

OverDepth Dredging

Joe Wilson
Navigation Branch
Operations Division
HQ
US Army Corps of Engineers



ERDC/TN EEDP-04-37
June 2007

Overdepth Dredging and Characterization Depth Recommendations

by John F. Tavoraro, 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.

BACKGROUND: It is USACE policy that dredging will be accomplished in an efficient, cost-effective, and environmentally responsible manner to improve and maintain the Nation's waterways to make them suitable for navigation and other purposes consistent with Federal laws and regulations (USACE 1996).

In a guidance memorandum dated 17 January 2006, Congress specifically authorizes Federal navigation channels with a specific depth and width (and length) (USACE 2006). The authorized depth and width (Figure 1) are generally based on maximizing net transportation savings considering the characteristics of vessels using the channel. In addition to authorized dimensions, channel reliability is considered and may result in the incorporation of advance maintenance depths into construction of the channel where such advance maintenance is justified to ensure channel reliability and least overall cost. There are inherent excavation inaccuracies in the dredging process. Excavation accuracy relates to closeness of the dredge's completed work to the design (project and/or overdepth) grade (Figure 1) as determined by an after-dredge hydrographic survey.

Dredge excavation accuracies vary as a function of type of dredging equipment used (mechanical or hydraulic) and interaction with site-specific physical conditions (tides, currents, waves), type and thickness of sediment or rock being dredged, and channel design (water depth, side slopes, etc.). Because of these variables and the resulting excavating inaccuracies associated with the dredging activity, USACE engineering design, cost estimating, and construction contracting documents recognize that dredging below the Congressionally authorized project dimensions

Outline

- Dredge operating characteristics and excavation accuracies
- Channel template (prism) definitions
- Current guidance on characterization depth

Excavation Accuracy

Relates to closeness of the dredge's completed work to the design (project and/or overdepth) grade as determined by an after-dredge hydrographic survey.

Excavation Accuracy

The are inherent excavation inaccuracies in all types of dredging excavation processes.

No dredge digs a perfectly flat bottom exactly to required project grade.

Major Factors that Influence Excavation Accuracy:

- Physical characteristics of dredged material
- Physical environment
- Level of crew skill and effort
- Quantities/physical layout
- Channel design

Additional Error Components

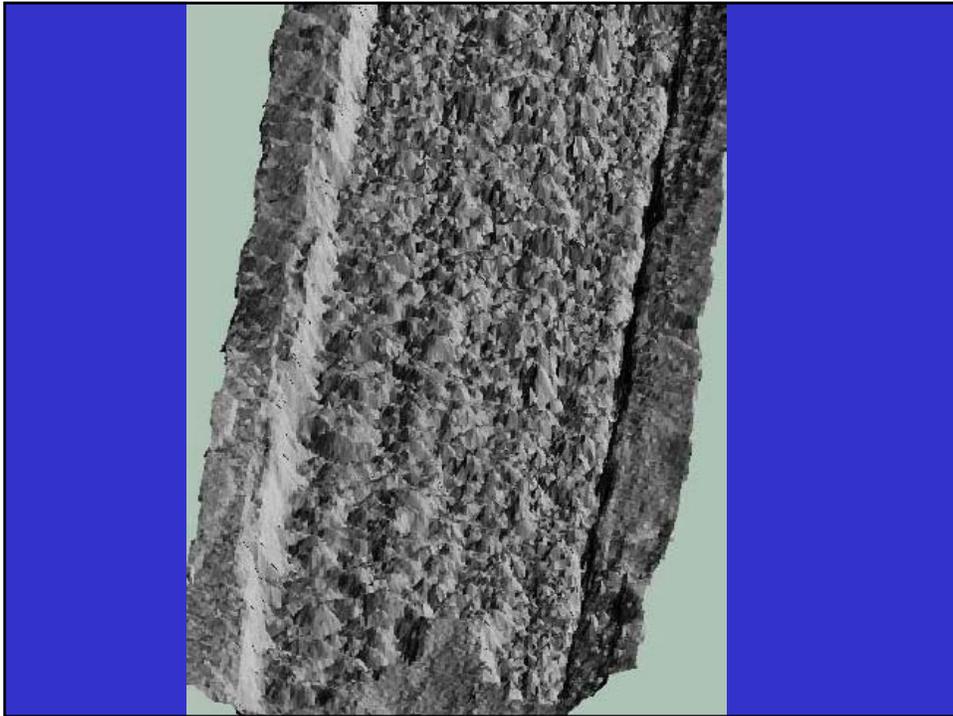
Hydrographic surveying accuracy.

