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Infrastructure, environment, buildings

Yosemite Slough Meeting

January 23, 2009

Presentation Objectives

- Sediment Management Framework
- Site Conceptual Model
- Technical Issues
- Preliminary Comments on the Sediment Sampling Work Plan

Yosemite Slough is Similar to Other Sediment Sites in Size, COCs, and Available Remedial Options

Sites of similar size and geometry from other regions can serve as models

Site Name and Location	Decision Document	Dimensions	Sediment Remedy
KeySpan, Brooklyn Borough Gas Works (Coney Island MGP), Coney Island, NY	NYSDEC ROD, 3/02, (OU #2 - Coney Island Creek)	1,600 ft of creek (average 200 ft. wide), about 7.3-acre area	• Excavate top 3 ft of sediments across entire length and width of the creek adjacent to the site (34,000 cy)
Battery Tech/Duracell, Lexington, NC	USEPA ROD, 9/99 (OU #1)	Upper 2,000 ft of the unnamed tributary of Fritz Branch	• Hot spot excavation and offsite disposal of 700 to 900 cy of mercury-containing sediments • Long-term monitoring
McCormick & Baxter (Old Mormon Slough), Stockton, CA	USEPA ROD, 3/99	2,330 ft long by approximately 167 ft wide; 8.8-acre area	• In-place capping of 70,590 cy of sediments with a minimum of 2 ft of clean sand, armoring in erosion-prone areas.
Dewey Loeffel Landfill, Nassau, NY	NYSDEC ROD, 1/02 (OU #3 – Drainageway)	Total length of Tributary T11A is 1,700 ft.	• Total removal of fine-grained sediments in Tributary T11A, offsite disposal • Remove 2,500 cy of sediments in Area 28 of Valatie Kill; offsite disposal • Monitored natural attenuation for Nassau Lake and remainder of Valatie Kill
Gulf States Utilities, North Ryan St., Lake Charles, LA	NTCRA Action Memo, 6/99	16,800 sq. ft. (0.4 acres)	• Soils in storm sewer area – excavate with offsite disposal in landfill – performed in 2001; 278 tons of soil removed
		30 ft x 64 ft (1,920 sq. ft.)	• Cap was placed in January 2001 over sediment adjacent to storm sewer discharge point
Duwamish/Diagonal CSO/SD, Seattle, WA	WDOE Cleanup Action Decision, 7/02	7-acre area	• Dredge at least top 3 feet of sediment (approx. 62,000 in-situ cy) in Lower Duwamish Waterway • Install sediment cap
White Lake, Montague, MI	RCRA Final Decision, 7/01	1.6-acre area	• Dredge sediment in vicinity of outfall (Cable Arm) • Dewater onsite (Geotubes) • Onsite thermal treatment and/or offsite treatment/disposal
Commencement Bay, Olympic View Resource Area, Tacoma, WA	Record of Decision	2000 x 400 feet	• Dredging of 90,000 cubic yards, thin and thick capping
[illegible]			• Excavate 1.2 acres down to 1.1 ft and backfill with clean material.

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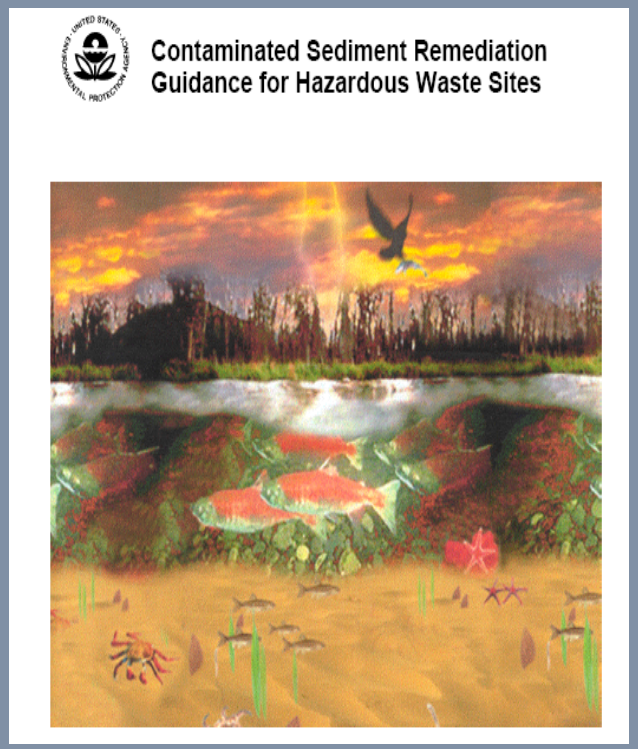
Key Principles for Managing Contaminated Sediments (EPA 2005)



