MOVING THE NEEDLE: BENEFICIAL USE OF CONTAMINATED SEDIMENTS

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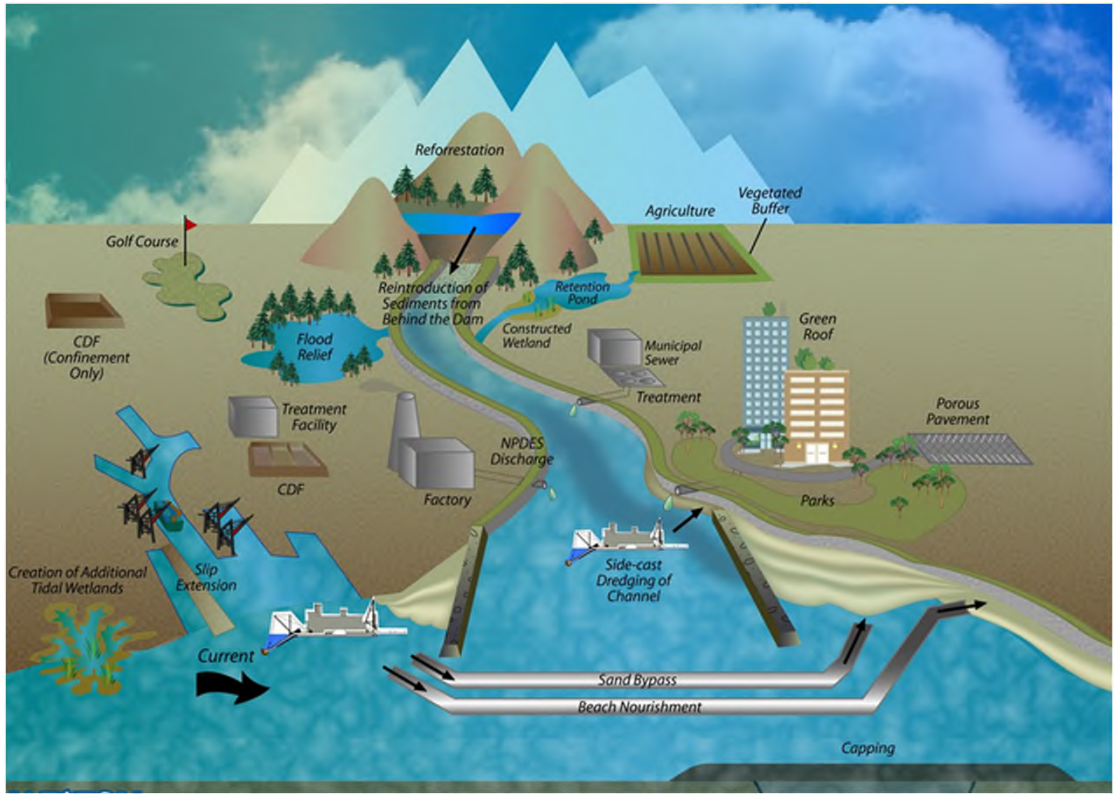
Context

- 190 million cubic meters dredged annually from federal navigation channels across the United States.
- 5-10% of navigational dredge material and virtually all environmental (clean-up) dredge material currently requires special handling and management.
- Diminishing capacity for upland management/disposal of contaminated material
- Environmental dredging needs are recurring.
  - Uncontrolled legacy sources
  - Permitted industrial outfalls
  - WWTP outfalls
  - CSOs
  - SWOs
  - Commercial maritime operations
- The opportunity costs of treating contaminated sediment as a waste are in the billions of US dollars.

Sustainable Sediment Management



Operating principles for finding sustainable sediment management solutions:

- Recognize sediments as a resource.
  - Link and leverage across multiple projects and authorities.
  - Consider regional implications of local sediment actions which benefit the region.
- Improve operational efficiencies by capitalizing on the natural coastal processes.
  - Evaluate and recommend economically viable and environmentally sustainable solutions.
  - Enhance technical knowledge and tools for regional approaches.
- Share lessons learned, information, data, tools, and technologies.
- Improve Relationships.
  - ***Communicate and collaborate with stakeholders, partners, sponsors, federal and non-federal agencies, academia, non-governmental organizations***

Regional Sediment Management (arcgis.com)

Beneficial Uses of Dredged Material

- **Purposeful, intentional use as a valued resource to provide social, economic and environmental benefits**
- **Value-added proposition**
  - **Use treated contaminated sediments as lower-tier fill for:**
    - **Habitat development**
    - **Parks and recreation**
    - **Brownfield development**
  - **Strip mine reclamation**
  - **Solid waste landfill (interim) capping**
  - **Material manufacturing**
- **Significantly reduces disposal requirements**
- **BU Interest is at an all-time high**
  - **USACE Chief of Engineers set a goal of 70% beneficial use by 2030**
  - **Use of treated, contaminated DM for BU aligns with this goal.**

Implementation Guidance for Section 125(a)(2)(C) of the Water Resources Development Act of 2020, Beneficial Use of Dredged Material 7 November 2022

When are Sediments “Contaminated”?

