



U.S. ARMY

SUSTAINABLE SEDIMENT MANAGEMENT AND DREDGING SEMINAR

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GALVESTON, TX

Project Formulation

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US Army Corps
of Engineers®

Overview

- **Project drivers and Objectives**
- **Constraints**
- **Social, Economic, and Environmental considerations/opportunities (Sustainability)**
- **Other Considerations**
- **Regulatory Frameworks**
- **Conceptual Models**
- **LOE/WOE**

Project Drivers and Objectives

What is the project purpose?

- Navigation
 - O & M dredging
 - Capital dredging (Channel Deepening/Expansion)
- Flood Control
- Coastal Protection
- Environmental Restoration
- Combination

What are the project activities and over what area and time period will these activities occur?

Project Drivers and Objectives

Activities:

- Hydrographic/Topographic Surveys
- Sediment sampling and analysis
- Dredging, bed leveling, clearing, excavation
- Drilling/pile driving
- Material Management (placement/disposal)

Temporal:

- Duration
- Staging or phasing
- Design life
- Sensitive species (Windows)

Spatial:

- Footprint
- Upland, intertidal, aquatic
- Freshwater, Estuarine/Marine
- High energy, low energy
- Sands, silts clays
- Vertical strata (recent deposits vs geologic materials)
- Critical habitat, sensitive species

Constraints

What are the financial, potential environmental, operational effect or constraining factors on the project is critical to

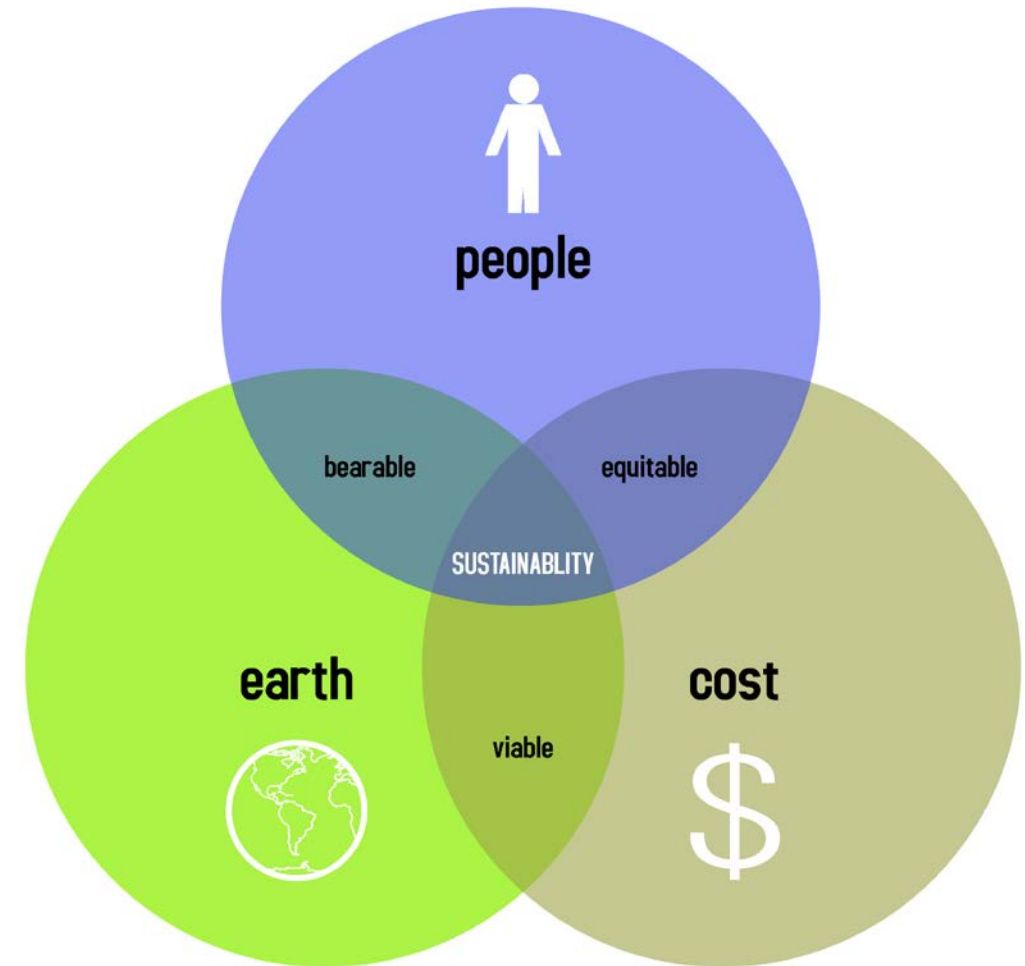
- Budget and schedule
- Cost sharing requirements
- Environmental windows
 - ▶ proximity to
 - ▶ sensitive habitat/species
 - ▶ Commercial Use Areas (shellfish beds, fish pens)
 - ▶ Recreational Use Areas (swimming surfing beaches)
 - ▶ Utilities (electric, gas)
 - ▶ Cultural/Heritage (sacred areas, shipwrecks)
- Aesthetics
- Active shipping
- Presence of UXO
- ...

