Dredging and Dredged Material Disposal Overview

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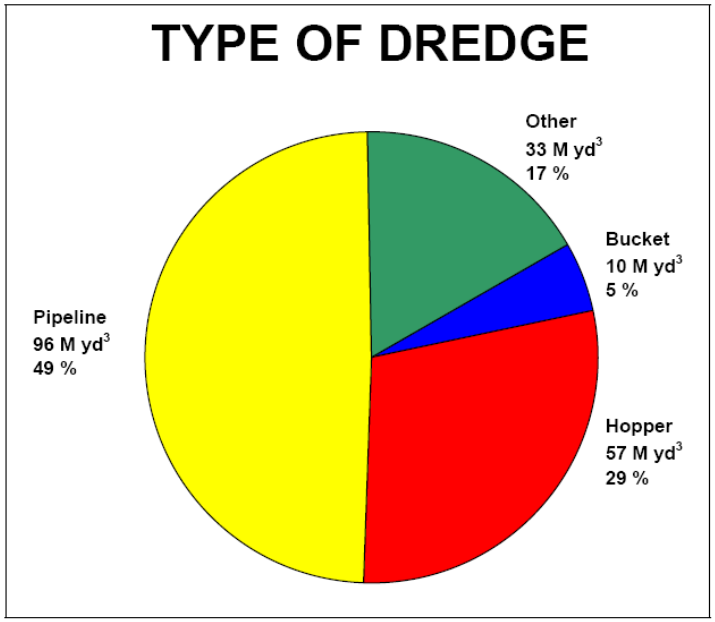
The process of dredging consists of the following stages:

- Excavation (loosening or dislodging) of the material from the bottom.
- Removal of the loosened material to the dredge vessel.
- Transportation of the material to the placement area.
- Placement of the material.

Basic Dredge Types

- Mechanical
  - Clamshell
  - Backhoe
- Hydraulic
  - Pipeline
  - Hopper
- Other / Combinations

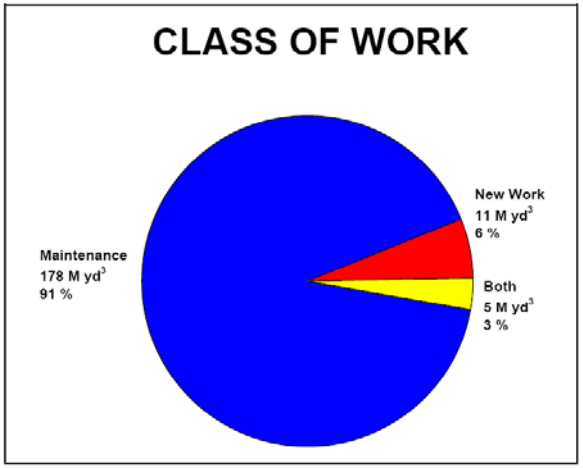


Factors in Selection of Dredging Equipment

- Physical characteristics of sediments,
- Quantities to be dredged,
- Dredging depth,
- Distance to disposal (placement) area,
- Physical environment of and between areas,
- Contamination level of sediments,
- Method of disposal (placement),
- Production required,
- Types of dredges available.

Two Types of Navigation Dredging

- **Maintenance Dredging:** Removal of sediments accumulated in the channel since the previous dredging project.
- **New Work Dredging:** Removal of sediments which have not been previously dredged - virgin sediments - channel deepening.



