Use of Dredged Materials for Contaminated Sediment Source Control

David W. Moore, Damarys Acevedo, Dave Perkey, Dan Farrar, Jim Biedenbach, Steve Larson, Paul Schroeder, Joe Gailani, and Gunther Rosen

Background/Objectives. Navigation channels, turning basins, and other US Army Corps of Engineers (USACE) managed navigation infrastructure often become repositories for contaminated sediment originating from offsite sources. It has been estimated that about 10% of the material that the USACE dredges annually is contaminated to the extent that it requires additional and more costly management (e.g., re-handling and placement in engineered confined disposal facilities). Presence of contaminated sediments constrains dredged material (DM) management options resulting in additional management costs as well as opportunity loss resulting from the inability to beneficially use the material. One potential solution is thin layer placement of clean or perhaps marginally suitable DM to stabilize and isolate contaminated sediment sources preventing further transport and introduction to USACE managed navigation infrastructure. Sediment removed during maintenance dredging programs often has organic carbon content in the 1-2% range (supporting contaminant sequestration) and may be more representative of local substrate occurring at off channel contaminant source areas (facilitating improved recovery of the benthic community). Consequently, DM may represent a better, more cost effective alternative when compared with other traditional source control measures (clean sand, activated carbon, etc.). However, as materials from maintenance dredging are often finer grained it is important to understand the nature and necessity of engineering controls for handling and placement to ensure viability of the approach under a variety of field conditions.

Approach/Activities. The USACE Engineer Research and Development Center (ERDC) conducted a series of laboratory bench-scale studies to better understand behavior and stability of fine grained dredged materials placed as thin layer caps. Five representative capping materials placed as 5-inch layers (based on final estimated consolidation) were evaluated for post-placement stability (measured as critical shear stress) using a sediment erosion flume (SedFlume) coupled with x-ray density scans. Cap treatments assessed included a fine grained (96% fines) DM from Pascagoula, MS, Pascagoula DM with 10% sand added (86% fines), Pascagoula DM with a biopolymer addition (1% by dry weight, sodium alginate), a dried DM from the Waipio upland confined disposal facility in Pearl Harbor, HI (64% fines) and a DM from West Loch Pearl Harbor, HI (72% fines). All caps were placed over a base layer that had consolidated 40 days with representative benthic organisms added (an amphipod and a polychaete). Cap treatments utilizing Pascagoula DM were placed as 200 g/L slurries using a diffuser tube just beneath the water surface. The Waipio material was sprinkled as a dry mixture on top of the water column while the West Loch Pearl Harbor Sediment was placed as a 445 g/L slurry to better represent practical handling/placement strategies under consideration for those materials. Both the Waipio and West Loch materials were also evaluated in a separate parallel US Navy SPAWAR-led field effort evaluating efficacy of these materials in reducing contaminant bioavailability. Stability of cap treatments were assessed at 48 hours, 7 days, and 30 days post-placement.

Results/Lessons Learned. Good survival of representative benthic organisms' post-cap placement suggests organisms are able to tolerate thin layer placement of fine grained materials (>60%) either in the dry or as a wet slurry. Addition of biopolymer substantially reduced TSS during placement in comparison to unamended materials but resulted in elevated BOD and anoxic conditions in the amended treatment. Results of SedFlume analysis are presented and the consequent implications for handling and placement strategies discussed.