From EPA 2005 pg 1-5

1. Control sources early
2. Involve the community early and often
3. Coordinate with states, local governments, Indian tribes and natural resource trustees
4. Develop and refine a conceptual site model that considers sediment stability
5. Use an iterative approach in a risk-based framework
6. Carefully evaluate the assumptions and uncertainties associated with site characterization data and site models
7. Select site-specific, project-specific, and sediment-specific risk management approaches that will achieve risk-based goals
8. Ensure that sediment cleanup levels are clearly tied to risk management goals
9. Maximize the effectiveness of institutional controls and recognize their limitations
10. Design remedies to minimize short-term risks while achieving long-term protection
11. Monitor during and after sediment remediation to assess and document remedy effectiveness

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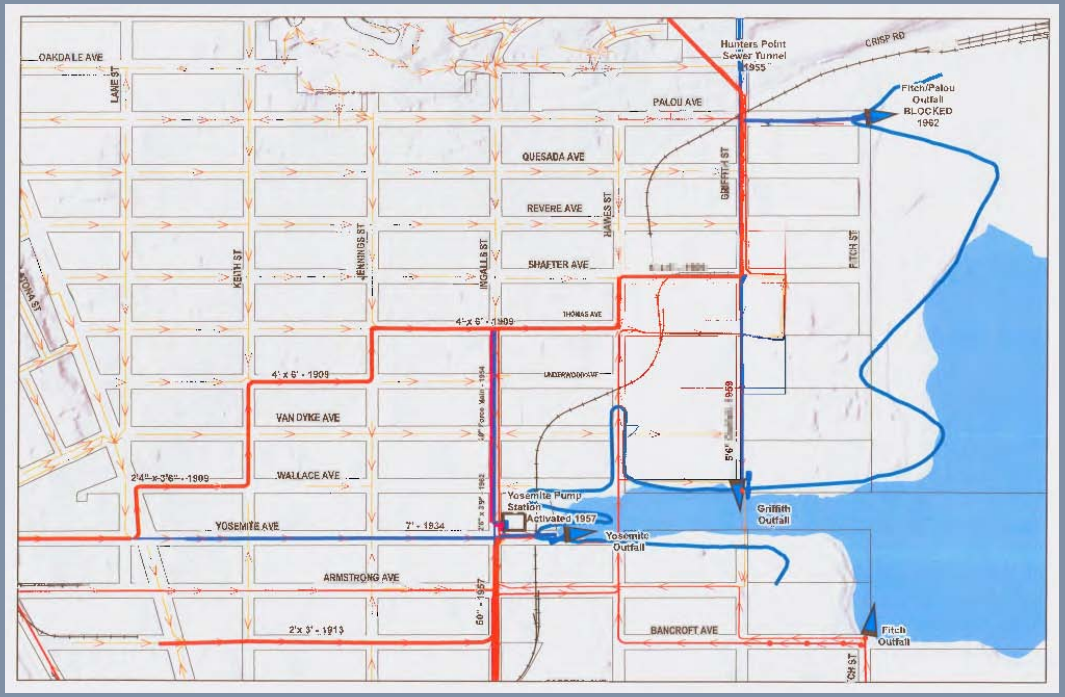
Control Sources Early



- Two outfalls in the Slough and another nearby.
- Other significant sources may exist.
- Site-specific data are required to evaluate the potential for recontamination and the need for source control.
- The absence of these data and analyses contraindicate removal action.

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Recontamination is a Real Threat

- Recontamination has tarnished several notable sediment remedial actions including those involving dredging, capping, and combinations of dredging and capping.
  - 8 capping sites
  - 6 dredging sites
  - 5 combination capping & dredging sites
- These examples are shown on the following slides

From Nadeau and Skaggs, 2008

Recontaminated Sites

Site	Response Measure(s)	Recontamination Information
Anacostia River, DC	2004 cap	2006 urban sources, upstream sources
Bloomington, IN (3 creeks)	1987 sediment removal	1992 all sources unclear – point source discharge included
Convair Lagoon, CA	1998 cap	2002 public storm drain discharges
Denny Way Site, WA	1990 cap	1993 CSO point source discharges
Duwamish Norfolk CSO, WA	1999 dredge-cap	2001 CSO point source discharges; unremediated adjacent contaminated sediment
Duwamish River Diagonal, WA	2004 dredge	2005 sewage system discharges
Eagle Harbor Site, WA	1994 cap	1999 “surface sources,” “offsite sources”
Ford Outfall/River, Raisin, MI	1997 dredge	2001 unremediated upstream sediments and/or upland sources; sediments sloughed from adjacent navigational channel
Fox River SMU 56/57, WI	2000 dredge-cap	2005 1.2-1.5 m of new impacted sediment deposited in 5 years
Housatonic River, MA	2002 dredge-cap	2005 upstream sources, CSO and SSO point source discharges