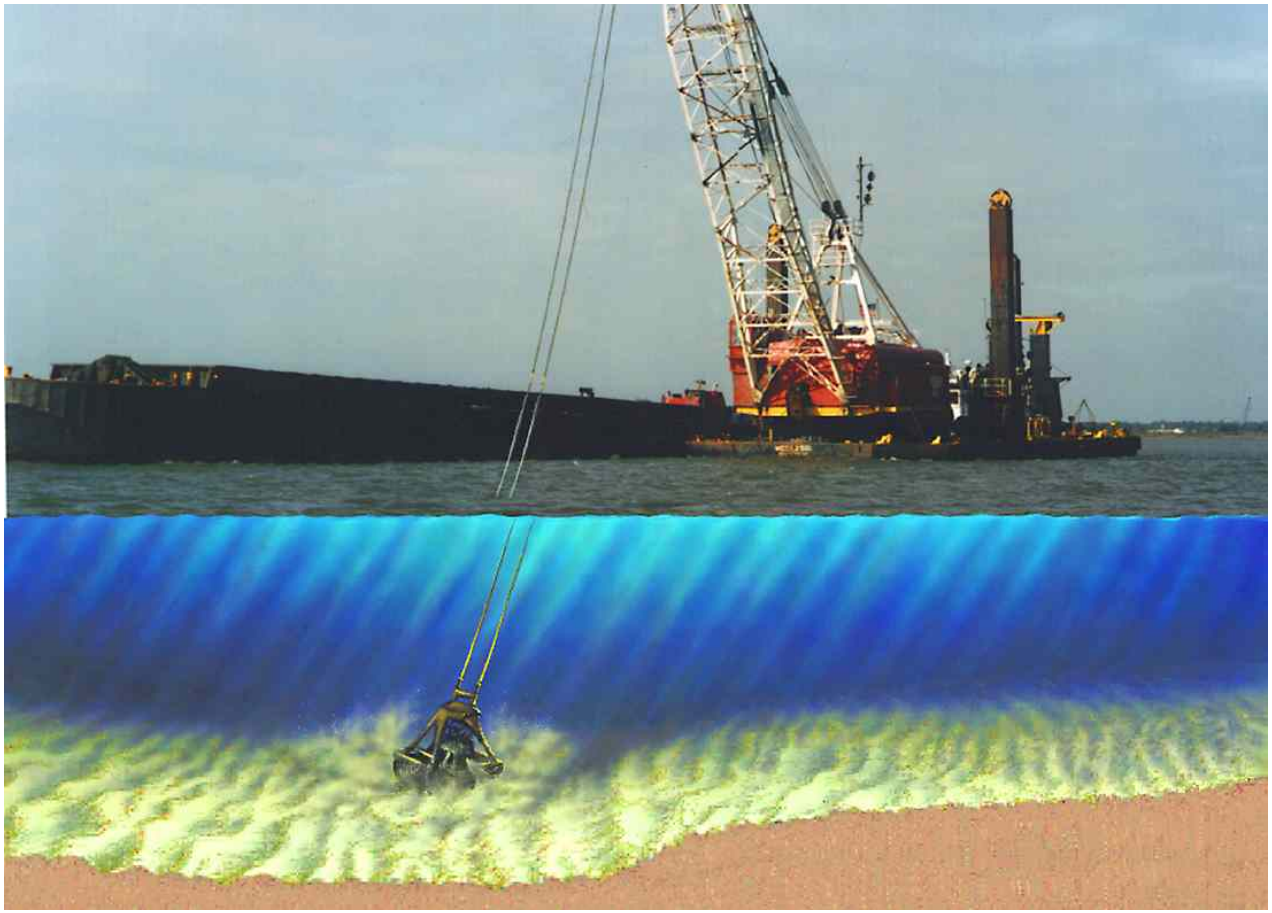
Environmental Dredging

Definition:

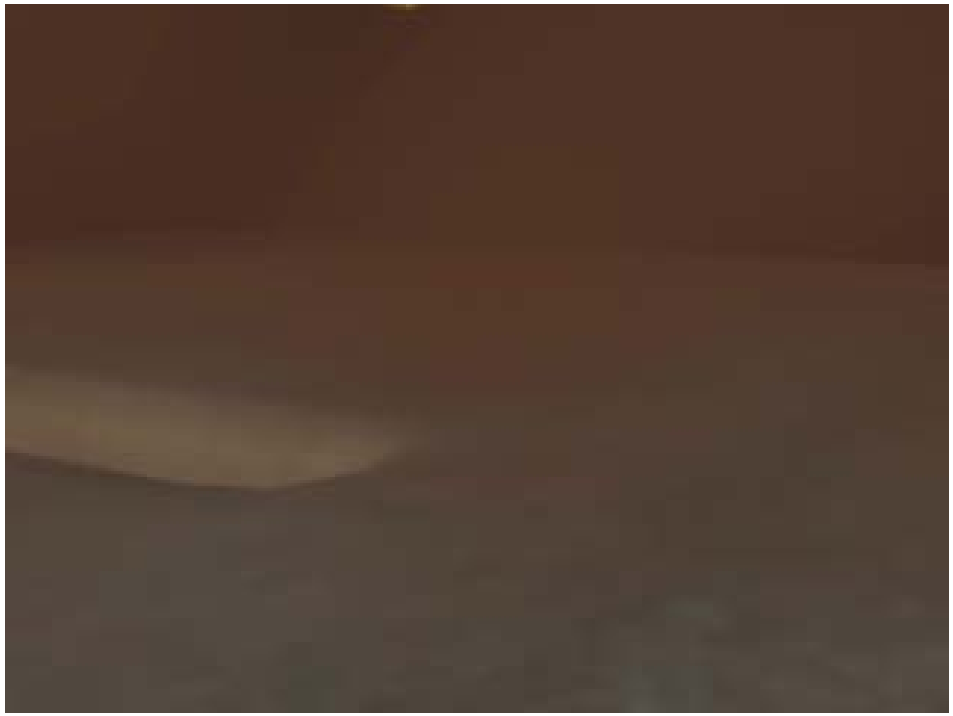
The removal of contaminated sediments from a waterbody for purposes of sediment remediation.

