



# Phytoremediation Legacy: Evaluating Long-term Effectiveness at USACE Sites

## Dredging Operations Environmental Research (DOER) Program

U.S. ARMY CORPS OF ENGINEERS

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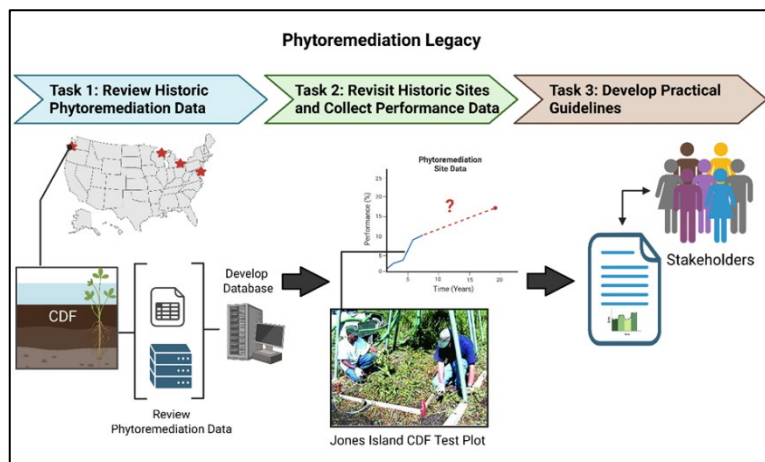
### Focus Area

Risk Management

### Problem

Phytoremediation has long been recognized as a cost-effective and environmentally sustainable strategy for managing contaminants in dredged material placed in beneficial use (BU) applications and confined disposal facilities (CDFs). However, the long-term field performance of phytoremediation within USACE-managed sites remains largely unquantified. Most existing performance data are short-term, site-specific, or lack the monitoring needed to evaluate contaminant reduction, sediment stabilization, and risk mitigation over operational timeframes relevant to CDF management.

This absence of robust, long-duration performance data current limits regulatory confidence hinders prediction of ecosystem service outcomes, and restricts integration of phytoremediation into BU and CDF decision frameworks. Therefore, comprehensive multi-year to multi-decadal evaluations are needed to understand how vegetation dynamics, site hydrology, and contaminant fate interact under real-world conditions and to provide practical, defensible guidance for incorporating phytoremediation into USACE risk-based management and design practices.



### Study Description

This study will build on historic USACE phytoremediation projects to generate the first comprehensive assessment of long-term contaminant and ecosystem responses within dredged material BU and CDF settings. Representative contaminants of concern—including heavy metals (e.g., Pb, Cd, Hg), PAHs, and PCBs—will be evaluated to quantify changes in total concentration, speciation, and bioavailability across multi-year to multi-decadal timescales. Field assessments will pair contaminant fate measurements with detailed evaluations of vegetative performance, tracking plant persistence, biomass production, and contaminant uptake. The work includes three major components: (1) a nationwide review and database of past USACE phytoremediation efforts to consolidate existing knowledge and identify representative field sites; (2) performance monitoring at legacy sites using sediment cores, plant tissue analyses, and microbial profiling to quantify long-term contaminant trajectories and ecosystem service outcomes (e.g., carbon storage, biodiversity, resilience); and (3) development of practical monitoring frameworks and risk-based decision guidelines to support USACE, EPA, and stakeholders in integrating phytoremediation into BU and CDF management strategies.

### Products

**FY26:** Historic USACE phytoremediation literature review (Tech Report); Development of a phytoremediation performance database; **FY27:** Long-term performance assessment of phytoremediation at dredged material sites (Tech Report); **FY28:** Journal Article: Past and present effectiveness of phytoremediation at USACE sites; Journal Article: Practical guidance for implementing phytoremediation within beneficial use projects.



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



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### Summary

This project will evaluate long-term phytoremediation performance at historic USACE dredged material sites by examining representative contaminants—such as heavy metals, PAHs, and PCBs—and tracking changes in concentration, speciation, and bioavailability over time. Field monitoring will pair contaminant fate assessments with measurements of vegetation performance, including species persistence, biomass production, and contaminant uptake, alongside biogeochemical indicators such as redox conditions and rhizosphere microbial activity. These data will significantly improve the predictability and acceptance of phytoremediation for managing contaminated or marginally contaminated sediments, strengthening risk-based sediment management and advancing beneficial use opportunities across USACE projects. Collaboration will include USACE Districts, federal resource agencies (EPA, NOAA, USFWS), technical communities of practice, and academic partners. Findings will be transferred through workshops, a web-accessible database, technical reports, and peer-reviewed publications, distributed via the DOER Program, ERDC Knowledge Core, and Navigation and Dredging CoPs. Primary users of this information will be USACE District environmental and operations staff, project managers, regulatory reviewers, and interagency partners involved in beneficial use planning and decision-making.



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