- In sheltered waters typical hydrographic survey accuracies of +/- 0.5 ft are achievable
- As waves increase, so can the motion of the survey vessel
- Water surface's relationship to the dredge datum must be measured

The dredge often relies on the same methodology for determining depth at excavation point.

Clamshell Dredge



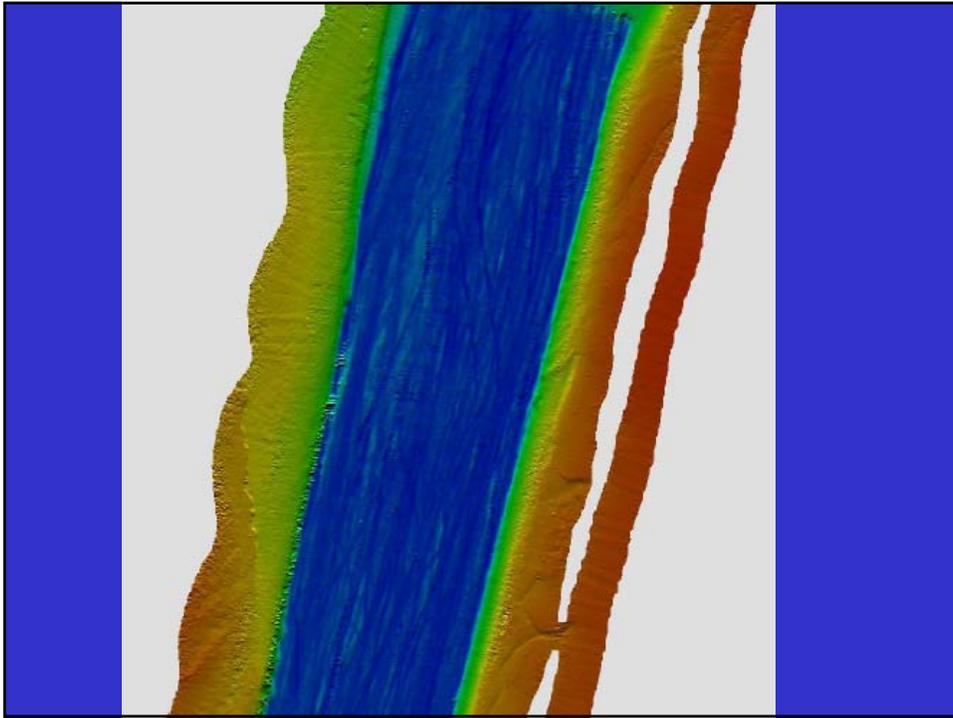