Sustainability

Project Drivers, Objectives, and Constraints help frame consideration of potential Social, Economic, and Environmental opportunities

What are potential alternative approaches to meet the project purpose?

- Are there opportunities to couple projects to meet local needs via beneficial use (shoreline protection, habitat creation, contaminant source control, ...)
- Are there EWN opportunities to reduce the project footprint, reduce O&M cost, facilitate higher environmental/social benefit?



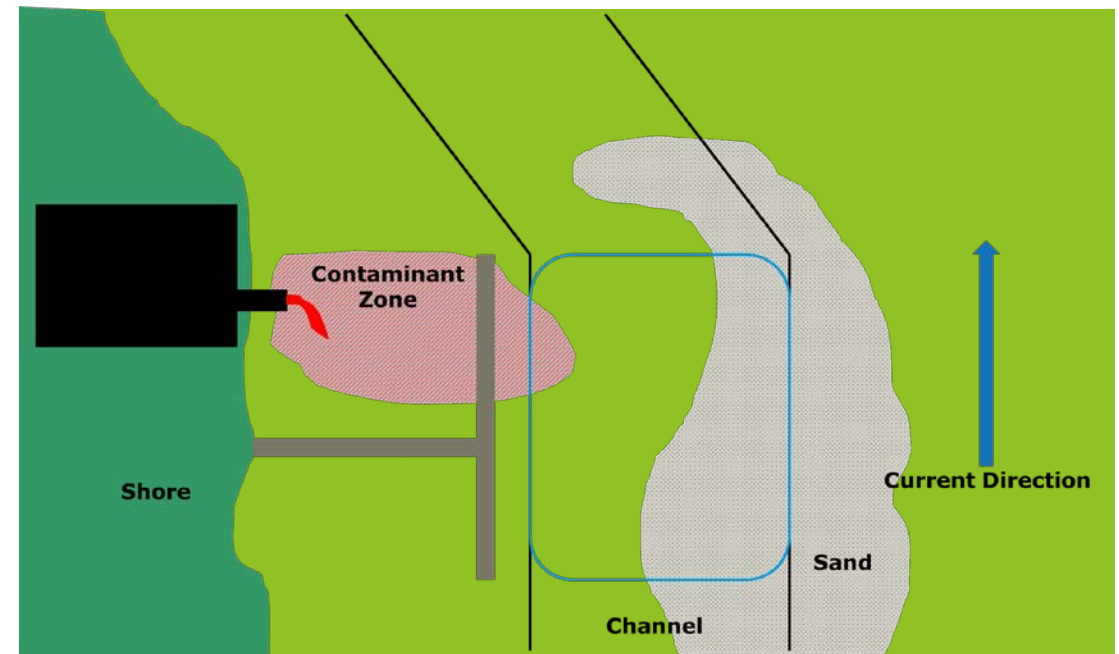
Other Considerations

- Volume of material
- Applicable management options
- How will material be handled?



Other Considerations

- **Volume of Material**
 - Smaller volumes <5,000 cubic meters
 - Larger volumes >100,000 cubic meters
- **Site Characteristics**
 - Site Configuration (outfalls, etc.)
 - Current land use
 - Site History (previous dredging/clean-up history, legacy contamination, etc.)



Other Considerations

- **Material Characteristics**
 - Sands & gravel
 - Silts and clays
 - Organic content
 - Contaminants
 - Geologic strata
- **How the material will be handled**
 - Knock down
 - Mechanical (open or closed bucket)
 - Hydraulic (pipeline or hopper)
- **Sensitive species or habitats**



Management Alternatives

The assessment approach and required lines of evidence (LOEs) are determined by project elements and the range of management alternatives under consideration...

- In Water Placement/Disposal
- Upland Placement/Disposal
- Beneficial Use (in water and/or upland)



Regulatory Frameworks

- International Treaty (The London Convention for Disposal of Wastes at Sea)
- National Regulatory Frameworks (Section 10 of the Rivers and Harbors Act, CWA, & MPRSA);
- Local Regulatory Requirements (US – State Water Quality Requirements; State Residential Soil Criteria, etc.)



Conceptual models

- Used to organize, guide, and inform the collection of information for purposes of making management decisions.
- Represents a compilation of current and historical data describing site conditions, project related activities and associated potential stressors impinging on the system.
- Identification of potential stressors are based on “Reason to Believe”
- Presents the relationships between the source (S) of a stressor (or hazard), the pathways (P) by which exposure might occur, and environmental receptors (R) potentially affected.



