

## **WEDA 2013 Dredging Award Submission**

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### **1. Summary (Award: Environmental dredging)**

Since 2005, the Governors of NY and CT have worked with the US Army Corps of Engineers (USACE) New England district to prepare a dredged material management plan (DMMP) for the Long Island Sound region. The goal of the DMMP is to identify, evaluate, and recommend dredged material management alternatives through a broad-based process that involves public input with scientific, engineering, economic, and environmental analyses. The plan is intended to develop safe, economic, and environmentally sound solutions to dredging in an essential region for New England's water-based commerce, transportation, and security. However, meeting the goals of the project was initially hindered due to the diverging interests amongst the various stakeholders involved. In 2010, to support the DMMP, USACE requested neutral, expert support from the US Army Engineer Research Development Center (ERDC), a technical lab within USACE, to assist in identifying stakeholder priorities. ERDC is tackling this issue by using two analysis methods to innovate dredging decisions: multi-criteria decision analysis (MCDA) and Life Cycle Assessment (LCA). MCDA is a tool of management science that seeks to decompose complex problems into tractable components and synthesize information in a way that is useful for decision making. LCA is a form of environmental accounting used to compare the extended environmental impacts associated with the material extraction, manufacture, use, and end of life associated with a product or process. The combined use of these analyses has reframed how stakeholders view dredged material management, and is helping establish a DMMP that simultaneously meets social, economic, and environmental goals.

To date, the DMMP Working Group has developed a decision framework to incorporate stakeholder input in sediment-placement site evaluations, and interviews have been conducted in which stakeholder values were elicited. Through this formal decision-analytic process, decision makers will be able to make more nuanced, robust, and defensible decisions that transparently reflect stakeholder values, as opposed to the ad hoc decision processes that have often been used in the past. By the end of the process, all participants will be well informed about potential alternative management actions and their relative advantages and disadvantages along with included criterion. The involvement of a neutral expert on decision analysis and a moderated working group has helped establish a better understanding of others' priorities and concerns. Ultimately, this gives decision makers an opportunity to understand how the community and stakeholders are impacted by potential decisions and to explicitly incorporate their voice.

The Long Island Sound DMMP is unique in its ability to improve stakeholder knowledge and cooperation. The DMMP Working Group has created a balanced and voluntary representation from the community and stakeholder organizations that did not exist before ERDC's involvement. In particular, MCDA and LCA have supported stakeholder engagement in a transparent process, where many representatives have already commented on how much they learned by working with ERDC and the MCDA process. The relationship among stakeholders and other parties involved has also improved through the open expression of individual and shared ideas and concerns. The Long Island Sound DMMP project contributes to the goals of WEDA by promoting communication and understanding of environmental issues through the use

of stakeholder engagement, decision analysis and Life Cycle Assessment. For more details on the DMMP visit <http://www.lisdmmmp.org/>.

## **2. Project Team Members**

1. Tom Fredette –USACE-ERDC, WEDA member, Decision Analysis
2. Igor Linkov- USACE-ERDC, Decision Analysis
3. Matthew Bates-USACE-ERDC, Decision Analysis
4. Zachary Collier-USACE-ERDC, Decision Analysis
5. Mike Keegan- USACE New England District, Project Manager
6. Mark Habel- USACE New England District, Technical Analysis
7. Steve Wolf- USACE New England District, Technical Analysis

## **3. Environmental Benefits**

Managing dredged sediments in a way that properly balances environmental risks and benefits is often a point of controversy between and among federal agencies and stakeholders. Current decision making includes environmental criteria, but is often limited to local or immediate risks. The variety of distributed and long-term impacts resulting from transportation by truck or barge, use of loading equipment, and long-term site management have implications for carbon emissions, environmental and occupational health, and social welfare that are not normally accounted for in the dredged material management. Life cycle assessment (LCA) provides a solution to account for these extended impacts and present them in a format that supports stakeholder decisions for dredged material management.

As described above, LCA is an internationally recognized method to measure the extended environmental and human health impacts associated with a product or process. Traditional LCA has been indoctrinated into the International Organization for Standardization (ISO) 14000 standards for environmental management and sustainability. By applying LCA in Long Island Sound context, we are able to develop more holistic sediment-management decisions that cause less global warming, cancer, ecotoxicity, and land use impacts. In addition, LCA classification and characterization of impacts into weighted and normalized categories makes it possible to communicate to stakeholders which dredging management options are better from an environmental perspective. By utilizing both MCDA and LCA, the resulting decisions from the DMMP are likely to not only be cost effective but also environmentally beneficial.

ERDC has been working on two LCA projects to improve environmental decisions. The first, completed project is to model the extended environmental impact of placement alternatives for sediments dredged from Long Island Sound. The alternative scenarios include open water disposal, upland disposal and island habitat creation. The information gained from this assessment influences the views of stakeholders who favor transport or handling intensive solutions, as results demonstrate a larger environmental impact associated with upland sediment disposal than open water or island creation alternatives. Current efforts include the analysis of different dredging scenarios to measure the extended impacts associated with sediment removal. Future work will combine these separate assessments together to create a holistic and first-of-its-

kind LCA that considers environmental impacts for the entire process of dredged sediment management.