http://el.erdc.usace.army.mil/elpubs/pdf/trel08-29.pdf

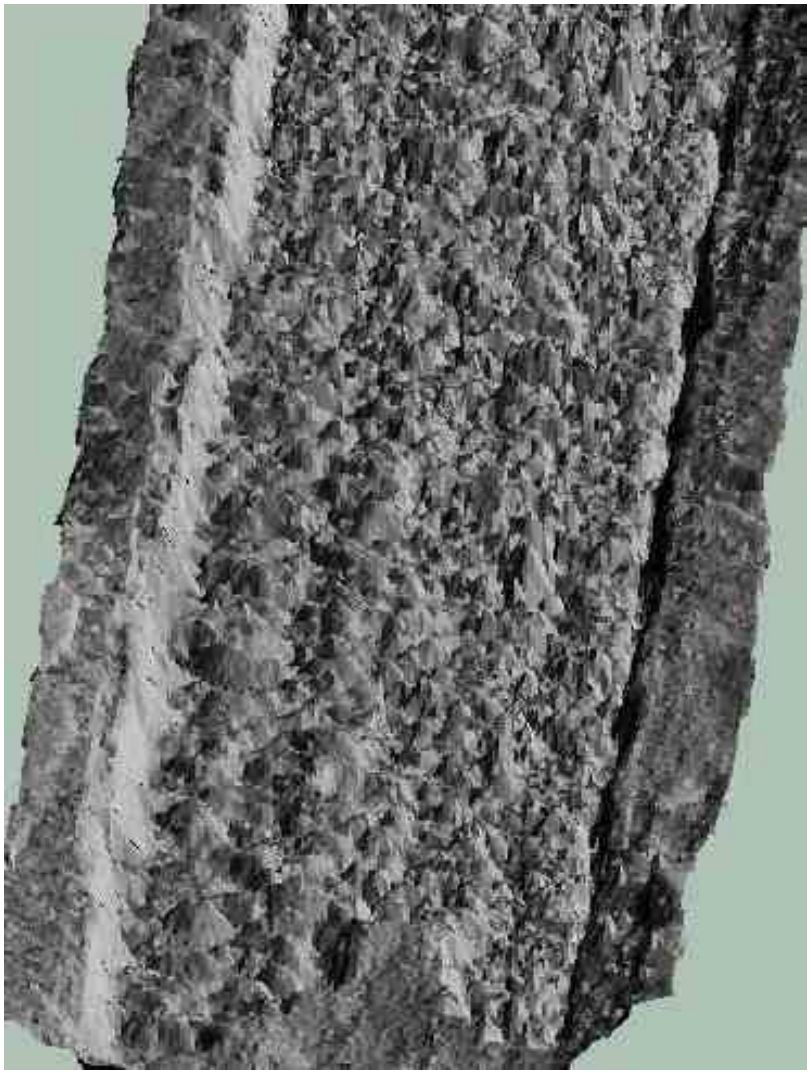
Clamshell (Bucket) Mechanical Dredge



Bucket Dredge Excavation Process



Bucket Dredge Excavation Pattern



Source: Great Lakes Dredge and Dock Co.

Backhoe (Bucket) Mechanical Dredge

Mechanical Dredges can Excavate Sediment at Near In situ Percent Solids

Source: Cable Arm

Hydraulic Offloaders

Source: Great Lakes Dredge and Dock Co.