From Nadeau and Skaggs, 2008

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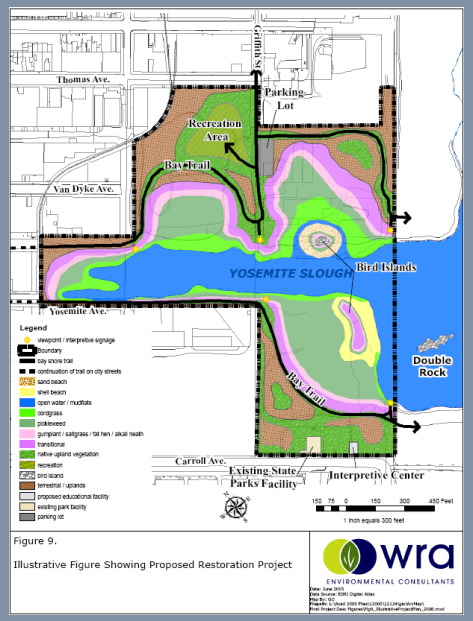
Recontaminated Sites

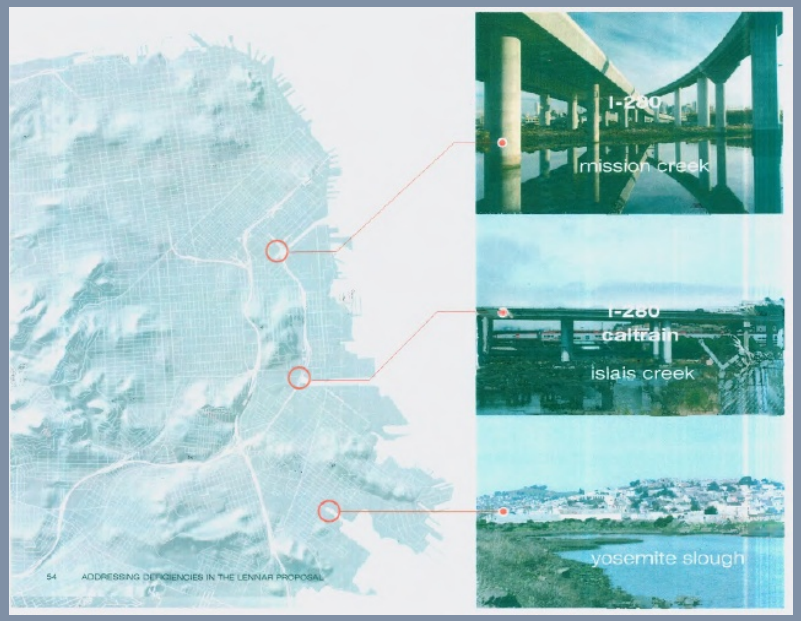
Site	Response Measure(s)	Recontamination Information
Lauritzen Canal, CA	1996 dredge-cap	1998 undetected point source(s); incomplete remediation near margins of site
Long Beach North Energy Island Borrow Pit (NEIBP), CA	2001 cap	2004 “deposition from the surrounding harbor”
Pier 51 Ferry Terminal, WA	1989 cap	1990 PAHs due to pile pulling; metals from “new sediment deposition”
Pier 53-55, WA	1992 cap	2002 prop wash resuspension near edges; PAHs due to pile removal
Pier 64-65, WA	1994 cap	2002 piling repair work released creosote
Puget Sound Naval Shipyard Pier D, WA	1994 dredge	1998 suspected resuspension of sediments from outside response area
Sitcum Waterway/Nearshore Tideflats, WA	1993 dredge	2002 “continued source input from recent sediment deposition or off-loading activities”
St. Clair Shores, MI	2002 dredge	2003 sewer pipe discharges
Thea Foss Waterway, WA	2002 dredge-cap	2006 city storm drain discharges

From Nadeau and Skaggs, 2008

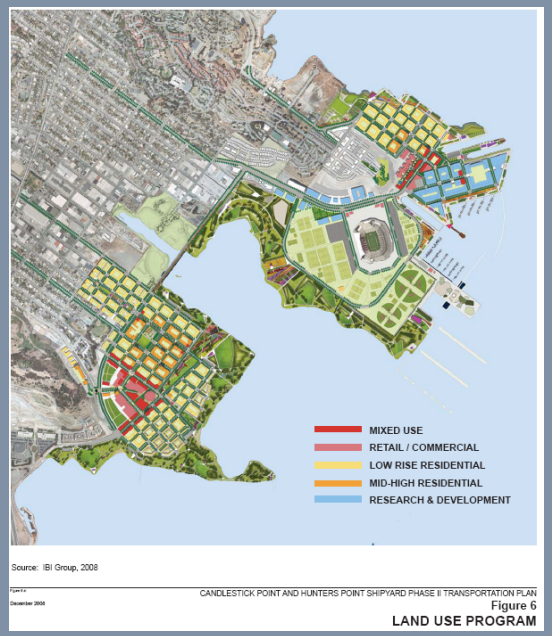
Involve the Community
Coordinate with Stakeholders



From WRA 2006



From ARC Ecology 2009



From Lennar 2008

- Multiple plans for adjacent uplands.
- Each plan could have a different impact on risk-based management goals and the selection of a remedial alternative.