Backhoe Dredge



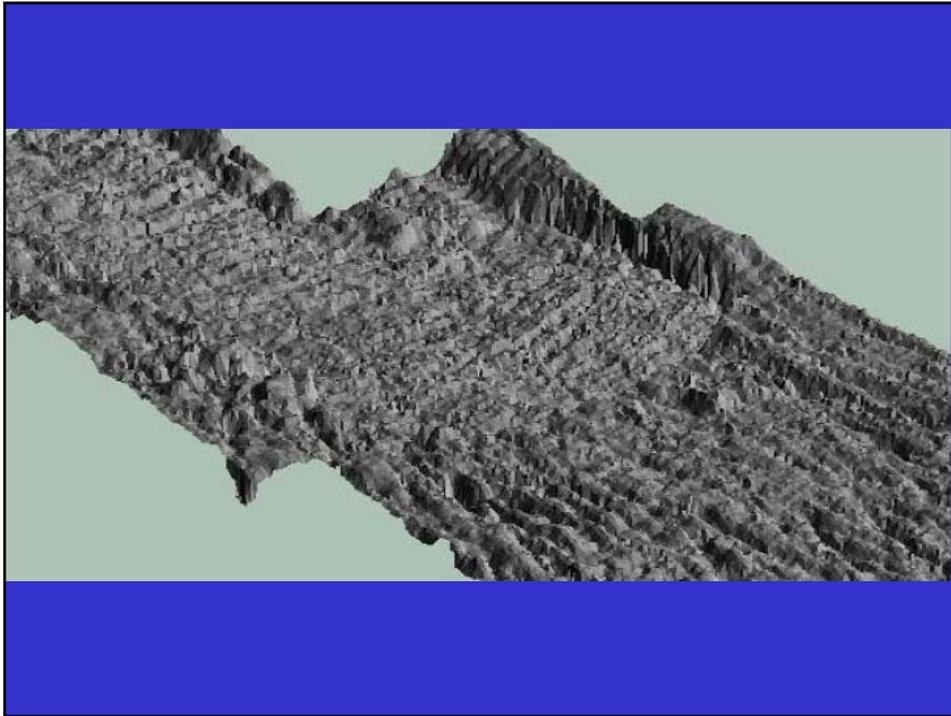
Hopper Dredge



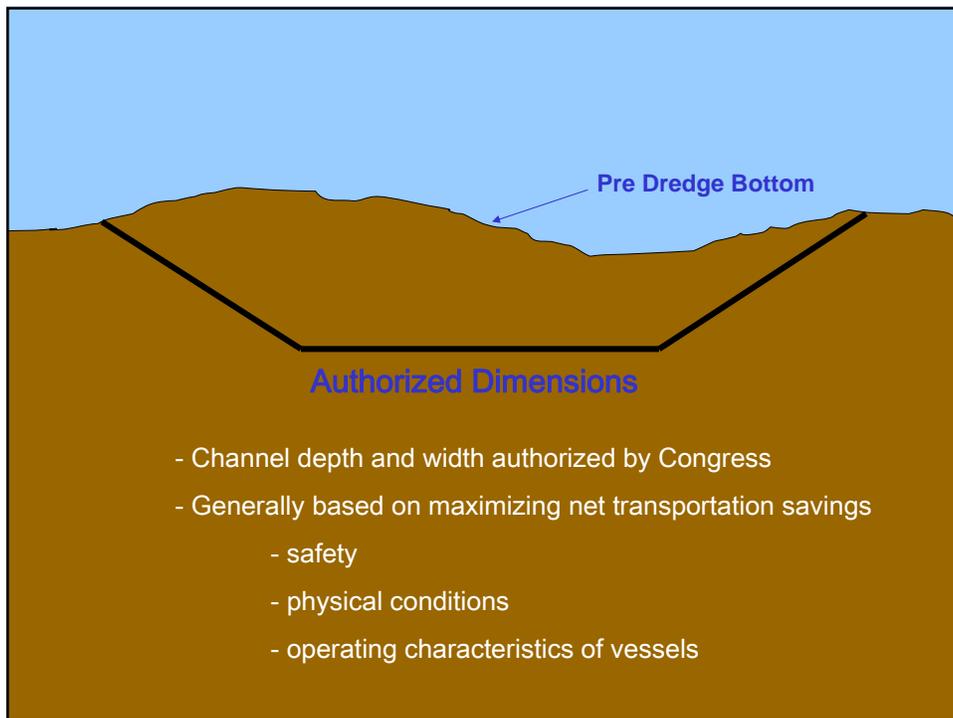
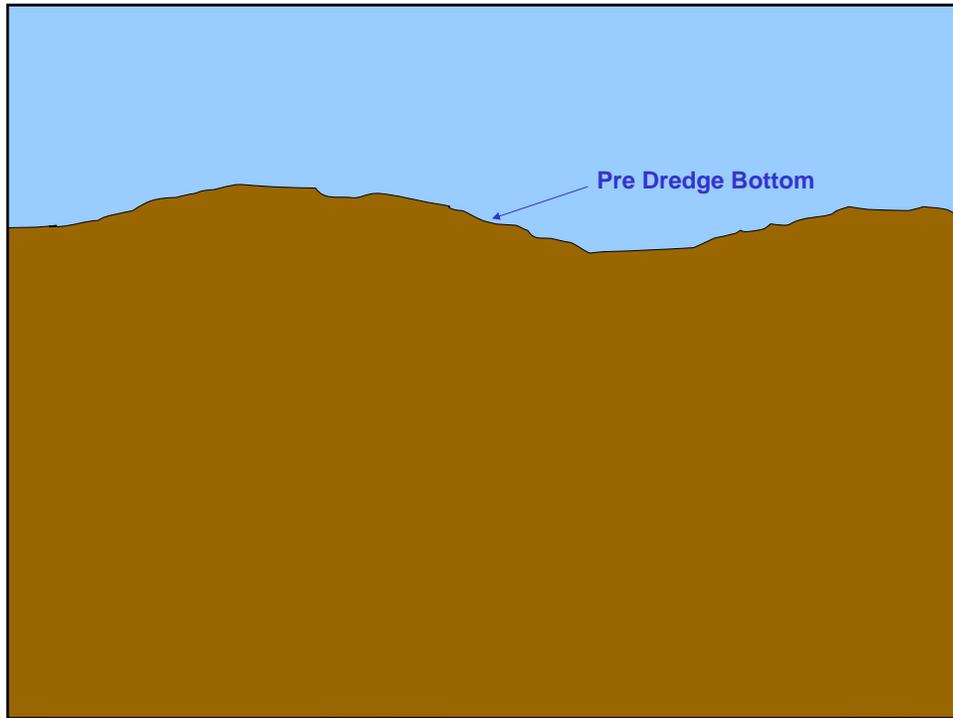