Advantages of Mechanical Dredges

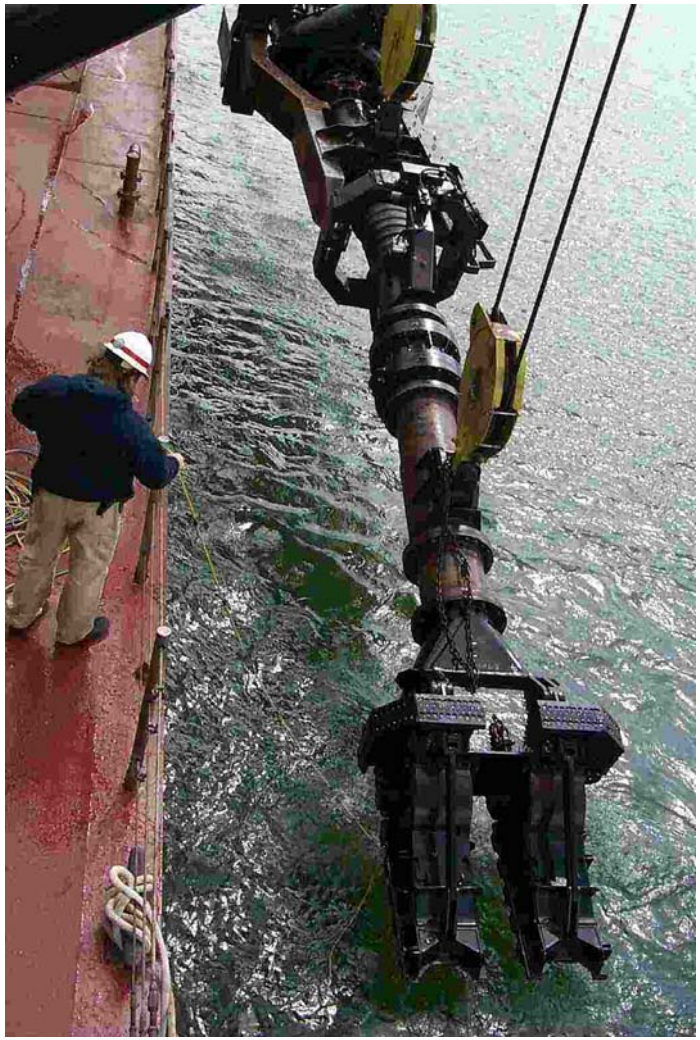
- Rugged and capable of removing hard packed materials,
- Can remove debris,
- Can work tight areas,
- Efficient for disposal at long haul distances.

Limitations of Mechanical Dredges

- Difficult to retain fine loose material in conventional buckets,
- Production low compared to pipeline dredges,
- Resuspension can be an issue, especially in presence of debris.