- All sediments contains traces of the landscapes they passed through prior to being deposited as sediment.
- Majority of sediments pass through landscapes that are altered by people (directly or indirectly).
- Majority of sediments have an anthropogenic fingerprint.
- Contamination gradient

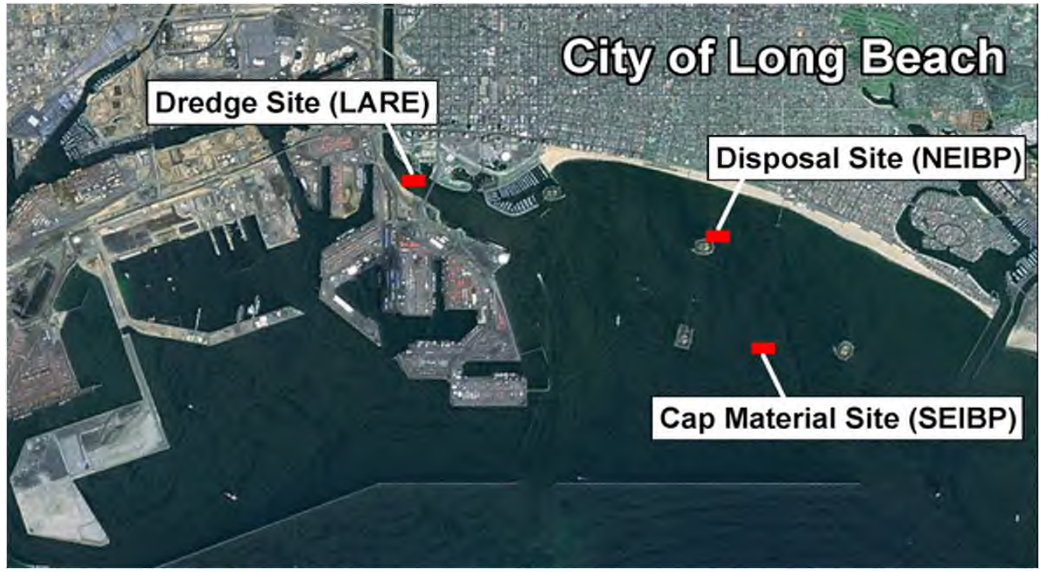
- Concentrations, properties, and “availability” of sediment-associated contaminants determines suitable uses.
  - Unconfined beneficial use
  - Engineered placement for beneficial use
  - Treatment for beneficial use
  - Disposal
- Analogous to how physical sediment characteristics determine suitable uses.

Management

Capping

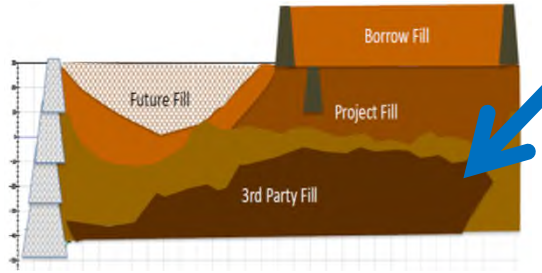
Los Angeles River Estuary (LARE) Capping Project:

- 100K cubic yards of contaminated material from LARE placed in old borrow pit
- Capped over with 3' clean sand from adjacent area
- Over a decade of monitoring - no contaminant movement
- Not intended as beneficial use but…
  - Subsequent biological surveys showed thriving benthic community in what was formerly an anoxic dead zone due to poor circulation.
  - Simply changing elevation led to significant improvement in habitat.



Engineered Fill

Port of Long Beach – Middle Harbor Project



Contaminated sediments from other projects in the region meeting pre-specified criteria:

- Contaminant Levels
- Geotechnical Characteristics
- Schedule

Treatment

- ***Physical Treatment Processes***
  - ***Soil Washing/Particle Sorting Technologies***
  - ***Solidification***
- ***Chemical Treatment Processes***
  - ***Extraction/stabilization***
  - ***Chelation***
  - ***Chemical reduction/oxidation***
- ***Thermal Treatment Processes***
  - ***Vitrification***
  - ***Thermal Desorption***
- ***Biological Treatment Processes***
  - ***Composting***
  - ***Land Farming***
  - ***Phytoremediation***
  - ***Fungal Remediation***

Physical - Particle separation

Physical/Chemical – Soil Washing

Thermal – Rotary kiln

Biological – Myco (Fungal) remediation

Expands potential opportunities for beneficial use

Moving the Needle

- Understanding where we are now?
- Identifying Technical & Regulatory Challenges
- Improved Accounting (Ecosystem Services)
- Establishing RDT&E pipeline for development and transitioning of new technology

- Two White Papers
  - Beneficial Use of Contaminated Sediments
  - Sediment Treatability Technology
- Workshop in the Spring of 2024
- OMB guidance for ES in Cost Benefit Analysis (August 2023)
- Public Private Partnership for RDT&E FY23

Where are we now?