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Develop a Conceptual Site Model that Considers Sediment Stability

- Conflicting information regarding sediment stability exists for the site.
- Key data including sediment radioisotope geochronology are needed.
- Sensitivity will depend on end-use scenario.
- Speculation is not adequate for decision making.

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Select Specific Risk Management Approaches to Achieve Risk-Based Goals

- RAOs are intended to provide a general description of what the cleanup is expected to accomplish. What is being protected ?
- RAOs are derived from the conceptual site model and address the significant exposure pathways.
- Different receptors and exposure pathways may result in different RAOs and cleanup goals.
- RAOs are a means to compare proposed remedial alternatives to confirm that they are appropriately protective.
- Risk management and remedy selection should also consider impact of the remedial option on stakeholders.

TABLE 2-2: RANGE OF PRELIMINARY REMEDIATION GOALS FOR CHEMICALS OF CONCERN IN SEDIMENT AT PARCEL F

Feasibility Study Report for Parcel F, Hunters Point Shipyard, San Francisco, California

Preliminary Remediation Goal	Copper (mg/kg)	Mercury (mg/kg)	Total PCBs (µg/kg)
Surf Scoter			
Based on a SUF of 1.0	135	0.94	620
Based on a SUF of 0.5	271	1.87	1,240
Human Consumption of Shellfish[a]			
Based on a cancer risk 10^{-6}	Not applicable	Not applicable	135
Based on a cancer risk 10^{-4}	Not applicable	Not applicable	13,500

Notes:

a Unacceptable risk was not shown to occur for copper and mercury for the consumption of shellfish.

HPS Parcel F FS (Barajas 2008)

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Minimize Short-term Risk and Achieve Long-term Protection

- Removal of sediments invokes short-term risks to the community.
- Actions involving less intrusive remedies may achieve the same long-term goals.
- The toolbox approach and community quality of life need to be considered.

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Conceptual Site Model

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Conceptual Site Model

Current

- Current Land Use
  - Slough: intertidal mud flat
  - Adjacent shoreline: sloping banks, limited riprap, and seawall
  - Adjacent properties: industrial and open space
- Potential Sources
  - Urban stormwater and combined sewer outfalls
  - Adjacent industrial sites
  - Groundwater
  - HPS Area X in South Basin
- Transport Pathways
  - Sediment stability and potential for contaminant movement?
- Current Exposures
  - Intertidal mudflats: sandpipers, ruddy ducks
  - Fringing salt marsh: minimal
  - Human Exposure?

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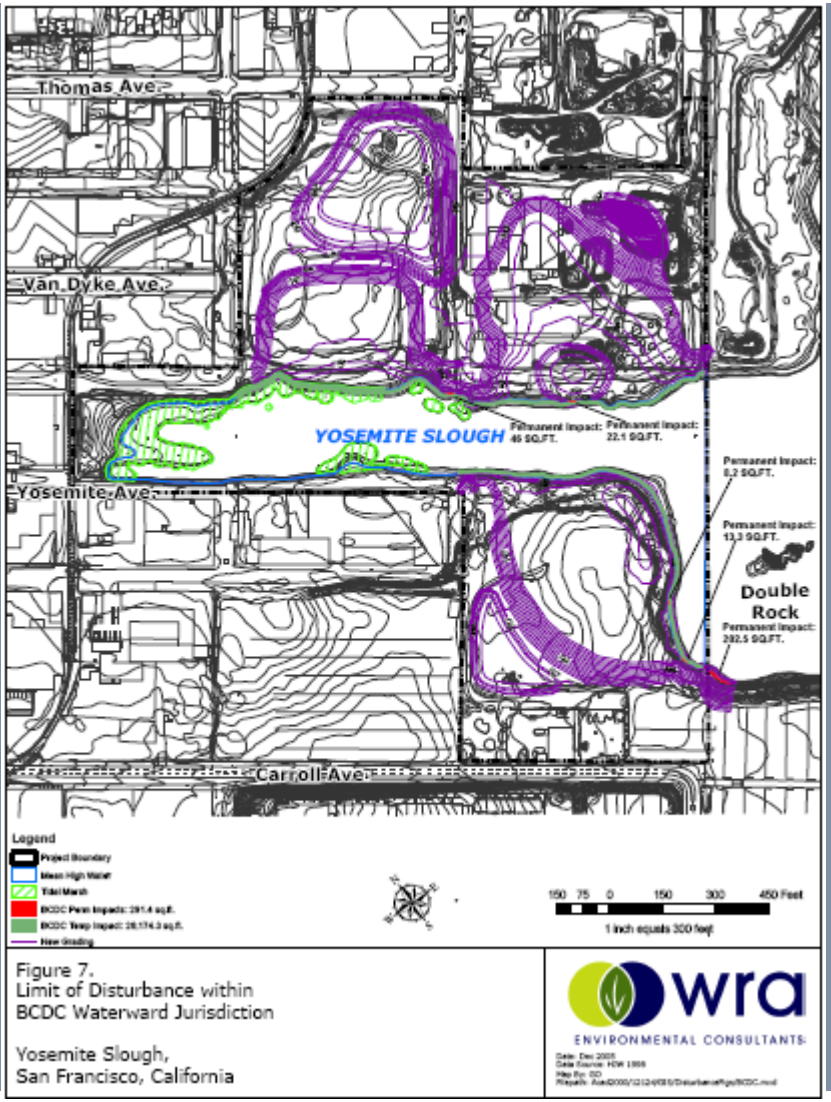
Conceptual Site Model

