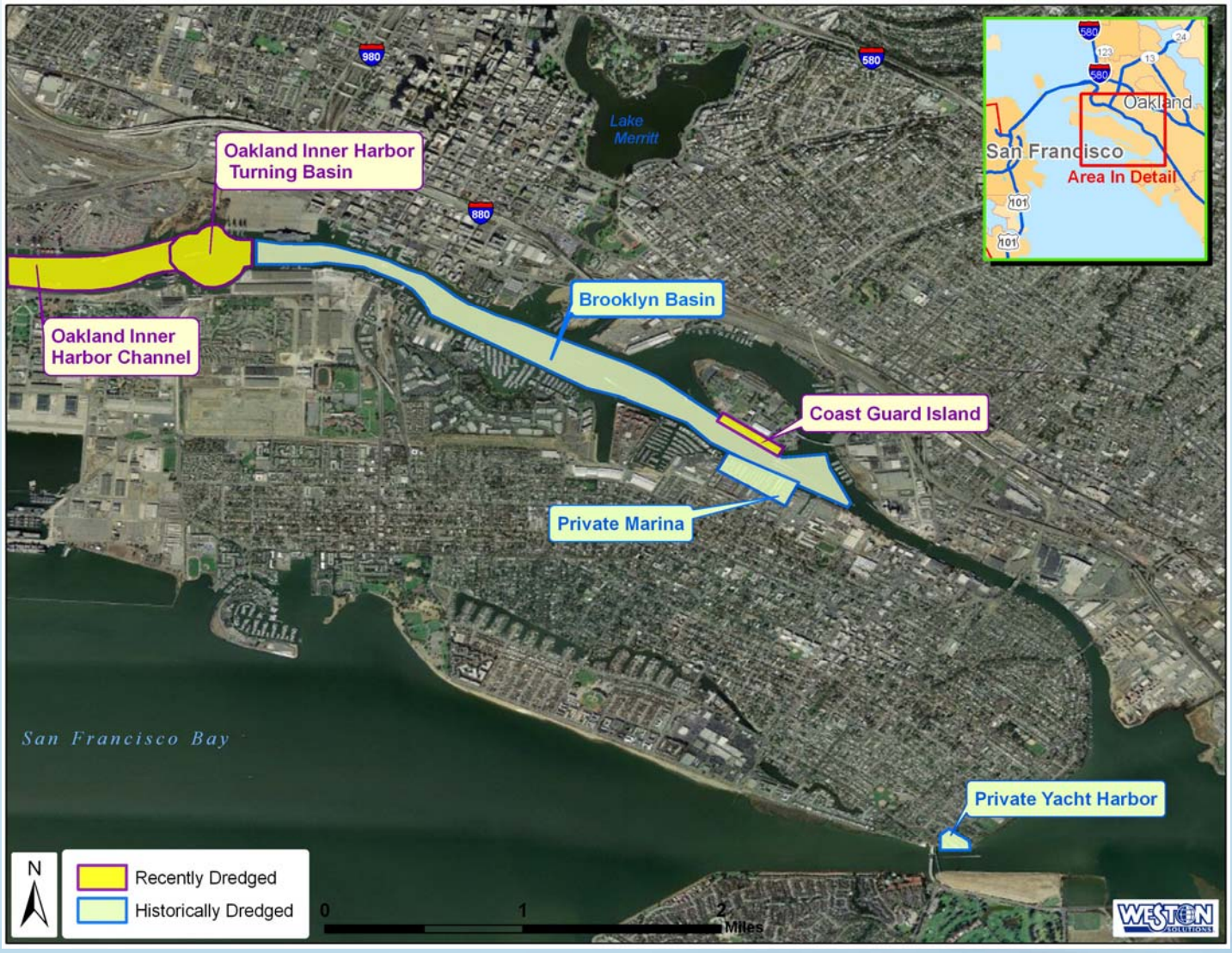
- The mercury TMDL was amended to the SF Bay Regional Water Quality Control Board Basin Plan in 2008
- TMDL approach to managing dredged material as a contaminant source:

  The disposal of dredged material will not be restricted unless the concentration exceeds the 99th percentile of the previous 10 years of Bay sediment sample data collected through the RMP