CM of baseline conditions for mixed urban/natural setting

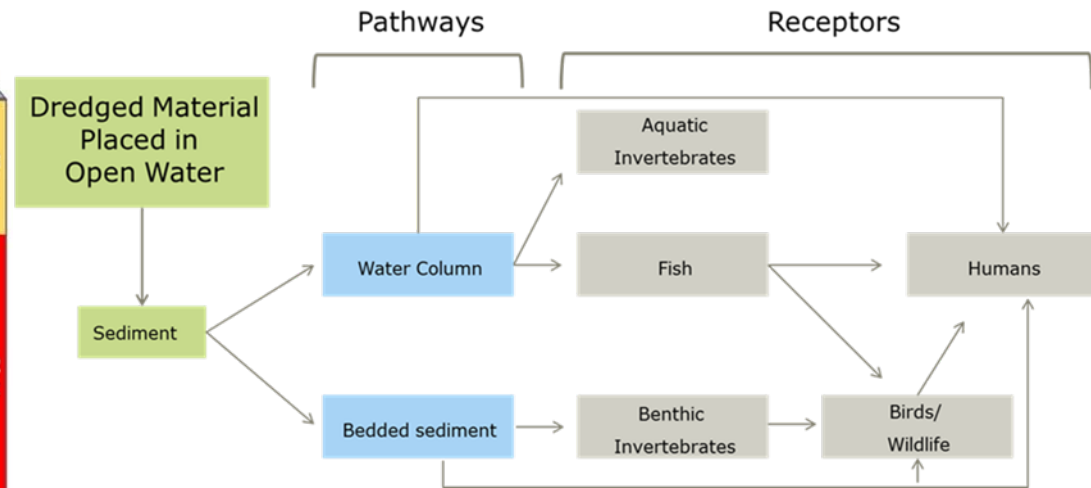
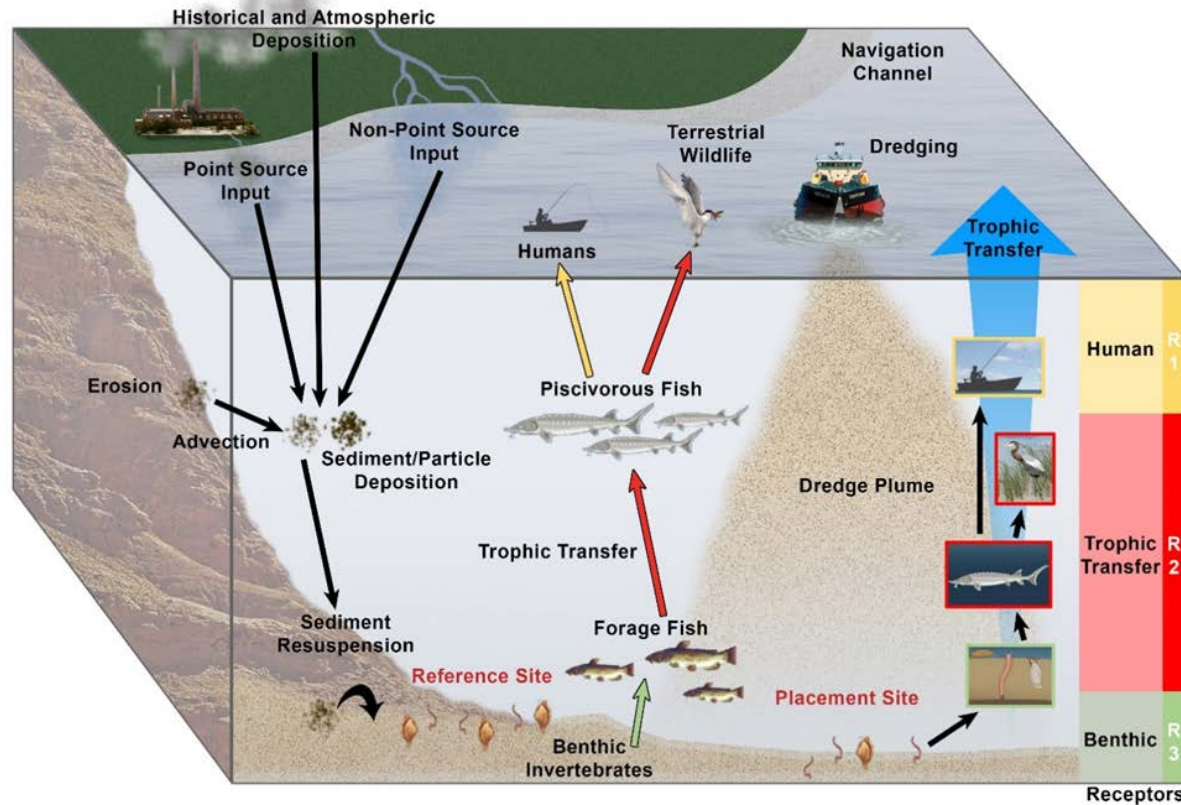
“Reasons to Believe”