Future – Full Wetland Restoration and HPS Remediation

- Future Land Use
  - Slough: intertidal mud flat, limited salt marsh
  - Adjacent shoreline: salt marsh, and seawall
  - Adjacent properties: industrial and salt marsh
- Potential Significant Recontamination Sources
  - CSOs?
  - Stormwater?
  - Bank erosion?
- Transport Pathways
  - Sediment stability and potential for contaminant movement?
- Future Exposures
  - Intertidal mudflats: sandpipers, ruddy ducks
  - Salt marsh: greatly increased in size, potential for clapper rail, salt marsh harvest mouse
  - Human Exposure ?



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Conceptual Site Model

Future – Partial Wetland Restoration and Delayed HPS Remediation

- Future Land Use
  - Slough: intertidal mud flat, limited salt marsh
  - Adjacent shoreline: salt marsh, riprap/seawall
  - Adjacent properties: industrial and salt marsh
- Potential Significant Recontamination Sources
  - CSOs?
  - Stormwater?
  - Bank erosion?
  - HPS Area X in South Basin?
- Transport Pathways
  - Sediment stability and potential for contaminant movement?
- Future Exposures
  - Intertidal mudflats: sandpipers, ruddy ducks
  - Salt marsh: increased in size, potential for clapper rail, salt marsh harvest mouse
  - Human Exposure?

Technical Issues

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Issue 1 – Development of Risk-Based Management Goals

- How are constituents of concern (COCs) identified?
- What are the COCs?
- What are the receptors, contaminants and exposures that should be addressed in the remedial action objectives (RAOs)?
- What are the appropriate clean-up goals or "action levels" based on the COCs and RAOs identified for the project?
- Concerns:
  - Battelle COC list based on sediment chemistry = Pb, Hg, Zn, PCBs, dieldrin, chlordane, DDT
  - Battelle COC list based on ecological risk assessment (ERA) = PCBs, DDT
  - Proposed Action Levels = ERMs. How do these relate to management goals of protection of human health and the environment?

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Issue 2 – Sediment Stability

- How stable are sediments under current conditions?
- How stable will they be in future conditions?
- What are the significant factors at this site?
  - Erosion?
  - Storm waves?
  - Tidal currents?
- Are there engineering solutions to mitigate for these factors?
- Are there sufficient data to answer these questions (historical or proposed new data)?
- Concerns:
  - Erosion Scenario - large rain event, concurrent with low tide, and 900+ CFS combined-sewer discharge could incise a 3-ft deep layer of contaminated sediment and mobilize and distribute sediments further out into the Bay.
  - Preliminary analysis of potential for erosion lead to an exaggerated conclusion. This type of outcome is highly unlikely and easily prevented.

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Issue 3 – Contaminant Migration

- How mobile are shallow sediments?
- Do existing data indicate highly mobile and variable shallow sediments?
- Will proposed data collection address the issue of the potential for contaminant migration?
- Concerns
  - Historical surface sediment data do not indicate significant transport from Yosemite Slough into South Basin.

