A PIANC ENVICOM REPORT ON THE BENEFICIAL USE OF DREDGED MATERIAL

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Guidance Report Goals

- Increase industry-wide Beneficial Use (BU) practices globally
- Develop strategies to overcome barriers to BU
- Advance circularity and sustainability goals by managing sediment as a resource

Overall Approach

Create a framework for users to promote sediment as a beneficial resource

- Build on existing documents
  - CEDA, USACE, PIANC
  - More focus on governance than technologies
- Identify key barriers / catalysts
- Understand regional differences
  - Country / continent / region
  - Learn from different regions and case studies
- Collaborate: PIANC, WEDA, CEDA, SedNet

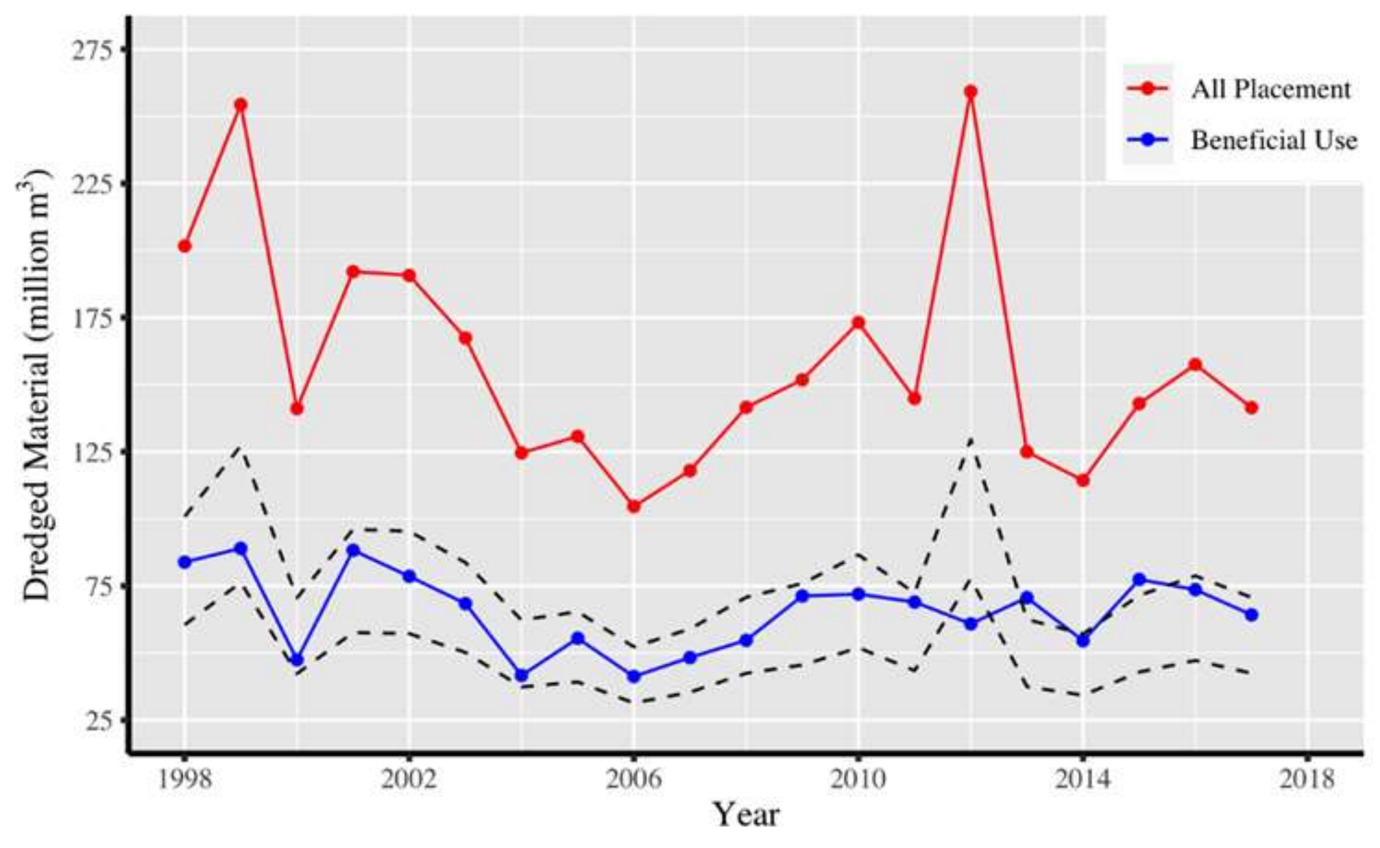
Seven Mile Island Innovation Laboratory (SMIIL), New Jersey Coast, US: Transforming Practice from Dredged Material as Waste to Dredged Material as a Resource