Contaminants known to be or likely to be present in dredged material

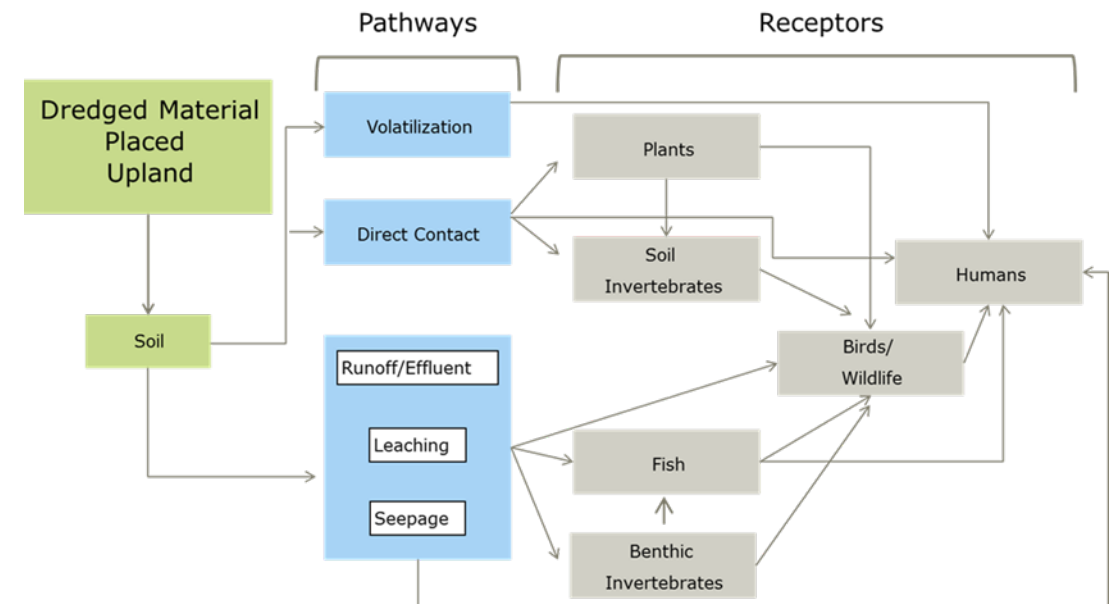
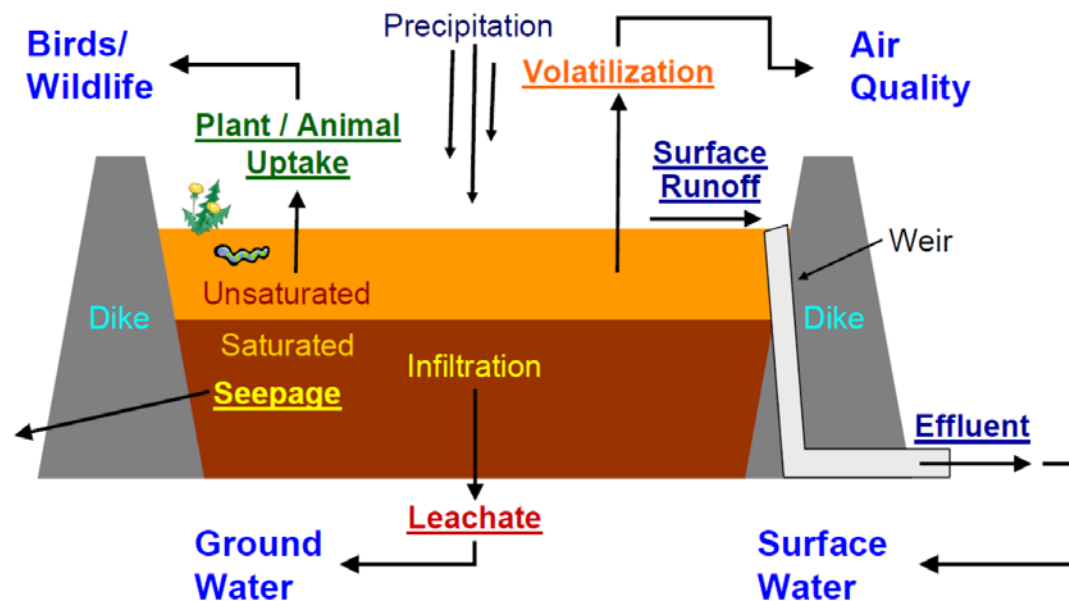
- Results of previous testing
- Knowledge of historical site activities
- Presence of outfalls
- Spill records
- Results of prior testing indicate material to be suitable
- ...



Conceptual models-In Water Placement/Disposal



Conceptual models – Upland Disposal/Placement



Weight Of Evidence Approach

- Process of integrating individual pieces of information (Lines of Evidence) to arrive at a conclusion with some degree of confidence/certainty.
- Each LOE must be assessed with regard to quality, associated level of certainty, and ultimate significance to supporting a decision.
- The greater the preponderance, quality, and significance of the LOEs (weight) the greater the certainty in the conclusion.