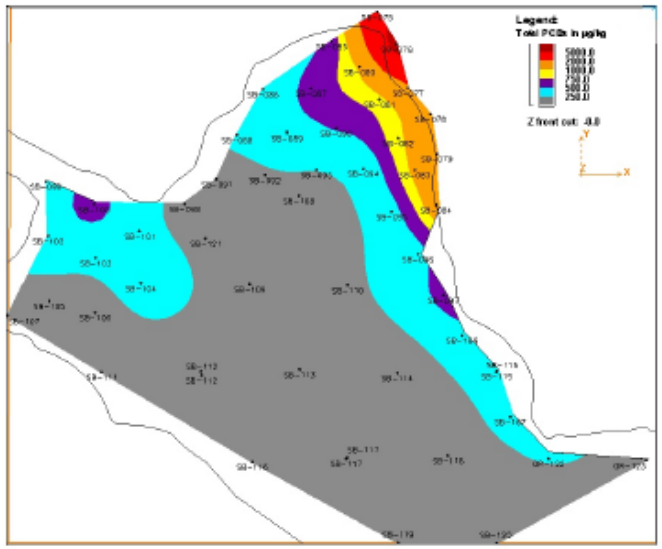

Figure 2-4a. Total PCB Distribution in Surface Sediment (2003)

From Barajas & Associates 2008

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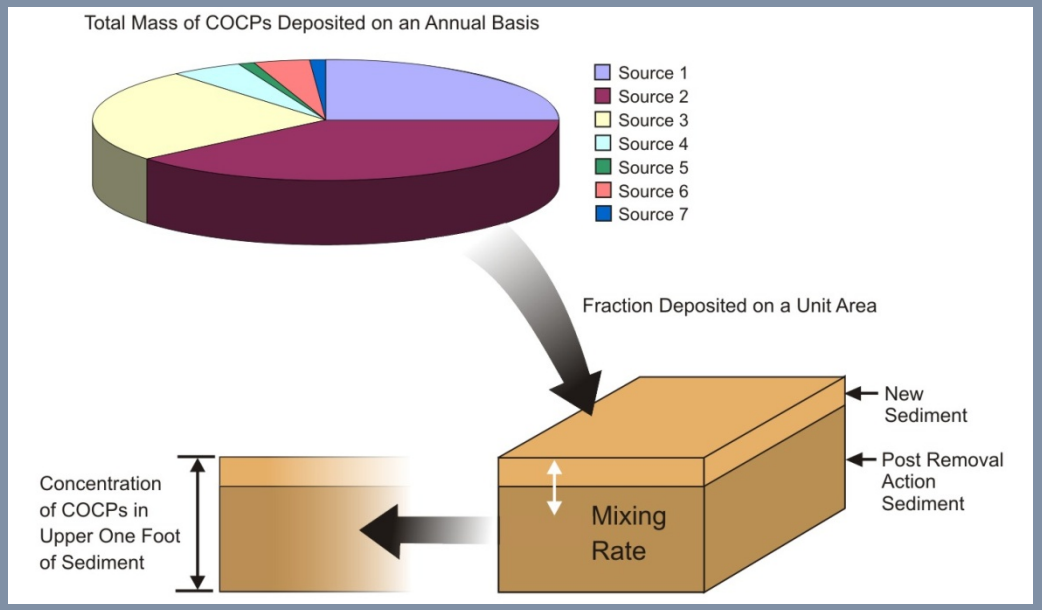
Issue 4 – Recontamination



- Recontamination evaluation should be performed prior to remedial action.
- Mass of contaminants being transported by CSOs, stormwater runoff from banks, bank erosion and HPS Area X at South Basin may cause recontamination.
- Current and future sources of contamination and mass of contaminants from each source have not been evaluated.
- Source control should be evaluated and implemented prior to remedial action, per USEPA Contaminated Sediment Remediation Guidance for Hazardous Waste Sites

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Issue 5 – Monitored Natural Recovery

- What is the mass of contaminants entering Yosemite Slough? Will this lead to natural recovery or recontamination?
- Are shallow sediments stable or are they being mobilized and transported.
- Concerns
  - Conflicting lines of evidence and Insufficient data make reliable conclusions impossible.
  - Radioisotope data from Navy investigation indicate sediment at site shows signs of mixing and Battelle report suggests shallow sediment is mobile yet hydrodynamic modeling indicates erosion is only a potential problem during a storm event at low tide. This is conflicting information.
  - Battelle surface sediment data collected at same location over successive years generally indicate similar concentrations (within USEPA acceptable criteria for field duplicates). Exception is total PAH concentrations which indicate decrease in concentration with time.
  - Very limited subsurface data available. Battelle historical sediment core data for a given location generally does not show a clear pattern with depth. Exception is location 1N at head of slough which typically has a subsurface maxima for compounds, indicating natural recovery may be occurring.
  - May have different sediment processes occurring at various locations in the slough.