What Has Changed?

Key events and publications

- UN SDGs/COP21/EU Green Deal towards developing business models that leverage sustainability and circularity
- PIANC Guide on WwN (2018)
- Building with Nature (BwN) and Engineering with With Nature (EWN®) established implementing WwN in practice
- IADC and CEDA guide on delivering dredging projects that enhance economic, social, and environmental values in a sustainable manner
- Collectively advancing BU through nature-based solutions (NBS) for achieving multiple benefits and resilient natural systems
- Beneficial use web resources
  - USACE (https://budm.el.erdc.dren.mil/)
  - CEDA (https://www.dredging.org/ceda-working-group-on-beneficial-use-of-sediment-wgbu/203)
  - USACE thin layer placement (https://tlp.el.erdc.dren.mil/)

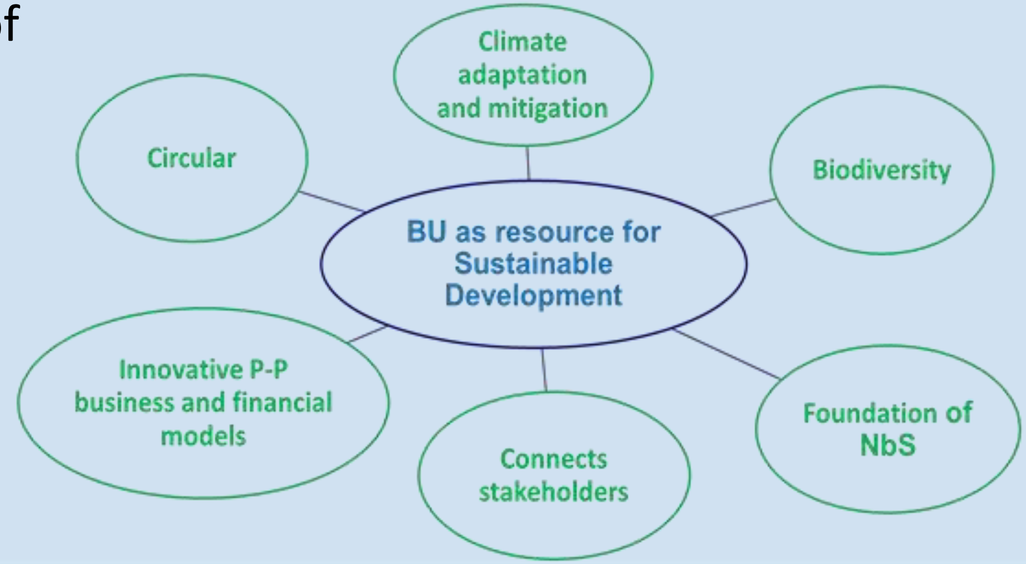
Beneficial Use Percentages (US)



Dredging placement for USACE navigation dredging from 1998–2017. Dashed lines represent 50% and 30% thresholds of all dredged material placed and are shown to demonstrate what percentage beneficial use is of all placement (Adapted from Searcy Bell et al. 2021).

