Assessing Sustainability and Ecosystem Support in Navigation Projects

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Abstract

Sustainability of the Navigation Mission requires a balance of three efforts: 1) reducing costs/impacts from the activity, in terms of both monetary and other resources, 2) increasing the potentially many types of benefit/value of the activity, and 3) aligning costs and benefits that accrue at different points and time. Case studies in Galveston and Cleveland are used to investigate project alternatives that attempt to maximize the beneficial use of dredged sediment and/or reduce the impact of sediment management activities to demonstrate potential sustainability improvements from removing specific inefficiencies or implementing specific improvements in terms of both operations and policy.

Approach

Sustainability is traditionally described as balanced pillars of effects to society, economics, and environment. An important aspect of Sustainability to the Corps is the long-term ability to manage substantial sediment volumes in a cost-effective way. This must be traded off against the specific environmental and regional economic concerns in order for effective planning and negotiation with non-Federal sponsors. A major consideration for long-term planning in sustainability is describing what entities pay the short term and long-term environmental and economic costs and to whom do the long-term benefits accrue. Some strategies employed are:

Multi-Criteria Decision Analysis (MCDA)

MCDA allows the integration of different types of data into a single output without monetizing every criterion. MCDA is achieved through value functions, for example: greater cost = worse (simple case) or greater annual sediment capacity is better up to the limit of annual sediment produced, after which greater capacity has little or no benefit.

Life Cycle Assessment (LCA)

Environmental LCA is a process to track environmental impacts over the entire life span of a project; the process captures effects that can be overlooked (e.g. carbon emissions during dredging and transportation to a dewatering site) or are beyond the typical planning horizon (e.g. carbon sequestration of wetlands). In additional to atmospheric emissions, LCA can also be used to track energy use, water use, land use change, and other resource consumption.

Optimization

The ERDC-developed Dredged Material Decisions Management (D2M2) tool is a linear optimization program that matches dredging reaches with placement areas by optimizing on factors such as distance and cost and timing constraints over multi-year periods.

Portfolio Analysis

Although the optimization process will align dredge reaches with placement sites, under sediment volume or cost constraints, it may not be possible or necessary to use all placement areas. Portfolio analysis consider combinations of projects and calculates the marginal value of each additional project in a group. The result is a curve that identifies the set of projects that provide the greatest benefit (whether maximizing economic value, ecosystem support, or other) at each available funding level.

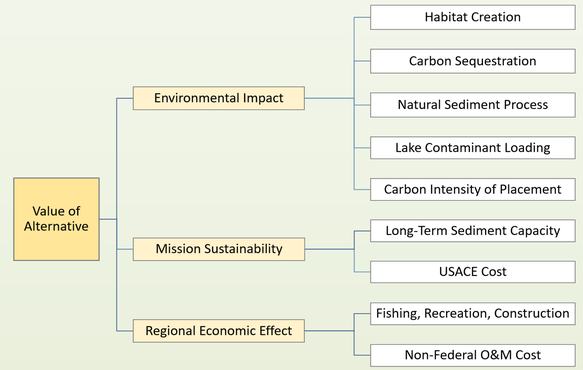
Case Studies

In order to assess the sustainability of most sediment management strategies, the alternatives for dredge sediment placement include some sites previously used but no longer favored or permitted, some current placement options, and some proposed but undeveloped alternatives.

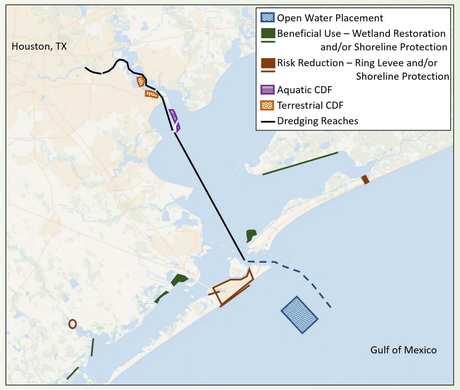
Cleveland
Cuyahoga River

Challenge The USACE has found 80% of dredged material in the Cuyahoga (from Dredging Reach 1) to be suitable for open lake placement but the state EPA will not permit it. The district is currently operating under reduced maintenance to help extend the life of the one available federal CDF, which is still required for management of Reaches 1 and 2. Beneficial use through wetland restoration is being investigated, as well as using sediment for upland construction fill and brownfield cover. However, current practice is to mine material for these latter uses from the locally owned CDF, which can be resource intensive and will still not provide the needed capacity over the long-term. Open lake placement, if designed, may also provide benefits through generation of complex fish habitat in a largely flat bathymetry, or can be strategically placed to cap existing contaminant hotspots.

Methods Develop a decision framework that integrates environmental effects of placement activities, environmental effects of the placed material, long-term utility and cost to the USACE mission of the placement option, and regional economic effect of the placement strategy. Demonstrate trade-offs in the effects on the environment, sediment management goals, and regional well-being. Metrics will include volumes of material, distances transported, and excess activities required to place and re-mine material from CDFs.

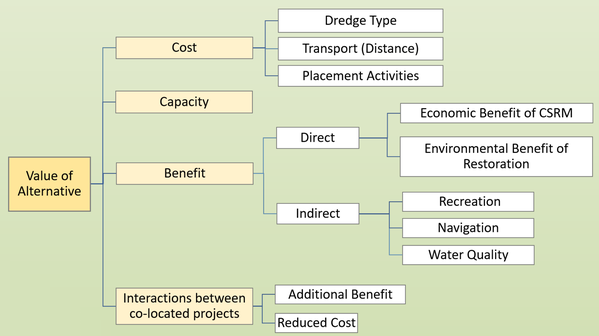


Galveston Bay
Houston Ship Channel



Challenge Deepening and widening the HSC will generate up to 200 Mcy of sediment over a 5 year period but terrestrial and aquatic CDFs are already near capacity. In addition to the open water placement site, several ER and CSRM projects in the area could benefit from the use of material. The deepening effort should generate both sandy sediment suitable for wetland enhancement in addition to consolidated bulk material which may be appropriate for construction of breakwaters and/or levees. Although these projects are often more costly placement options when considered on an individual basis, assessing the benefit to other business lines and the long-term sediment needs for the system, can provide a different perspective on the value of these alternatives in the planning process.

Methods Use D2M2 to optimize placement of the dredged material considering the sediment capacity of each, benefits provided by ER and CSRM projects as well as the costs incurred to transport the material and to prepare existing CDFs to receive more material. Metrics will include benefits to three USACE business lines as well as qualitative assessments of combining or co-locating projects to achieve multiple objectives.



Status

The project is scheduled to be completed in FY19. Both models are in the development process. Although the analysis results will include currently undeveloped and/or unpermitted alternatives, the results are expected to be instrumental in helping the districts communicate planning challenges to their local stakeholders.

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