#### **4. Innovation**

Ad-hoc and qualitative decision making does not have the rigor or transparency necessary to address the stated needs of the LIS DMMP. Decision-analytical methods including portfolio decision analysis, risk management and other tools from risk analysis, utility theory, and modern economic theory can help to address complexities of the project challenges. MCDA is a reasonable compromise tool that allows integration of technical and historical data with stakeholder value judgments. MCDA allows us to understand overall stakeholder view points and identify areas of potential compromise.

There are several important benefits that the MCDA process brings to dredging prioritization that may not be readily available through traditional approaches. An MCDA approach is transparent – interested parties can access and understand all assumptions leading to the final prioritization. This is especially important for continued understanding of the DMMP over the coming decades. Also, the MCDA process is flexible, and can be easily extended to prioritize specific dredging and placement sites or to update future results with new locations and technologies not currently available. Because organizational values are relatively stable, the weightings can continue to be applied as the data in the region develops over time. Lastly, the MCDA approach is fair to all involved. Each organization is allowed to influence the site prioritization through individual interviews; this can be achieved without intervention from other participants. Overall, these benefits are anticipated to improve the utility of the DMMP and its public and political acceptance in the Long Island Sound region.

This project “broke new ground” with the application of LCA, which had never been previously utilized in a Corps dredging management project. By providing the life cycle of dredging actions, we can better understand the effects of dredging not only on aquatic life, but other areas such as eutrophication and even global warming. The results from this management plan could potentially have a effect on the way dredging projects are assessed in the future.

#### **5. Economic Benefits**

The contribution of navigation-dependent activity to economic output in the LIS region is approximately \$9.4 billion per year. Navigation-dependent activity is estimated to contribute \$5.5 billion per year to the region’s gross state product (GSP), providing 55,720 jobs. In addition, navigation-dependent activity accounts for an estimated \$1.6 billion per year in federal and state tax revenues. This structured public input, along with the other analyses and studies, will be incorporated by the Corps of Engineers’ Project Delivery Team (the responsible party for the DMMP) as an important component of its planning recommendations. In total, these analyses and recommendations will provide a framework for dredging proponents to analyze dredged-material processing, use and placement-site alternatives in the LIS region for years to come. By incorporating stakeholder values, the planning recommendation can more accurately reflect the needs of the region which in turn will benefit the economy.

## **6. Transferability**

Earlier attempts at generating criteria focused on site specific screening constraints and these approaches did not comprehensively address stakeholder values. Using this DMMP methodology, project managers can apply the lessons learned to other sediment management and dredging projects that involve a diverse group of stakeholders. Collaboration involves time and resources, but it is important for large and complex projects to have stakeholders engaged on a regular basis and to clearly outline decision processes and goals. While it is sometimes difficult to get stakeholders to take the time to respond to questions, contentious issues were best illuminated for inclusion in the decision model through moderated group dialog and non-confrontational brainstorming sessions. It can sometimes be difficult to convince technical staff of the benefit of this type of process before roadblocks have been encountered, but early adoption of a fair and transparent decision framework can prevent later conflict and lead to better informed and well reasoned conclusions. These “lessons learned” can be applied to any dredging project involving stakeholder engagement.

## **7. Outreach and Education**

To work through the MCDA process, the New England District convened the Long Island Sound DMMP Working Group, creating a forum for representatives from Federal, state, regional, and local agencies, NGOs, and other stakeholder organizations to discuss their interests concerning dredged-material management in the region. Stakeholders were recruited for the Working Group from interested governmental and non-governmental organizations working in or having an interest in the Long Island Sound region. USACE funds a moderator for this group, Coastal Vision, which, with ERDC, guides the iterative and deliberative group process of identifying criteria, sub-criteria, and metrics to evaluate alternative plans.

Through almost 30 interviews conducted in 2012, ERDC captured the tradeoffs and preferences of individual stakeholder organizations and explored areas of consensus and divergence as well as differences in individual opinions from the combined view of all organizations together. In the final phase, in 2013, ERDC and the New England District will integrate the stakeholder values with technical evaluations of each management alternative to prioritize sediment management strategies around the Sound.

Through interviews and surveys, each representative of a stakeholder organization is able to contribute his or her view of the relative value/utility of different environmental impacts, species habitats, health risks, social benefits, economic costs, and other high-level criteria in the context of dredged materials placement. Collectively, average decision weights are derived for a Multi-Criteria Decision Analysis (MCDA) of sediment placement sites according to the type of dredged material (e.g., unsuitable, coarse, fine). Separately, District and local experts will provide numerical data for the performance of each placement site on each weighted criterion to prioritize locations. Sensitivity analysis will be performed on all results.

Stakeholders were recruited from interested governmental and non-governmental organizations from around the Long Island Sound Area. Concerns from each interested stakeholder group was collated and condensed into lists of related topics. Multi Criteria Decision Analysis was

performed based on stakeholder responses to ERDC's solicitation of environmental values. There was a balanced and voluntary representation from the community and other stakeholders involved in the project and by using transparent multi-criteria decision analysis, the engagement was a fully informed process.

## **8. Other**

### **What about this project makes it deserving of the WEDA Environmental Excellence award?**

This project was unique in that it fully integrated stakeholder opinions in a quantitative and robust manner. It was also unique for its use of Life Cycle Assessment, which the Corps has not applied to dredging management projects prior to the DMMP. WEDA goals include enhancing communication and knowledge as well as emphasizing the importance and development of solutions related to the protection and enhancement of the marine environment; this project exemplifies these goals.