Beneficial Use and Sustainable Development

- Sustainability often is described through three pillars:
  - Environmental
  - Social
  - Economic
- BU linked to recognized features of sustainability, achievable through the three pillars, especially those related to natural resources



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UN Sustainability Goals

BU can contribute directly to as many as seven of the UN SDGs

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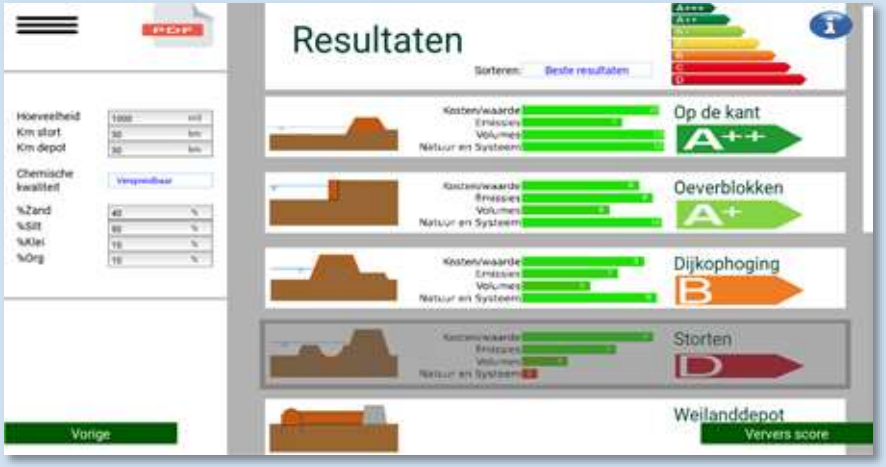
Circularity

- Circularity definition developed for dredged sediment projects based on three principles:
  - Maximizing the value of the resource
  - Minimizing waste (e.g., reusing most, ideally 100% of the dry mass)
  - Maximizing closure or extension of dredging chains
- Supported by two key enablers:
  - Working with Nature
  - Favoring partnerships that can connect supply and demand



Deltares and NETICS worked with STOWA and Dutch Water Regional Authorities to develop a circularity tool to identify how to manage dredged sediments. The circularity tool for dredged sediments (CircSed) can assess the level of circularity of dredge alternatives and processes.

Climate Change Adaptation & Mitigation

- Sediment BU >> SDG #13 Climate Action
- Modify dredging equipment with high-efficiency engines or dual fuel engines
- Reduce offshore disposal transport distances
- Create or restore carbon sinks such as salt marshes and mangrove forests
- Climate adaptation BU projects include:
  - Restore ecosystems
  - Maintain and restore barrier islands to improve community resiliency (e.g., Cat & Ship Islands on Mississippi coast; EWN Atlas V2*)
  - Use ripened sediments to reinforce dikes (e.g., Kleirijperij EWN Atlas V2*)

Dredged sediment is being used to raise agricultural land in The Netherlands. For example, in the Clay Ripener study, Kleirijperij dredged sediment is being used for this purpose.

***https://ewn.erdc.dren.mil/?page_id=4174**

Biodiversity

- Sediment BU as NBS for addressing biodiversity challenges
- Can enhance synergy between climate change adaptation and disaster risk reduction
  - Retrospective analysis of BU projects >> improves environmental outcomes while maximizing navigation benefits / minimizing costs (Berkowitz et al. 2021)
  - Solent Region in UK restoring coastal wetland ecosystems via strategic placement
  - Marker Wadden project on Lake Marken restored 1,000 ha of coastal habitat and related biodiversity

Horseshoe Bend Island on the lower Atchafalaya River, Louisiana, USA, built using dredged sediment, supports 81 plant species and 23 animal species, including 9 species of wading birds. It supports both a healthy invertebrate community and a microbial community that promotes nutrient sequestration in the soil.

Berkowitz et al. (2021). ERDC/EL TR-21-4. http://el.erdc.usace.army.mil/.

Stakeholders

Ports in Queensland utilize a framework to ensure best practice management of port sediment, recognizing that a "one size fits all" is not appropriate to manage port sediments.