Issue 6 – Engineering Site Conditions

Potential Engineering Implications of Site Conditions:

- Tidal Range & Water Depth:
  - Feasibility of sheet pile cofferdam (potentially large hydrostatic and hydrodynamic load)
- Geology / Depth to Bedrock:
  - Feasibility of sheet pile cofferdam → Need embedment into soil / sediment
- Subsurface Conditions:
  - Feasibility of sheet pile cofferdam depends in part on strength of soil / sediment
  - If sediment in slough is extremely soft, excavation "in the dry" can be extremely challenging
- Sediment Stability:
  - Sediment stability (erosion/sedimentation rates) affect effectiveness of remedial technologies
  - Monitored Natural Recovery (MNR) and capping could be affected in particular

Issue 7 – Alternative Technologies

- Potential Alternatives
  - Hot Spot Removal
  - Removal / Capping
  - Capping
  - Monitored Natural Recovery
  - Combination of several technologies (tool box approach)
- Potential effects of selecting alternative technologies:
  - Reducing removal volume reduces disposal cost and likely overall construction cost
  - Modifications to EPA alternative will require additional scientific studies & engineering
  - Modifications would likely require long-term monitoring
- Detailed analysis of removal action cost is needed
- A “Tool Box” approach is likely to achieve desired goals at a lower cost.

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Preliminary Comments on the Sediment Sampling Work Plan

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Sampling Objectives

EPA

- SAP Objective: Identify sediment concentrations that exceed actions levels and estimate volume of sediment that exceeds action levels.

Concerns

1. Inconsistency between the Data Quality Objectives (DQOs) identified in Appendix A and the remaining SAP. Some examples of inconsistencies include:
   a. Identification of hot spots. This is a different objective than identifying nature and extent and delineating removal area.
   b. Decide whether and what quantity of contaminated sediment requires removal to protect human health and the environment. How does using action levels based on ERMs relate to this decision rule?
   c. Data generated will be used to evaluate potential future actions at the site. No data are proposed that address the potential for recontamination, possible use of alternative remedies or engineering needs.
2. All decisions made stemming from the DQO Appendix are therefore inconsistent with the data use objectives, project task/sampling objectives, and DQOs described in the SAP.

Recommendations

1. Identify objectives that are consistently used throughout SAP. Objectives might include:
   a. Defining nature and extent of contamination.
   b. Development of RAOs that address management goals. Confirm “action levels” are relevant and detection limits are sufficiently sensitive.
   c. Evaluate potential for recontamination.
   d. Evaluate remedial alternatives.

Sampling Design

EPA

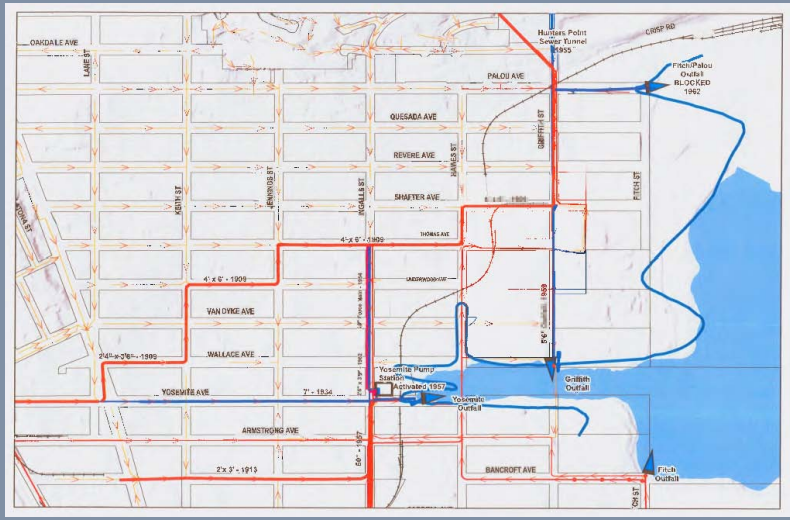
- Combination of systematic random and judgmental sampling.
- Samples collected at 1-foot intervals (0-1, 1-2, 2-3, 3-4 and 4-5 ft bgs).

Concerns

1. Approach is based on hot spots, but dispersal of contaminated material is likely on a concentration gradient, due to CSO discharges and tidal action. Samples should be collected along transects originating at the CSOs.
2. Approach assumes that a hot spot of 15,000 ft^2 can be identified. What is the management basis of this size hot spot? How does it relate to exposure concerns?
3. SAP notes that random sampling may result in inadequate spatial coverage for delineation of contamination so added 10 judgmental samples to cover that possibility.
4. Approach does not account for practical resolution of the remediation method. Grid isn't based on smallest area that can effectively be remediated.
5. Does not use historical data to guide proposed sampling locations.
6. Approach doesn't address most significant exposure horizon, surface sediments (0-5 cm).