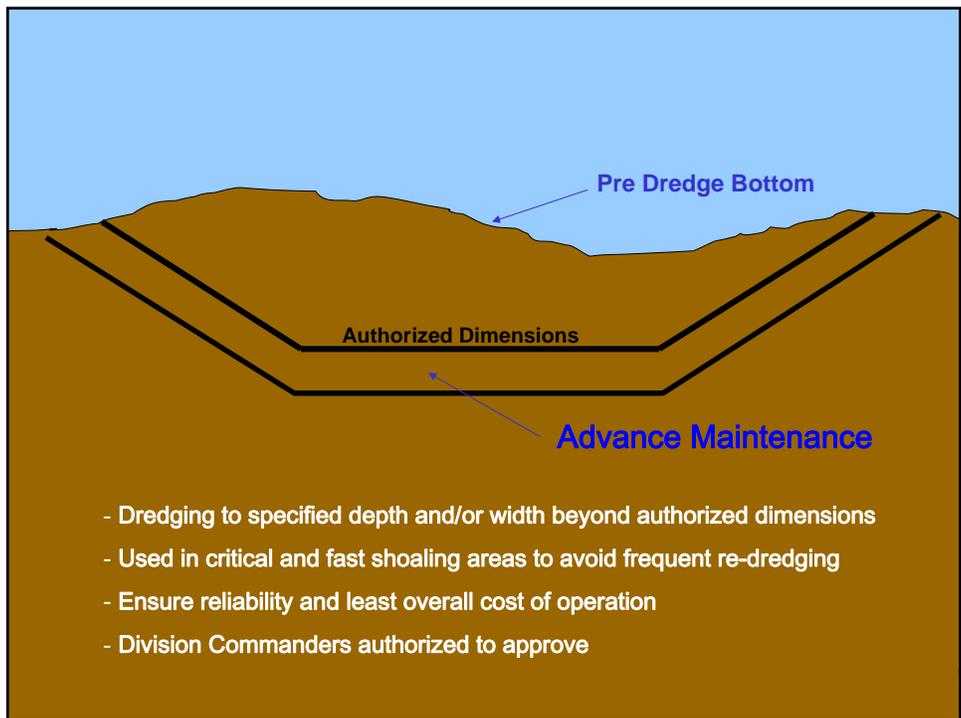
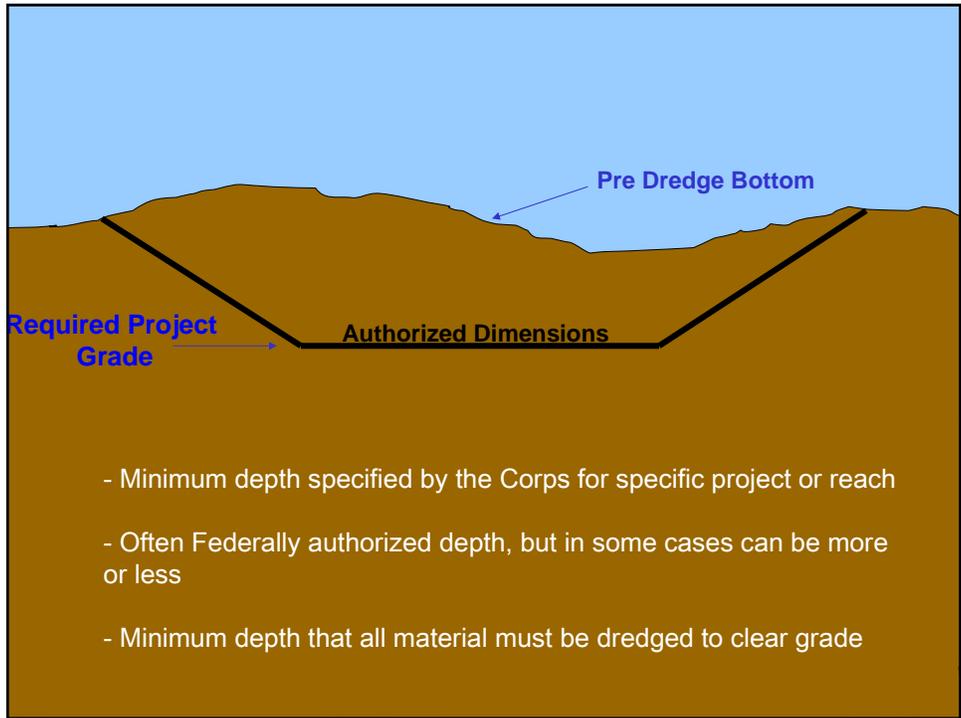
Cutterhead Dredge

