PROJECT ID:
572

Flexible Under Pier Sediment Assessment

The NIWC Z-boat in action. (Photo Credit: Chuck Katz)

Example of a bathymetric map created for Santa Margarita Estuary.
(Photo Credit: Google Earth 2013; Bathymetry Credit: Chuck Katz)

OBJECTIVE:

This project will develop a simple and cost-effective solution to ascertain the potential magnitude of recontamination occurring from unremediated underpier sediments slumping into dredged and/or remediated areas between piers.

PROBLEM STATEMENT:

Navigation dredging is required to be conducted alongside Navy piers on a frequent basis to enable access for ships. Unfortunately, many Navy harbors contain contaminated sediments from past activities that might also require targeted dredging to remediate. Dredging for navigation and/or to remove contaminated sediments does not typically target under-pier areas, where contaminated sediments can accumulate.

Contaminated sediments in Navy harbors are estimated to be a two-billion-dollar problem. Recontamination of remediated sites compound these costs, requiring further cleanup and monitoring efforts. One potential source of recontamination is the sediment built up underneath Navy piers where navigational dredging (and, typically, cleanup dredging) does not occur. These neglected and potentially contaminated under-pier sediments may fill in nearby previously remediated sites with new contaminants, confounding cleanup efforts.

A critical need exists for tools to map under-pier bathymetry and collect sediment samples from difficult-to-access spaces under piers.

DESCRIPTION:

To quantify the level and extent of contamination, and design effective solutions to remediate under-pier sediments, the volume, contaminant concentrations, and slumping potential of under-pier sediments are required. (Slumping refers to sediments sliding downwards into an adjacent trench or gap created by dredging.) This project will demonstrate and validate several creative solutions to accurately assess under-pier sediments at reasonable cost.

A small-scale demonstration in San Diego Bay will take place first to answer the following questions:

1. What volume of sediment is underneath a given pier?
2. What are the contaminant levels in these sediments?
3. How much slumping occurs after dredging?
4. Are these sediments potentially contributing to local contaminant issues?

Under-pier bathymetry will be acquired during surveys conducted before, immediately after and several months after maintenance dredging to quantify sediment volume and movement from under-pier areas at the demonstration site.

Sediment volume and slumping will be quantified using repeat acoustic-bathymetry surveys conducted with a small, remotely controlled vessel—the Teledyne Z-boat 1800.

The Z-boat was developed for bathymetric and habitat mapping, and has been successfully used by the Naval Information Warfare Center (NIWC) team in San Diego, CA in estuarine systems. The remote operator can control the boat and view the data in real time from a shore- or support-vessel-based laptop running the required software. The platform will collect georeferenced high-resolution bathymetric data from which Digital Elevation Models (DEM) and thus sediment volumetric estimates will be subsequently calculated.

Sampling underneath the pier prior to understanding the topography of the ocean bed would invite ineffective and thus costly sampling techniques.

The DEMs calculated during each survey will be compared to subsequent surveys to assess erosion rates of a given under-pier area and migration of sediments to surrounding areas.

With volumetric estimates from the processed bathymetric survey data, the team will determine the appropriate depth, layout and method for sediment sampling to assess contaminant concentrations.

The most appropriate sediment sampling strategy for a given under-pier area will be selected from a menu of appropriate sampling methods including:

1. Surface grab sampling (i.e. by divers from a small boat or kayak, or a specialized scoop on a remotely operated vehicle)
2. Short core collection (i.e., by gravity core from a kayak, or push-core by divers)
3. Long cores (i.e., a larger gravity core or vibracore from a small boat or from the pier surface through a manhole)

Following the small-scale demonstration, a full-scale demonstration will be performed, building on lessons learned from the initial demonstration.

This approach will allow the volumetric assessment of under-pier sediment piles before sampling for contaminants is conducted. This will allow for a direct assessment of which sampling technique will be the most relevant to the under-pier setting and promote a more cost-effective sampling strategy. Sampling underneath the pier prior to understanding the topography of the ocean bed would invite ineffective and thus costly sampling techniques.

TRANSITION DESCRIPTION:

Standard operating procedures (SOP) will be developed for each aspect of the demonstration. Existing SOPs for various under-pier sampling methodologies that will be included in the sampling menu will also be compiled or developed if not available. Finally, a comprehensive overview of the workflow developed for under-pier sediment assessments will be completed.

The technology will be transitioned by conducting presentations at relevant stakeholder meetings such as conferences and working groups, and the final report, SOPs and other guidance documents will be delivered to the Navy Sediment Management Working Group.

CONTACT:

For more specific information about this project, contact the Principal Investigator at 619-553-2768. Contact the NESDI Program Manager at 805-982-4893 for more general information about the program.

ABOUT THE NESDI PROGRAM

The Navy Environmental Sustainability Development to Integration (NESDI) program is the Navy's environmental research and development demonstration and validation program, sponsored by the Chief of Naval Operations Energy and Environmental Readiness Division and managed by the Naval Facilities Engineering Systems Command from the Engineering and Expeditionary Warfare Center in Port Hueneme, CA. The mission of the program is to provide solutions by demonstrating, validating and integrating innovative technologies, processes and materials and by filling knowledge gaps to minimize operational environmental risks, constraints and costs while ensuring Navy readiness and lethality.

Visit the program's public website at https://www.navfac.navy.mil/NESDI for more information.