Beneficial Use of Contaminated Sediments – A White Paper
By - Barr Engineering Co., Deltares, & Windward Environmental LLC

Key observations based on the literature:

- Sediment increasingly is seen as a resource, not a waste
- Treatment or pre-treatment facilitates/expands beneficial use options
- Beneficial use of contaminated material more common in upland settings than aquatic
- End use affects both risk and risk acceptability
- Regional sediment management/planning facilitates programmatic approaches to beneficial use
- Techniques and applications are advancing
- Beneficial use aligns with sustainability principles
- Sustainability evaluations are becoming more common
- Approaching management options through sustainability evaluation creates opportunities
- Calculating lifecycle costs facilitates beneficial use
- Stakeholders may draw valid but contradictory conclusions regarding acceptability
- Improved communication/engagement can reduce stigma
- Regulatory flexibility to allow adaptive management (to control risks and enhance rewards over time) is foundational to achieving the social, economic and environmental benefits of beneficial use
- Questioning conservative biases in screening-level risk assessments will enable risk characterization and management decisions that provide greater social, economic, and environmental benefits.

Where are we now?

The State of Treatment Technologies – A White Paper – by Integral Consulting

- 2,937 sources reviewed; 85 references selected
- State of the Science on Treatment Technologies
  - Solidification/Stabilization
  - Biological
  - Extraction
  - Hybrid
- Factors Warranting Consideration during selection
  - Treatment Technologies
  - Beneficial use applications
- Risks associated with Treatment Technologies and Beneficial Use
- Summary and Recommendations
- Appendix – Case Studies

Data Gaps, Research needs:

- Scaling of technologies (few full-scale demos)
- Management of heterogeneity in treatment approaches
- Long-term monitoring results
- Emergent tech (nano, ionic liquids) show promise but require addition R&D to costs and enable practical implementation.
- Need for transparent, decision-support tools that account for service benefits and LCA considerations.
- Info relating to LCA, timelines and durations, contaminant concentrations, reg thresholds and acceptance, and basis of selection is often not reported.

Recommendation

- Creating and maintaining a data repository or clearinghouse for data compilation on treatment technologies and BU applications

Technical & Legal/Regulatory Challenges…

- Multiple Authorities (Corps – Navigation and Flood Control, EPA and States – Inputs and beneficial use designations, ….)
- Multiple Jurisdictions (Federal, State, County, Cities).
- Lack of clear regulatory guidance
- Competing uses/users (navigation, flood control, water storage, waste discharge, recreation, other ecosystem goods and services….
- Perceptions (dumping/disposal, spoil, contamination)
- Uncertainty dealing with contaminants
- Emerging contaminants, e.g., microplastics, HABs, PFAS
- Concept of “adaptative management” is not widely accepted/understood
- Liability (Perceived vs Actual)
- Market demand/displacement for treated materials