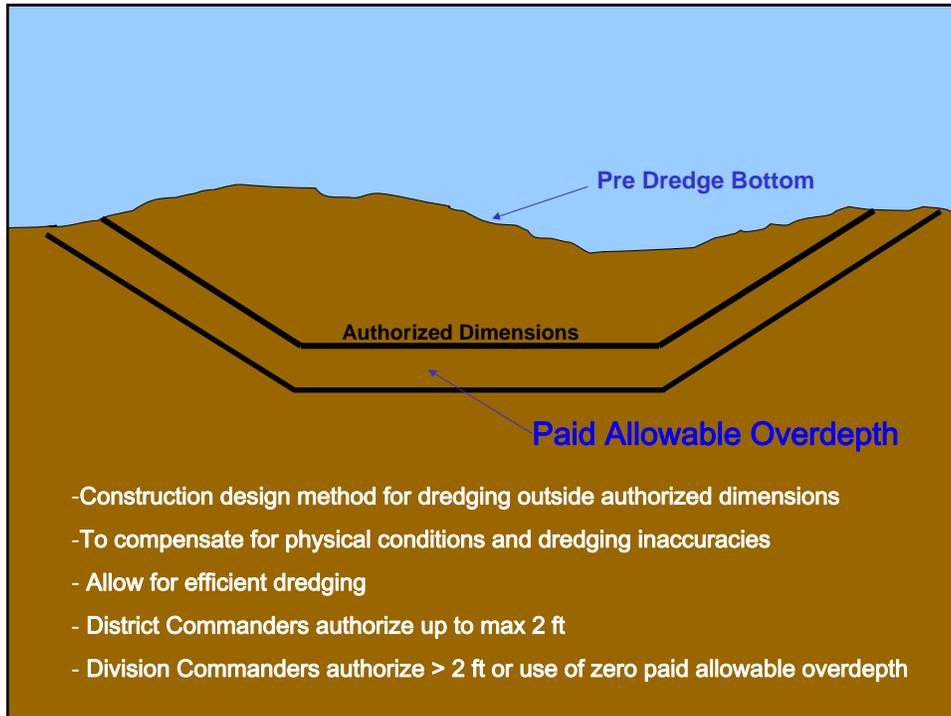




Prism Definitions

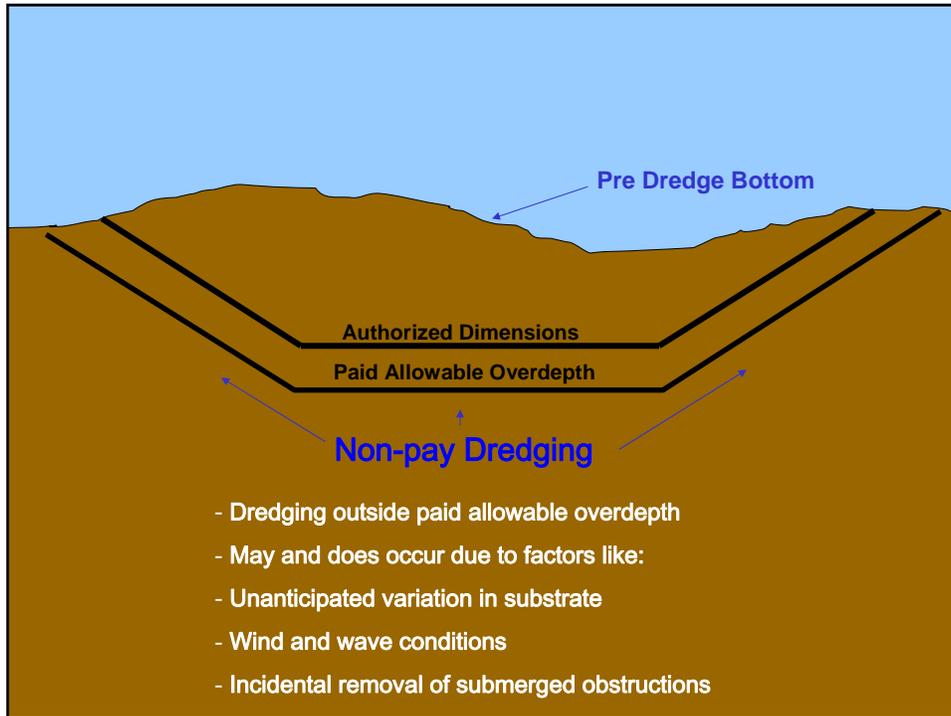






The Term “Allowable”

- Must be understood in the contracting context where dredging quantities are eligible for payment, rather than in the regulatory context where dredging quantities are reflected in environmental compliance documents.
- Environmental documentation must reflect the total quantities “likely” to be dredged.



