



Sediment Bacteria Mining for Beneficial Reuse

Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS

BUILDING STRONG®

Focus Area

Risk Management: Public Private Partnership – Innovative Technologies for Managing / Treating Contaminated Sediment to Expand Beneficial Use Opportunities

Problem

The US Army Corps of Engineers (USACE) navigation dredging program expends hundreds of millions of dollars on an annual basis managing contaminated sediments from navigation channels. It is widely recognized that there is a critical need for sediment management alternatives to sustainably utilize dredged materials while optimizing economic, environmental and social benefits.



AECOM collecting samples from the dredged sediment at three Confined Disposal Facilities within the Great Lakes area.

Study Description

This study falls under USACE's Engineer Research and Development Center (ERDC) initiatives and the Engineering with Nature Program, with the focus to support beneficial reuse of contaminated dredged sediment derived from the Great Lakes area. The purpose of the study is experimental and designed to be a proof-of-concept determination on whether bacteria residing in contaminated sediments can also adapt to plant tissues as inoculants or endophytes to enhance breakdown of contaminants using the application of phytoremediation.

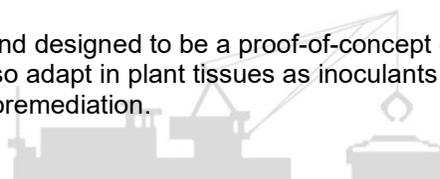
The work involves collecting sediment samples from three Confined Disposal Facilities (CFDs) including, the Clint River, Michigan, Calumet Harbor and River, Illinois, and Indiana Harbor, Indiana. Willows (*Salix purpurea*) will be grown in the dredged sediment over a 6-month greenhouse study. The sediment and purple willows will be sampled and analyzed using Next Generation Sequencing for 16S rRNA V3-V4 gene to evaluate the microbial populations potentially transferred to the plant tissue. The premise is compound-degrading bacteria residing in sediments may be adapted to host plants to help facilitate in-planta breakdown of sediment contaminants.

Products / Approaches

Artificial intelligence will be used to derive and identify patterns between the microbial data that may not be easily recognized by standard techniques such as linear regression analysis, using a combination of Python, R, and/or Orange v.3.0. The patterns (or specific bacteria identified) will be reviewed and compared to the published literature through online resources to determine if any have beneficial use related to degradation of contaminants and phytoremediation application. A brief report including a bibliography will be developed to summarize the research and a presentation of the study findings will also be prepared as a conference proceeding.

Summary

The purpose of the study is experimental and designed to be a proof-of-concept determination on whether bacteria residing in contaminated sediments can also adapt in plant tissues as inoculants or endophytes to enhance breakdown of contaminants using the application of phytoremediation.



Balancing operational and environmental initiatives and meeting complex challenges of dredging and dredged material placement in support of the navigation mission.