Self-Propelled Hopper (Hydraulic) Dredge

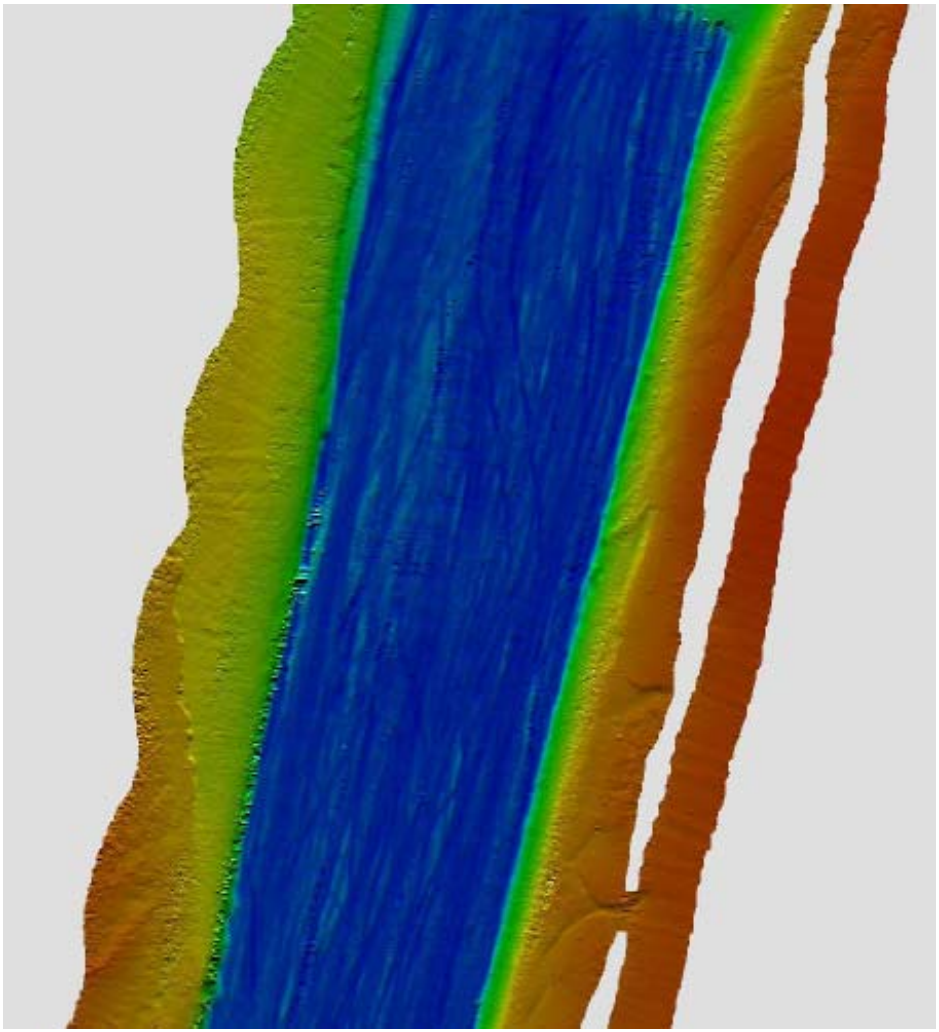
Hopper (Hydraulic) Dredge



Draghead

Dragarm Assembly

Hopper Dredge Excavation Pattern



Hopper Dredge Discharge

Split Hull

Bottom Dump Door

Hopper Dredge Pump Out

Advantages of Hopper Dredges

- Only dredge type for rough open water,
- Can move quickly to job under its own power,
- Minimizes traffic interference,
- Improves navigation depth quickly,
- Economical for long haul distance.

Limitations of Hopper Dredges

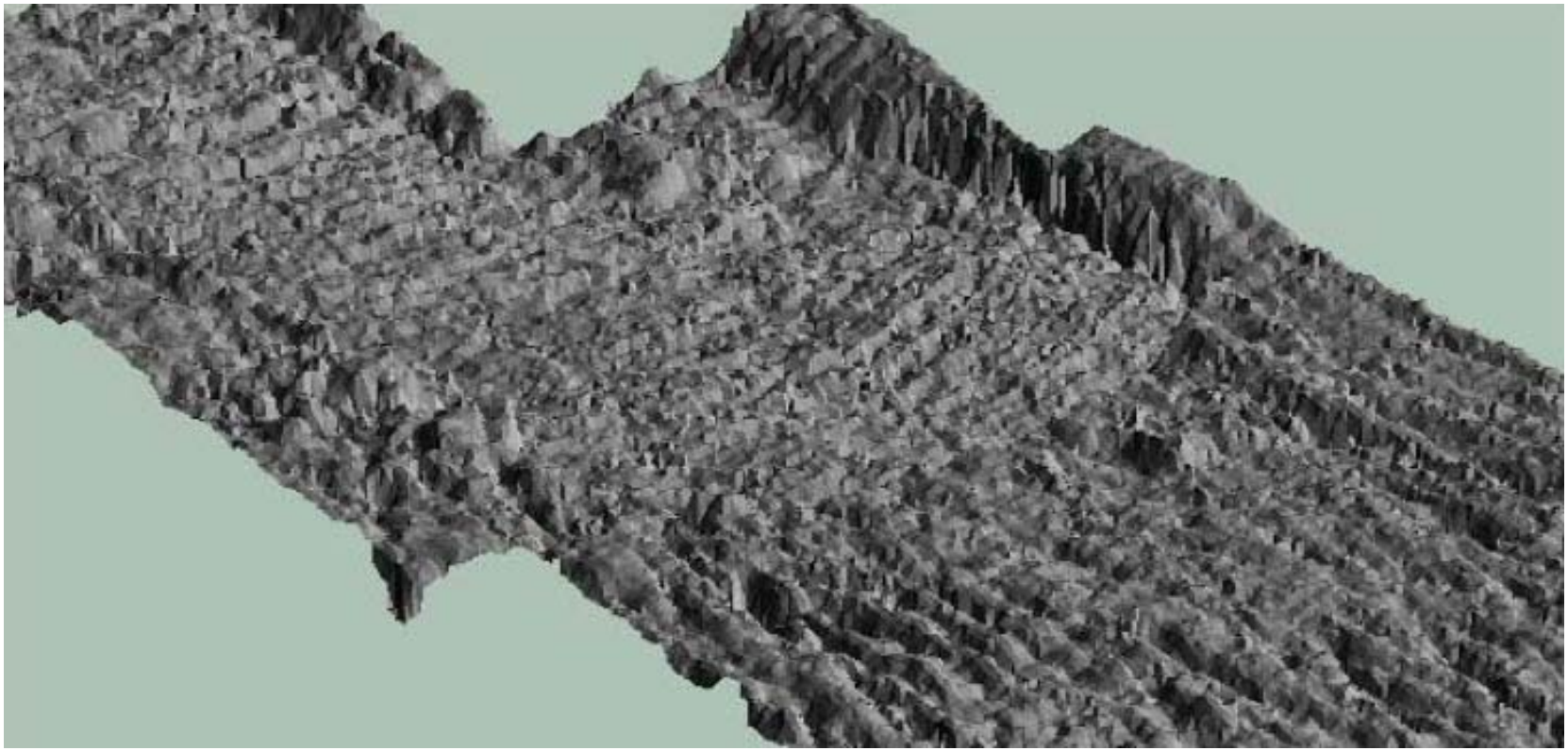
- Cannot work in shallow depths,
- Cannot dredge continuously,
- Excavates with less precision,
- Difficulty dredging hard banks,
- Difficulty dredging consolidated materials.