Non-pay Dredging

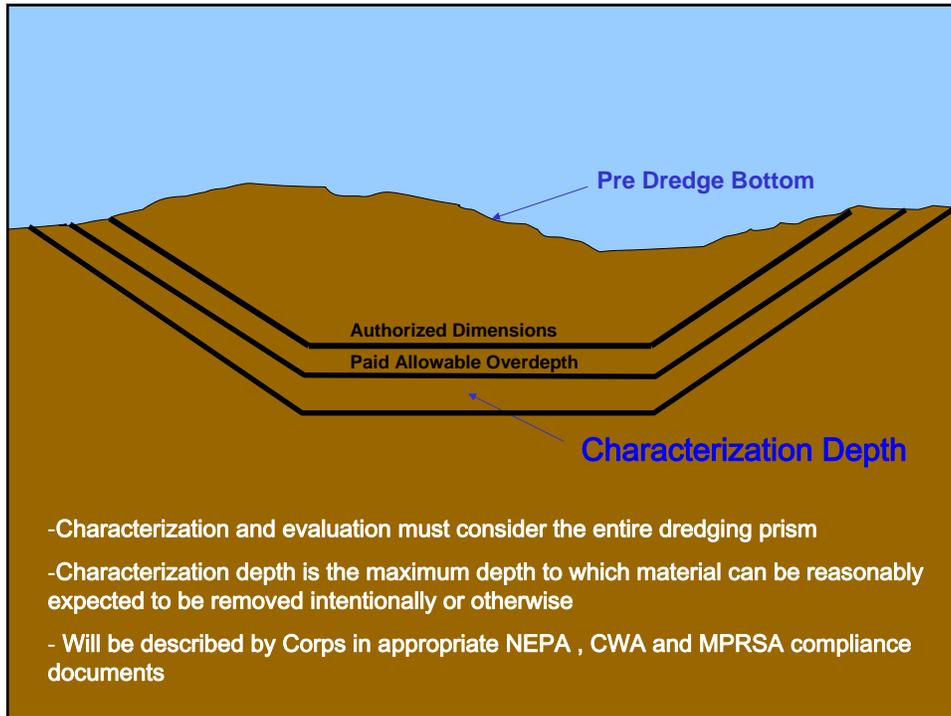
- In environmental documentation its usually recognized as a contingency allowance. In layman's terms it called accidental dredging.
- May and does occur in varying degrees at virtually every project.

Sediment Characterization

- Identifying and evaluating sediment characteristics to be dredged for predicting environmental impacts due to dredging and/or disposal activities.
- Can be physical, chemical or biological sampling and/or testing, or any combination.
- Extent of sediment characterization necessary to ensure compliance with applicable environmental laws and regulations is site specific.
- Is to be developed by the Corps after considering all site-specific variables.

Sediment Characterization

- Appropriate characterization important for evaluating impacts of placement and channel bottom quality.
- Important to remember that it is the disposal and not the excavation that is regulated.
- The quantity of overdepth dredging should be properly estimated to avoid misleading conclusions of environmental impact.



Summary

- The Corps will ensure all applicable environmental compliance actions for the dredging project have been identified and coordinated.
- Dredge excavation accuracy varies and it is the responsibility of the Corps to properly characterize what is expected to be dredged
 - If more material is dredged than described AMEND THE ENVIRONMENTAL DOCUMENTS
 - Working with EPA to make guidance more equivocal

The End



Authorized Dimensions.

Authorized dimensions are the depth and width of the channel authorized by Congress to be constructed and maintained by USACE. These authorized channel dimensions are generally based on maximizing net transportation savings considering the characteristics of vessels using the channel and include consideration of safety, physical conditions, and vessel operating characteristics. For entrance channels from the ocean into harbors, the authorized dimensions often include an additional allowance of safety for wave action for that portion of the channel crossing the ocean bar. For example, a 45-ft entrance channel may have an authorized 47-ft depth over the ocean bar.