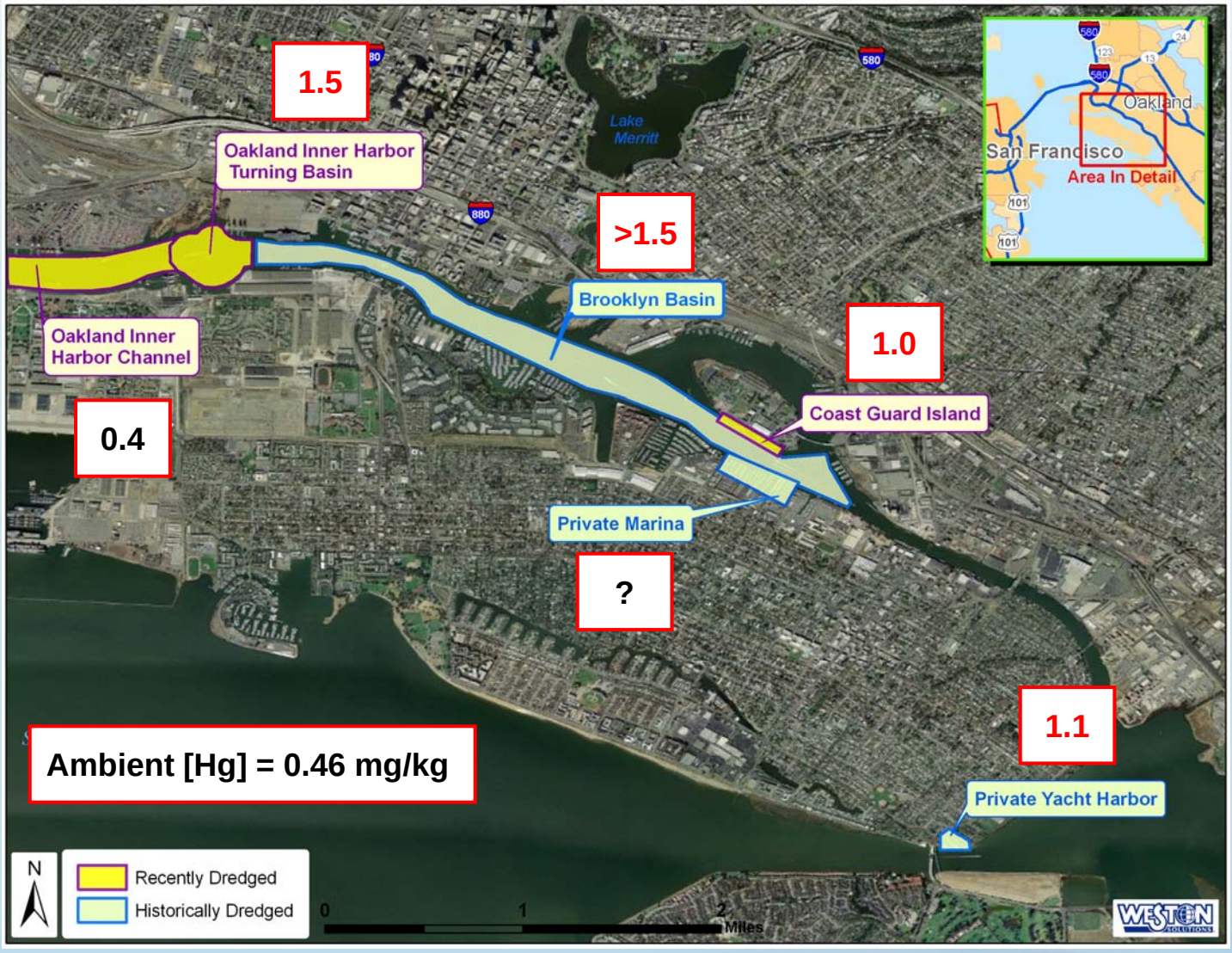
  CURRENT = 0.46 mg/kg

- TMDL restriction over-rides current regulatory process for determining aquatic disposal suitability.