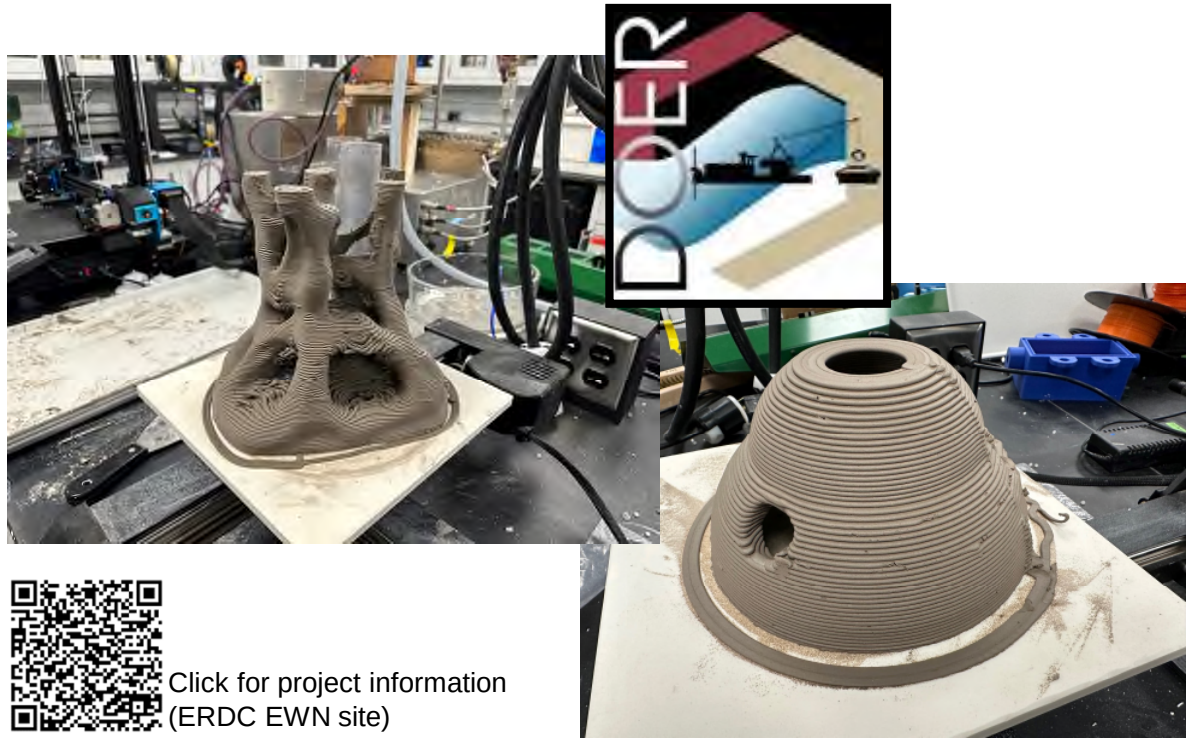
Public Private Partnership for Advancing RDT&E

- Funded by Congress in FY23 ($2M, with a private sector match)
- Four Projects selected FY24:
  - Applied Research and Field Demonstration Testing of Contaminated Sediment Beneficial Use at Two Regional Sites (Anchor QEA & UMBC)
  - Laboratory scale evaluation of combining advanced oxidation process with sediment stabilization for beneficial use in construction (TTU)
  - Development & Application of LC Cost Benefit Analysis to establish BU opportunities for CDF sediments (Ramboll)
  - Sediment Bacteria Mining for Endophyte Inoculation and Phytoremediation for Beneficial Use (AECOM)

Other USACE Research

- **Sequestering Dredged Material Contaminants for Nearshore Beneficial Use Applications in 3D Printed Structures – DOER RT24-07**

- **In Situ Beneficial Use of Contaminated Sediments: Leveraging Dredged Sediment for Enhancing Aquatic Habitats and other Benefits - DOER RT24-09**



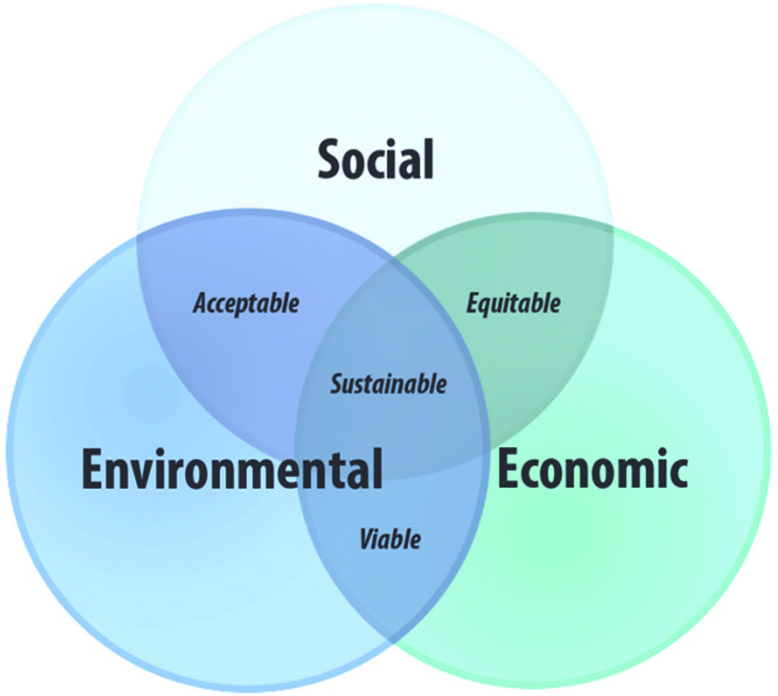
Click for project information (ERDC EWN site)

3D Printed Habitat Structures

Rendering of Habitat Uplift Using Contam. Seds.

Next Steps

- FY24 PPP Projects in progress
- Formalize Governance & Strategy for PPP
- Technical Workshop (To identify and prioritize technical and reg./policy needs)
- Set Priorities for selection of FY25 PPP Projects (should funding become available)



…efficient investment of resources to create present and future value.

Questions?

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