Advance Maintenance.

Advance maintenance is dredging to a specified depth and/or width beyond the authorized channel dimensions in critical and fast shoaling areas to avoid frequent re-dredging and ensure the reliability and least overall cost of operating and maintaining the project authorized dimensions. For maintenance dredging of existing projects, Major Subordinate Commanders (MSC) (Division Commanders) are authorized to approve advance maintenance based on written justification. For new navigation projects, advance maintenance is approved as part of the feasibility report review and approval process based on justification provided in the feasibility report.

Paid Allowable Overdepth. Paid allowable overdepth dredging (depth and/or width) is a construction design method for dredging that occurs outside the required authorized dimensions and advance maintenance (as applicable) prism to compensate for physical conditions and inaccuracies in the dredging process and allow for efficient dredging practices. The term “allowable” must be understood in the contracting context of which dredging quantities are eligible for payment, rather than in the regulatory context of which dredging quantities are reflected in environmental compliance documents and permits. Environmental documentation must reflect the total quantities likely to be dredged including authorized dimensions, advance maintenance, allowable overdepth, and non-pay dredging. The paid allowable overdepth should reflect a process that seeks to balance consideration of cost, minimizing environmental impact, and dredging capability considering physical conditions, equipment, and material to be excavated.

Paid Allowable Overdepth (continued)

ER 1130-2-520 (USACE 1996) provides that District Commanders may authorize dredging of a maximum of 2 ft of paid allowable overdepth in coastal regions and in inland navigation channels. Paid allowable overdepth in excess of those allowances or the use of zero paid allowable overdepth requires the prior approval of the MSC Commander. USACE recognizes that there may be circumstances where there is a need for increased excavation accuracy in the dredging process, for example in environmental dredging of contaminated material, which dictate trading potential increased costs for a reduction in paid allowable overdepth, i.e., reducing the quantity of material required for special handling/placement or treatment.

Non-pay Dredging.

Non-pay dredging, also known as non-paid overdepth, is dredging outside the paid allowable overdepth that may and does occur due to such factors as unanticipated variation in substrate, incidental removal of submerged obstructions, or wind or wave conditions that reduce the operators' ability to control the excavation head. In environmental documentation, non-pay dredging is normally recognized as a contingency allowance on dredging quantities, and may and does occur in varying magnitude and locations during construction and maintenance of a project.

Sediment Characterization:

Sediment characterization is the process of identifying and evaluating the characteristics of sediments to be dredged for the purpose of predicting environmental impacts due to dredging and/or disposal activities. It can take the form of physical, chemical, or biological sampling and/or testing, or any combination of these three forms of characterization. The extent of sediment characterization physical, chemical, or biological necessary to ensure compliance with applicable environmental laws and regulations is site-specific and should be developed by USACE after considering all site-specific variables that might influence the ultimate channel prism dredged.

Characterization Depth.

Characterization and evaluation of dredged material must consider the entire dredging prism, including paid allowable overdepth and non-pay dredging. Thus the characterization depth is the maximum depth to which material can be reasonably expected to be removed intentionally or otherwise. The characterization depth will be described by the USACE in appropriate National Environmental Policy Act (NEPA) and Clean Water Act (CWA) environmental compliance documents.

Required Project Grade.

This is the minimum depth specified by the Corps for each dredging project or specific reach within a project. Often it is the federally authorized depth, but in some cases can be less or more (for example, when advance maintenance has been authorized). This is the minimum depth that all the material must be dredged to clear grade.

- Dredging is a lot like war. The commander draws intricate plans, maps put every detail and makes sure everyone knows exactly what is going to happen. But, when the first shot is fired all bets are off.