The Weight of Evidence



Lines of Evidence

- **Material characteristics (inert sands and gravels vs clays and silts)**
- **Proximity to known/suspected sources of contamination**
- **Exposure pathway (stressors → receptors)**
- **Sediment and Elutriate/Leachate chemistry**
- **Toxicity of bedded sediments/soils**
- **Toxicity of sediment elutriates**
- **Bioaccumulation Potential of bedded sediments/soils**

Exclusion from testing

Under the MPRSA material is acceptable for placement/disposal in the ocean providing that the material "...will not unduly degrade or endanger the marine environment and that the [placement] disposal will present:

- No unacceptable adverse effects on human health and no significant damage to the resources of the marine environment;
- No unacceptable adverse effect on the marine ecosystem;
- No unacceptable adverse persistent or permanent effects due to the dumping of the particular volumes or concentrations of these materials; and
- No unacceptable adverse effect on the ocean for other uses as a result of direct environmental impact. "

Additionally, under section 227.13, the regulations specify a number cases where material can be deemed suitable for disposal without further testing. These cases include:

6 "Dredged material is composed predominantly of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larger than silt, and the material proposed for dumping is substantially the same as the substrate at the proposed placement/disposal site, and the site from which the material is to be taken is far removed from known existing and historical sources of pollution so as to provide reasonable assurance that such material has not been contaminated by such pollution."

Exclusion from testing

Lines of Evidence (LOEs) to be Considered:

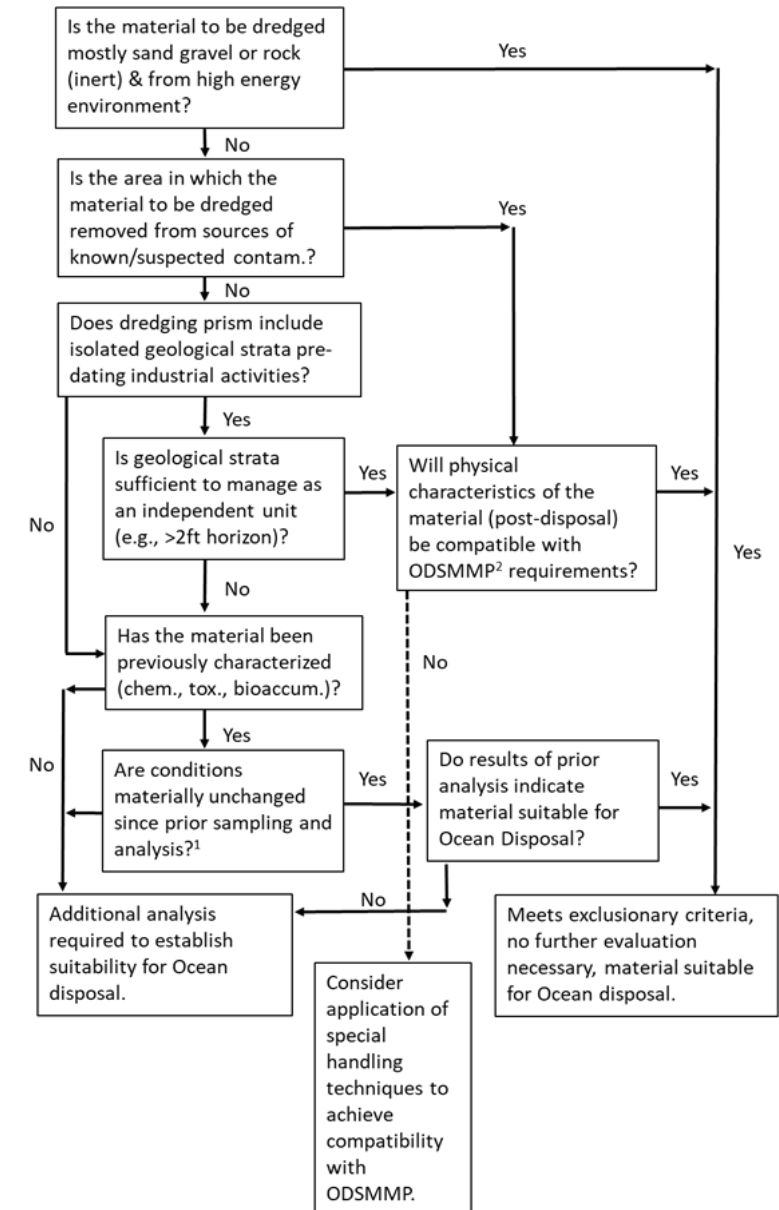
- Location of material to be dredged (e.g., proximity to known/suspected sources of contamination)
- Geochemical characteristics of the material to be dredged (e.g., clay, sand, gravel, etc.)
- Results of any prior testing of the material to be dredged (chemical, biological)
- Characteristics of the proposed placement/disposal site (i.e., is the material proposed for placement reasonably similar to substrate at the placement/disposal site).

WOE for Exclusion

WOE used to establish whether or not material associated with a project needs to undergo testing to meet requirements under MPRSA.

Can enter WOE framework at any point utilizing available LOEs to reach a decision.