Hydraulic Pipeline / Cutterhead Dredge

Cutterhead

Source: Great Lakes Dredge and Dock Co.

Cutterhead Dredge Excavation Pattern



Source: Great Lakes Dredge and Dock Co,

Types of Discharge Pipeline

Booster Pumps

Source: Great Lakes Dredge and Dock Co.

Source: GIW

Traditional Hydraulic Placement

Spider Barge

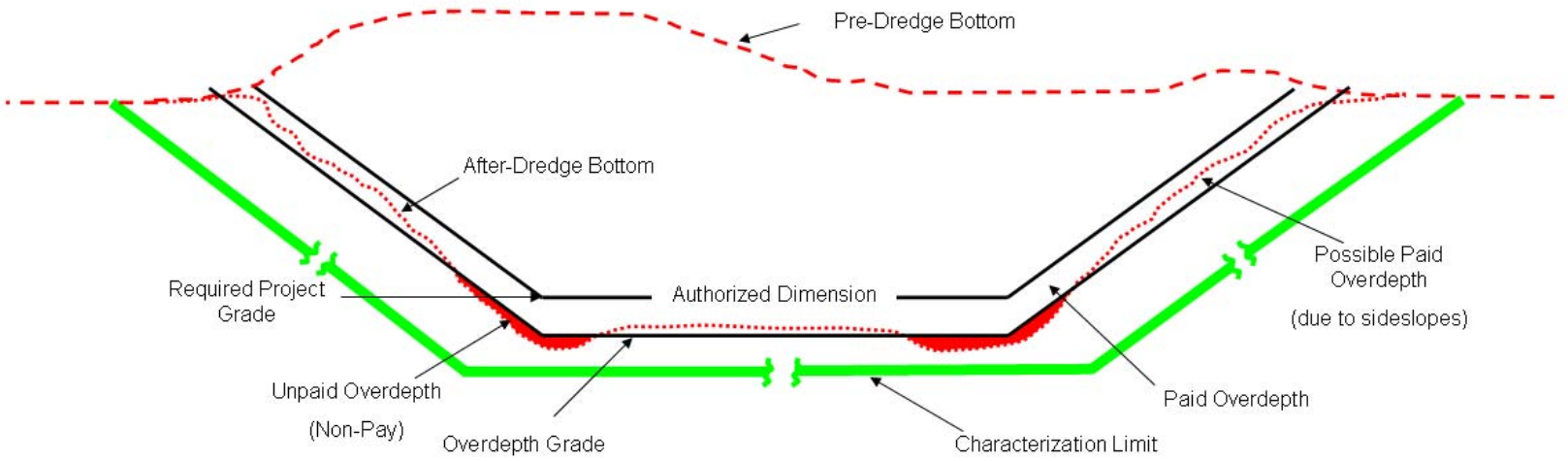
Advantages of Cutterhead Dredges

- Capable of excavating most types of materials,
- Can pump directly to disposal sites,
- Can dredge almost continuously,
- Can dredge some rock types without blasting.