Recommendations

1. Connect sample design to remediation considerations. Base size of grid on resolution of remediation method.
2. Use existing data to guide sampling design, such as samples in nearshore for each bank and in the center of the channel.
3. Collect surface samples.



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Sampling Approach

EPA

- SAP provides proposed sampling location figure and list of potential sampling methods.

Concerns

1. Sampling location figure does not have any sampling locations identified. Just identifies grid. Sampling locations should be identified with geographic coordinates in a table.
2. A specific sampling method should be proposed rather than a list of potential methods. Historical sediment investigations should be used to identify methods that are proven.
   a. Samples can be collected at high tide from a boat using a gravity core.
   b. Sampling at low tide will require significant time to mobilized and demobilize from each location. Also poses a serious threat to the safety of samplers who could potentially get stuck in the mud on an incoming tide.
   c. Sampling methods proposed are unlikely to be successful (e.g., hand augering in soft sediment usually results in sediment falling out of auger as it is retrieved). Hole will collapse as auger is retrieved, thus only a surface sample can be collected).

Recommendations

1. Collect samples from a boat at high tide using a vibracore as it provides better depth control.
2. Use of precision GPS .

Analytical Testing

EPA

- Analyze samples for metals, pesticides, PCBs, and TPH.

Concerns

1. How was the analyte list developed?
2. Cr and TPH were never identified in earlier documents as COCs.
3. How will TPH be evaluated from a management perspective? No “action levels” identified for TPH.
4. Many different ways to measure PCB congeners and then add to create totals. How does the analysis of 20 congeners compare to other investigations in SF Bay, including the Regional Monitoring Program? Should additional or different congeners be proposed? How will Aroclor and congener data be used?
5. Proposed analyte list will provide information on nature and extent but will be insufficient to evaluate recontamination potential or remedial alternatives.
6. To evaluate recontamination potential, need data on mass of contaminants from likely sources (such as sediment traps in CSOs) and sedimentation rates (such as sediment traps in the slough).

Recommendations

1. Recommend reevaluating analyte list. Confirm congener analyses.
2. Collect data to evaluate recontamination potential.
3. Test selected location for 137 Cs and 210 Pb geochronology to estimate sedimentation rate and assist in determining depositional history.

Engineering Data

EPA

- SAP only addresses collection of data needed to assess sediment quality (i.e., chemistry).

Concerns

1. Engineering data will be needed to properly design and implement the remedy, select viable technologies, and estimate costs.
2. Some of the engineering data can and should be collected during the proposed sampling effort to reduce the number of sampling events and complete sampling in a timely fashion.

Engineering Data Needs

Recommendations

Bathymetry

- **Topographic and bathymetric surveys** should be performed that can be used for design and determination of water depths. This is particularly important for the cofferdam design and to generate a proper base map for development of drawings.

Geotechnical Properties / Soil Classification

- **Index Properties:** Determine moisture content, Atterberg limits, grain size, in-situ density, and total organic content → soil classification and general material characteristics.
- **Vane Shear Testing:** Use hand-operated device to measure soil strength of cohesive material → will help assess equipment use within the slough
- **Sediment Thickness:** Determined by pushing or driving a steel bar or wooden stick into the sediment until a hard layer or refusal is encountered → determine practical removal depth.
- **Bulk Samples for Bench-Scale Testing:** Collect bulk samples for bench-scale testing, including treatability/solidification testing to estimate the amount of reagent (e.g., lime) needed to meet paint-filter requirements. Additional testing may be performed to determine dewatering demand/characteristics. (Also refer to next slide regarding waste characterization).

Engineering Data Needs

Subsurface Conditions at Potential Cofferdam Location

- **In-Water Soil Borings:** Drill every 200 feet along cofferdam alignment. Advance boring to at least 40 feet below mudline or to refusal on bedrock.
- **Soil/Sediment Samples:** Collect disturbed and relatively undisturbed samples for geotechnical laboratory testing.
- **Laboratory Testing:** Index properties (moisture content, Atterberg limits, grain-size) and advanced geotechnical laboratory testing (e.g., triaxial shear strength testing and consolidation testing) on selected samples.
- **Vane Shear Testing:** At various depths in borehole to measure the in-situ undrained shear strength of cohesive soil layers (e.g., bay mud).
- Geotechnical investigation needs to be performed by experienced, licensed professional. Ideally, the engineer that will use the data for design should also design the subsurface investigation program.

Preliminary Waste Characterization

- **Composite samples for waste characterization** should be collected and prepared to estimate whether the dredged sediment will classify as non-hazardous or hazardous waste. This testing can be combined with bench-scale treatability/solidification testing. The addition of a reagent (e.g., lime) will affect the test results.

Imagine the result