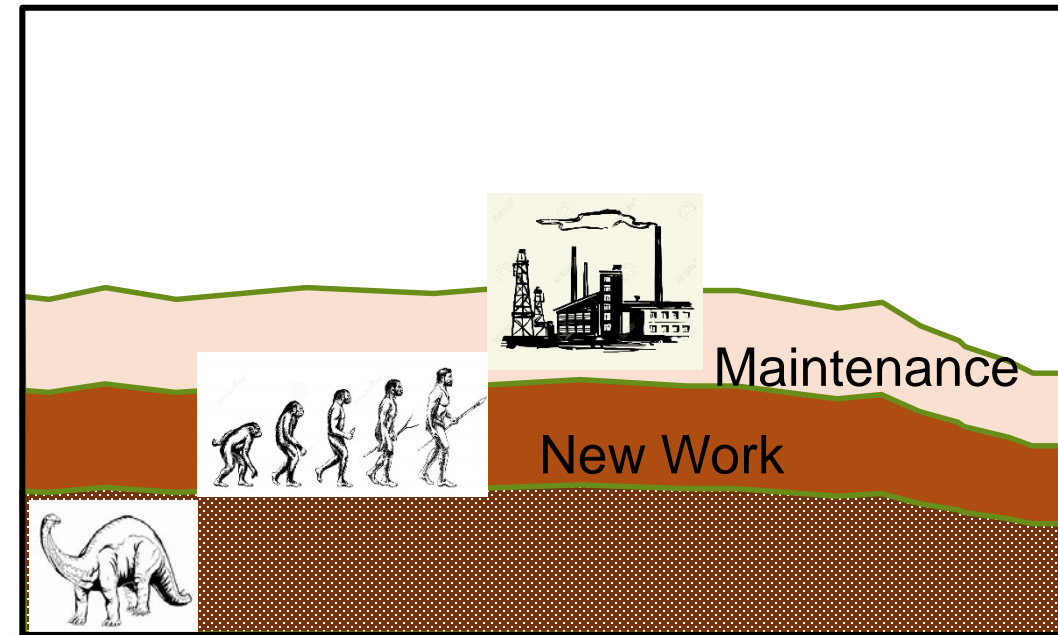
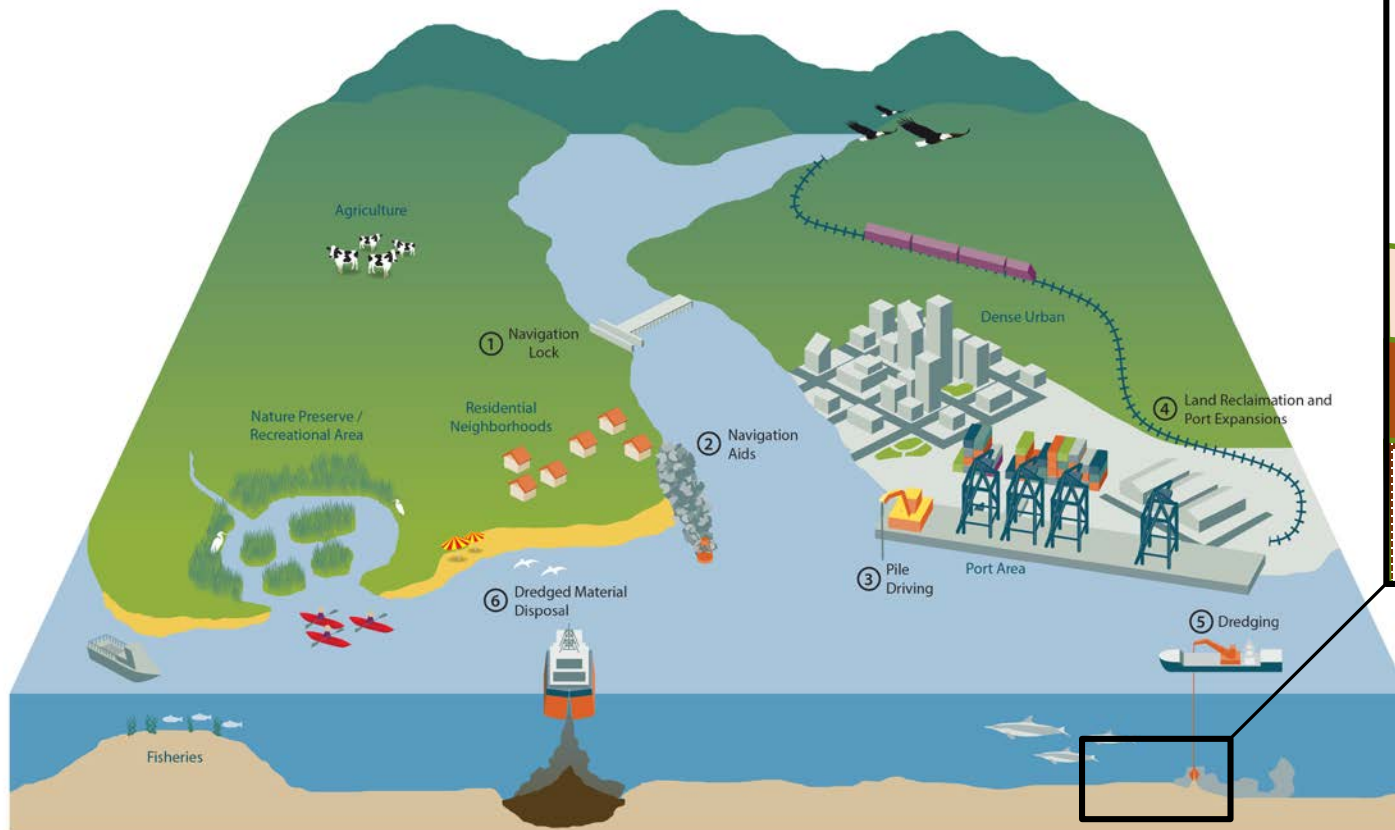
Each box involves consideration of multiple types and sources of information.



