Sediment and Site Characterization for Environmental Dredging

(Tab C)

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Training Objectives

- Identify site characterization components needed for dredging design.
- Identify sediment characterization needs specific to dredging.
- Identify sediment characterization tools and methods.

Removal Issues

- Accuracy and Precision
  - horizontal and vertical
- Sediment Resuspension
  - sediment transport and contaminant release
- Residual Sediment
- Production/ Efficiency of Removal
  - debris removal
  - rate of removal
- Interface with transport, treatment and placement
  - solids concentration

Need for Characterization

- Inadequate site and sediment characterization is one of the major causes for problems associated with use of dredging as a remedial alternative
- Contributes to
  - Delays and low removal rates
  - Low solids production
  - High treatment/dewatering costs
  - Unacceptable resuspension
  - Unacceptable residuals; inaccurate or imprecise removals
  - Failure to meet CULs, RAOs
- Critical for equipment selection, alternative design, resuspension controls and residuals controls

Site Characterization

- Identify and quantify the contaminants present
- Understand vertical and horizontal distribution of contaminants
- Identify sources
- Understand geomorphological setting and processes affecting the stability of sediment
- Understand key processes affecting the fate, transport, and bioavailability
- Identify the complete exposure pathways
- Identify human and ecological risks posed by the contaminants (air)
- Collect data necessary to evaluate the potential effectiveness of remedial alternatives, and
- Provide a baseline of data that can be used to monitor remedy effectiveness

Environmental Dredging

- Navigation dredging principles generally applicable
- Differences
  - Resuspension must be controlled
  - Precision removal required
  - Special purpose dredges available for special project, site and sediment conditions
  - Additional controls available

Typical Characterization

- **Physical**
  - Geometry/bathymetry of water body
  - Turbidity
  - Temperature
  - Sediment resuspension and deposition rates
  - Depth of mixing layer/degree and depth of bioturbation
  - Geophysical survey results
  - Flood frequencies, annual and event-driven hydrographs and current velocities
  - Tidal regime
  - Surface water/ground water interaction
  - Ground water flow regime

Typical Characterization

- **Chemical**
  - Near-surface contaminant concentrations in sediment
  - Contaminant profiles in sediment cores
  - Contaminant concentrations in biota tissue
  - Contaminant concentrations in ground water
  - Total organic carbon (TOC) in sediment
  - Contaminant concentrations in surface water
  - Simultaneously extracted metals (SEM) in sediment
  - Acid volatile sulfide (AVS) in sediment
  - Other chemical species that may affect contaminant mobility
  - Oxidation-reduction and pH profile of sediment cores
  - Carbon/nitrogen/phosphorus ratio
  - Non-ionized ammonia concentration in sediment

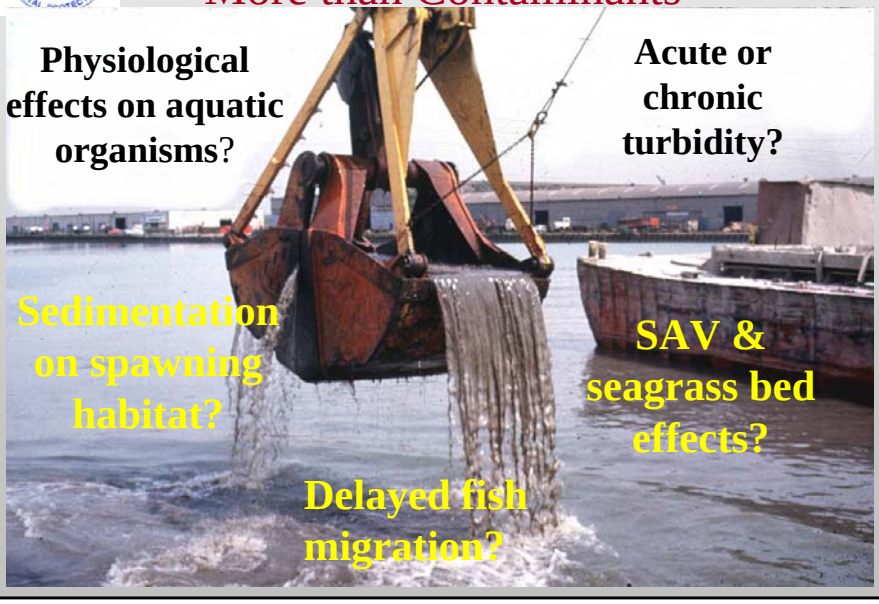
Typical Characterization

- **Biological**
  - Sediment toxicity
  - Extent of recreational/commercial harvesting of fish/shellfish for human consumption
  - Extent of predators dependent on aquatic food chain (e.g., mink, otter, kingfisher, heron)
  - Abundance/diversity of benthic species and fishes
  - Abundance/diversity of emergent and submerged vegetation
  - Habitat stressor analyses
  - Contaminant bioavailability
  - Pathological condition, such as presence of tumors in fish
  - Presence of indicator species

Site Characterization for Dredging

- Buried debris (wood, concrete, scrap, cables…)
- Boulders, rock, hard pan or “refusal” (overdredge)
- Dredging depth and side slopes
- Slope stability
- Currents (seasonal, tidal)
- Access and navigation demands
- Staging area and disposal area
- Transport routes for dredged material

Resuspension Concerns – More than Contaminants



Sediment Characterization

- Solids/moisture content and variability
- Atterberg limits
- Specific gravity
- Grain-size distribution and variability
- Organic content, oily phase and volatiles
- Shear strength and/or bearing strength
- Erosional characteristics (Sedflume)
- Dewatering characteristics (settling, filtering, consolidation, permeability …)

Sediment Characterization

- Cores
- Probing
- Geophysical techniques
- Side scan sonar
- Magnetometers

QUESTIONS?