Limitations of Cutterhead Dredges

- Limited capability in rough open water,
- Most are not self-propelled,
- Difficulty with coarse sand in high currents,
- Pipeline can be an obstruction to navigation,
- Debris in sediment can reduce efficiency.

Channel Prism Terminology



ERDC/TN EEDP-04-37
June 2007

Overdepth Dredging and Characterization Depth Recommendations

by John F. Tavolaro, Joseph R. Wilson, Timothy L. Welp, James E. Clausner, and Angela Y. Premo

PURPOSE: This technical note (TN) describes the excavation accuracy of various dredges under different project conditions, and provides guidance to U.S. Army Corps of Engineers (USACE) personnel in determining depths to adequately characterize and evaluate material to be dredged in the entire dredging prism, including paid allowable overdepth and non-pay dredging. The technical note also improves communication on these subjects with other agencies and the public. Proper selection of characterization depths, considering the dredge's excavating accuracy and respective project-specific conditions, is critical to ensure future compatibility of the dredging description and quantities in environmental compliance documentation with the dredging as actually implemented. This guidance is meant to supplement Engineer Regulation (ER) 1130-2-520 (USACE 1996) and the Memorandum for Commanders, Major Subordinate Commands, "Assuring the Adequacy of Environmental Documentation for Construction and Maintenance Dredging of Federal Navigation Projects" (USACE 2006). Much of the information from the USACE 17 Jan 2006 Memorandum is included in this technical note.

http://el.erdc.usace.army.mil/elpubs/pdf/eedp04-37.pdf

Dredged Material Disposal Alternatives

- Open Water Placement
  - Ocean ~ Estuarine ~ Lakes ~ Rivers
- Confined Disposal
  - Confined Disposal Facilities (CDFs)
  - Contained Aquatic Disposal (CADs)
- Beneficial Use Applications

Planning Considerations

- Project Requirements
  - Volumes and Frequency of Dredging
  - Planning Horizon
  - Stage of Evaluation
- Material Characterization
  - Physical and Dredgability
  - Chemical / Biological
- Regulatory or Other Constraints

Open Water Placement

- Site Characterization
- Site Designation / Selection
- Material Suitability
- Design Evaluations
- Operational Considerations
- Control Measures / Management Actions
- Monitoring
- Site Management Plan

Confined Disposal Facilities (CDFs)

- CDFs used because:
  - More economical for some projects
  - Most common option for material unsuitable for open water
- Regulated under CWA
  - Discharge to US waters by definition
  - 404 permit
  - 401 state water quality certification

CDF Considerations

- Site characterization / selection
- Engineering design
- Operational considerations
- Contaminant pathways and controls
- Long-term management
- Monitoring

Types of CDFs
Upland, Nearshore, and Island

Contained Aquatic Disposal (CAD)

Beneficial Use (BU) Applications

- BU is alternative of first choice
- Needs and opportunities
- Material suitability
- Logistical constraints
- Regulatory requirements vary
  - CWA / MPRSA
  - Other

Beneficial Uses Categories

- Wetland Habitat / Shoreline Protection
- Beach Nourishment.
- Mine land Restoration.
- Recreation.
- Agriculture.
- Island Habitat
- Construction Fill.
- Construction Materials.

http://el.erdc.usace.army.mil/dots/budm/budm.cfm

Basic References

- EM Dredging and Dredged Material Disposal
- EM Beneficial Uses of Dredged Material
- EM Confined Disposal of Dredged Material
- Technical Framework for Environmental Evaluations
- Ocean Testing Manual
- Inland Testing Manual
- Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities
- Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material

Available at http://el.erdc.usace.army.mil/dots/guidance.html

The End

Questions?