¹ Note: may require confirmatory chemical analysis.

² Ocean Disposal Site Material Management Plan.

New Work Material



“Reason to Believe” – Lines of Evidence (LOE)

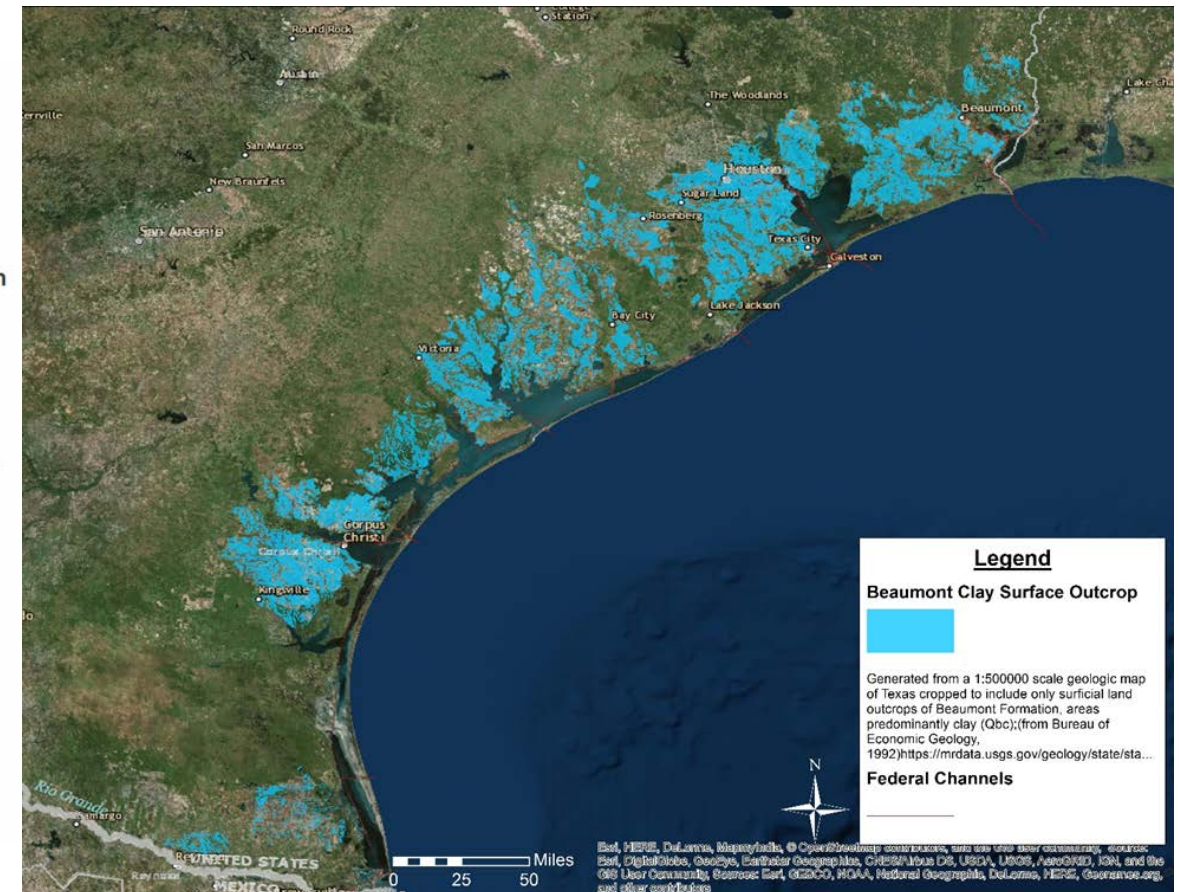
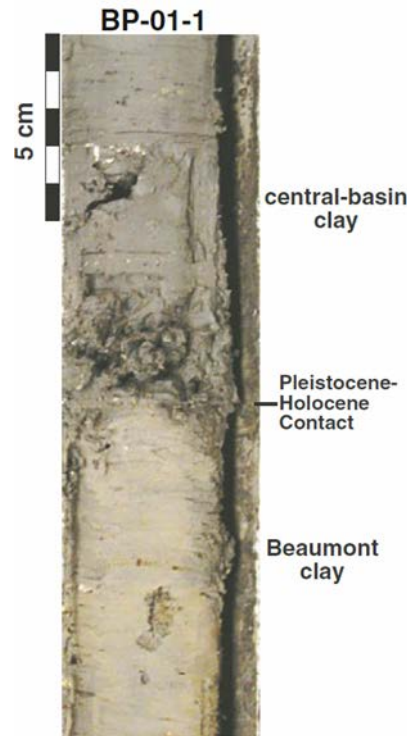
For New Work, relevant LOEs may include:

- Proximity to sources of contamination (e.g., surficial vs deeply buried, nearshore vs offshore, etc.)
- Geology (e.g., consistent with pre-anthropocene geological deposits)
- Relevant Prior analysis – (geological, chemical, biological assessments)
- Confirmational physical/chemical analysis – (no elevated chemistry, grain size and mineralogy consistent with pre-anthropocene deposits)

WOE evaluation for New Work Material Case Study

Beaumont Clay Formation of Coastal TX:

- Late Pleistocene (2.5M to 11K years) deltaic plain deposit.
- Distributed throughout Texas coastal plain seaward to continental shelf.
- Clay grading to sands in the most surficial portions
- Strata thickness 25-1500ft
- Highly consolidated
- Bluish gray, yellowish gray, pinkish gray, purple, with shades of red.



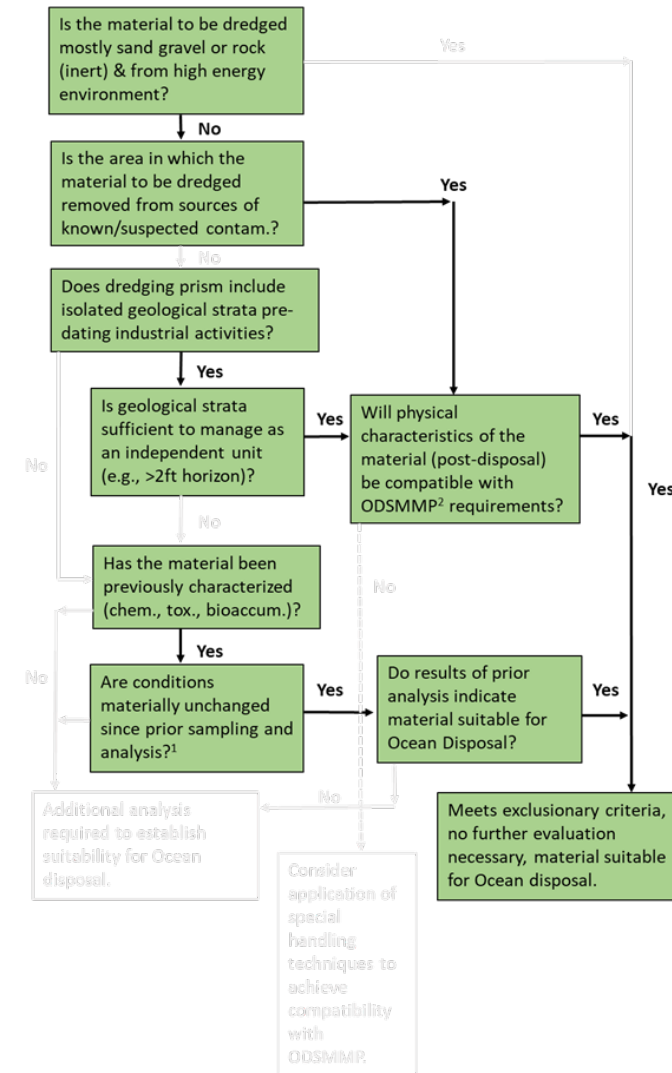
WOE evaluation for New Work Material Case Study

Available LOEs:

- Location (contact depth, vertical and horizontal distribution)
- Physical appearance and characteristics (color, texture, plasticity, ...)
- Results from previous testing
 - Physical
 - Chemical
 - Tox.
 - Bioaccum.

WOE evaluation for New Work Material Case Study

- Is the material mostly sand and gravel from high energy environment?
No
- Is the material removed (isolated) from sources of contamination?
Yes - material is from a buried (isolated) geological deposit pre-dating industrial activities.
- Is the strata sufficient to dredge and manage as an independent unit (DMMU)?
Yes - depending on contact depth and project dredge prism.
- Are physical characteristics compatible with SMMP requirement of proposed disposal site?
Yes - based on review of all SMMPs for disposal sites within SWGs AOR.
- Has the material previously been tested?
Yes - (Corpus Christi Channel Deepening 2017)
- Are conditions materially unchanged relative to previous testing?
Yes - material is from the same isolated, undisturbed strata.
- Do results of prior testing indicate material suitable for Ocean Disposal?
Yes
 - Chemistry - metals – reflective of regional back ground; organics largely ND, PAHs reflective of background.
 - Toxicity – no toxicity in either elutriates or solid phase Tier III tests.
 - Bioaccumulation – no uptake relative to reference of bioaccumulative contaminants.



¹ Note: may require confirmatory chemical analysis.

² Ocean Disposal Site Material Management Plan.

Meets exclusionary requirements – material is suitable for Ocean Disposal - no testing required

Summary

- **Thorough understanding of project drivers, objectives, constraints and opportunities is critical to development of alternatives, decision-making requirements and associated data needs.**
- **Project conceptual models (CM) help organize, guide, and inform the collection of information.**
- **Individual Lines of Evidence are integrated via Weight of Evidence approach providing technically sound basis for management decision-making.**