- Involve stakeholders as participating partners as much as feasible
- Involve stakeholders early in decision-making process to increase likelihood of BU success
- Example: North Queensland Bulk Ports
  - Conducted thorough, best practice stakeholder engagement process
  - Outcome: offshore disposal was the most sustainable solution
  - Stakeholder driven development of Queensland Maintenance Dredging Strategy & Guidelines for Long Term Maintenance Dredge Management Plans
  - Resulted in effective tools for managing maintenance dredging at Queensland Ports

Ecosystem Services

- In the context of sediment BU, ES can encourage better decisions by providing insights into the true costs and benefits of sediment BU
- ES can facilitate planning to reveal environmental, social, and economic costs and opportunities of sediment management alternatives
- ES can help quantify:
  - The ecological impacts of dredging (versus not dredging or reduced dredging)
  - The ecological impacts of conventional sediment disposal methods
  - The ecological impacts of sediment BU
  - Cost offsets and ecological impacts of cost avoidance
  - Long-term stability (e.g., reducing erosion)

Ecosystem Services at Prins Hendrik Zanddijk (PHZD) project were compared with a conventional alternative. While PHZD generates both positive and negative effects on ecosystem services, positive effects outweigh the negatives, especially benefits created to enhance fish production, climate and water quality regulation, and erosion prevention.

From Barriers to Catalysts

Sediment BU hindered by economic, social, and environmental barriers that constrain implementation

- Economic barriers involve the cost of BU, if perceived as unacceptable or not fairly distributed
- Social barriers involve public perception, limited stakeholder support and suboptimal governance
- Environmental barriers involve categorizing sediment as ‘waste’ and legislation limitations to BU, often linked to contamination or concerns about negative impacts to ecosystems

At the Brussels workshop, participants were asked to privately provide the first three words that came to mind when hearing the term ‘Beneficial Use’ to construct a Word Cloud for further discussion.

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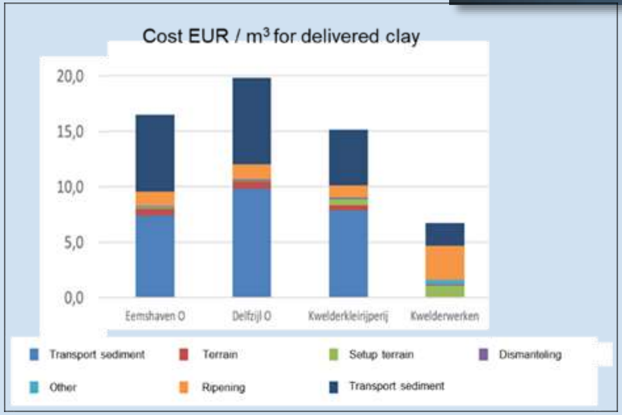
BU Catalysts - Costs

- Two practical means of reducing costs:
  - Redefine cost, focusing on both present and future value creation in cost-benefit analysis
  - Explore strategies to reduce costs
  - Practical examples of both strategies exist, with the focus on both present and future value



Above: Aerial photo of the dewatering basin after deposition of fresh dredge sediments. Left: Results of the cost analysis for producing clay form ripening dredge sediments for sediment from the ports of Eemshaven, Delfzijl and from salt marshes distant from the clay.

Formation of Horseshoe Bend island via 9 BU placements over 12 years in the Atchafalaya River reduced dredging requirements and hence reduced dredging costs. The cost savings translates into $4.3 million USD annually.

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Sediment Beneficial Use: The Way Forward

Prioritize BU

- Focus on value creation, multi-functionality, & ecosystem services
- Connect supply & demand; distribute costs & benefits appropriately
- Improve perception, engagement, and governance
- From waste to resource, adaptive risk management and monitoring
- Create vision toward sustainable BU: triple-win bottom line outcomes: environmental, social, & economic benefits

Pursue Multiple Opportunities

- Sediment as a resource
- Increasingly limited volumes remaining in CDFs
- Cost of dredging and disposal
- Both short- and long-term value
- Sustainability / circular economy / public interest
- Public / stakeholder engagement and education
- Brownfields applications using stabilized sediment
- Sea level rise and coastal resilience
- Biodiversity enhancement

QUESTIONS?

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Dredging in the Port of Oakland, CA