Case Studies



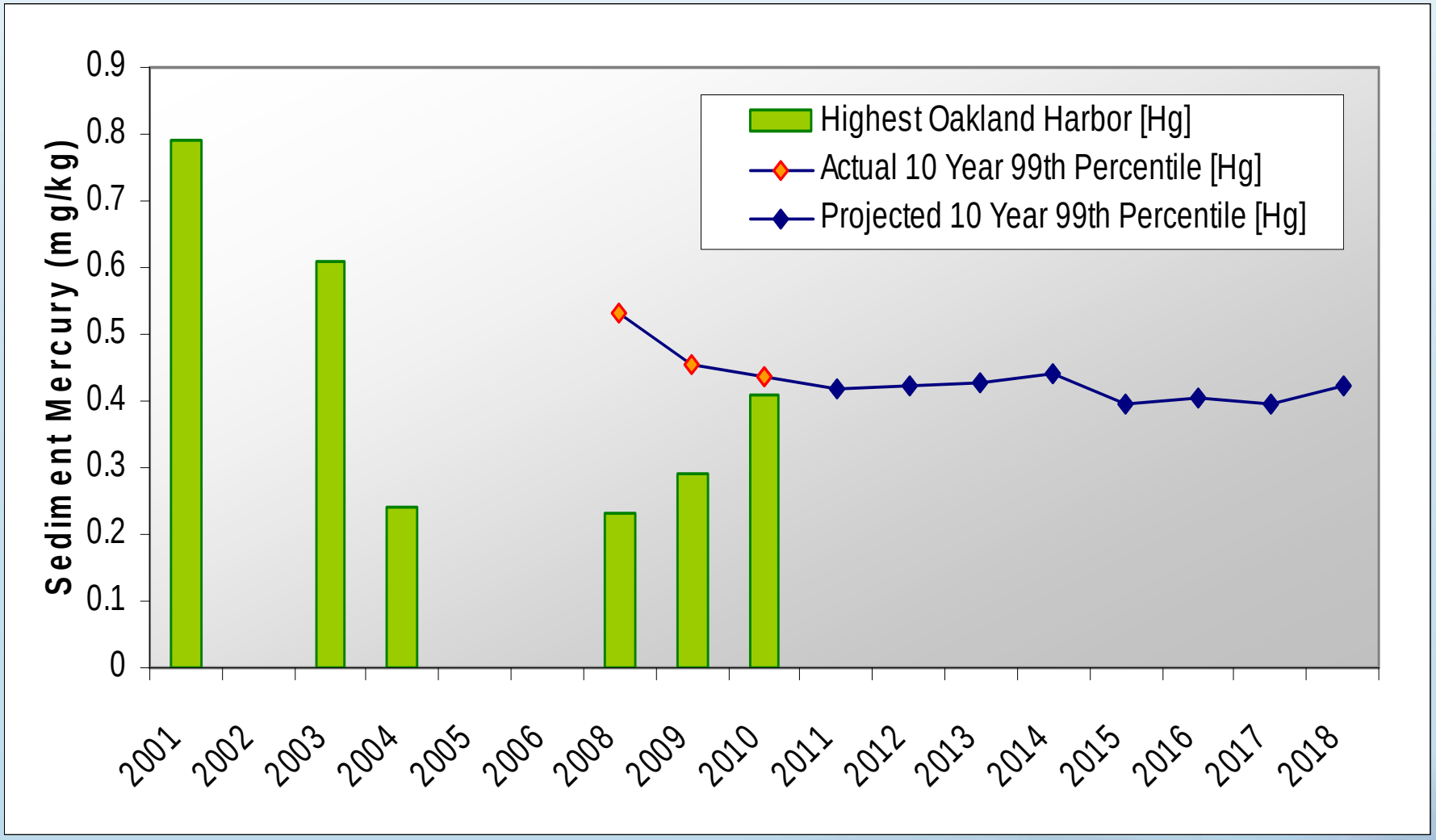
Case Studies – Hg Levels



Case Studies – Dredge Disposal/Reuse Options

Project	[Hg] (mg/kg)	Relocation Option	Cost per CY
Brooklyn Basin	>1.5	?	
Oakland Inner Harbor Turning Basin	1.5	Landfill	>$100
Coast Guard Island	1.0	Landfill	>$100
Private Yacht Harbor	0.6	Beneficial Use	$50
Oakland Inner Harbor Channel	0.4	Beneficial Use + Aquatic Disposal	$15 - $25
Private Marina	?	?	?

Potential TMDL Impacts on Dredging



Future Considerations

- Environmental:
  - Mercury methylation
  - Mercury cycling
  - PCB cycling

- Economic:
  - Potential for small dredger concessions
  - Development of more beneficial use options
  - Federal project funding commiserate with reuse costs

QUESTIONS??

ANSWERS??