Gjenbruk av masser fra mudringsprosjekter

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Anchor QEA AS

ANCHOR QEA

CEDA Central Dredging Association

Contents

- Introduction to CEDA and the Environment Commission (CEC)
- Overview of the CEC Working Group on Beneficial Use of Sediment activites
- Case studies

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What is CEDA?

World Organisation of Dredging Associations

WEDA CEDA EADA

- an independent, international association of dredging and maritime construction professionals
- an authoritative reference point for objective knowledge expert advice to governments and international conventions
- a vital worldwide network for the exchange of knowledge and information through seminars, conferences, publications and training courses
- it promotes dredging as a tool for sustainable development

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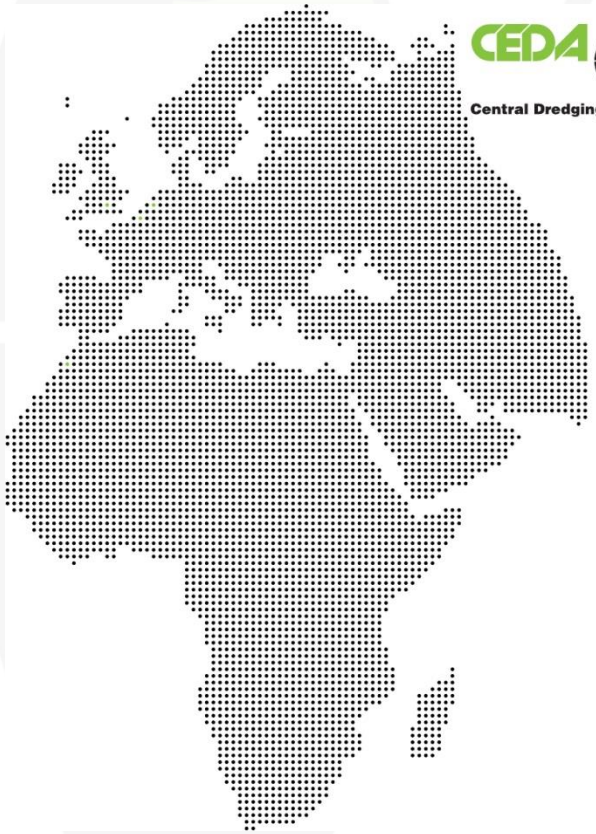
Who are the Members?

- 550 individuals and 130 companies from Europe, the Middle East and Africa representing:
  - Ports, government bodies
  - Owners of large infrastructure
  - Consultancy firms and knowledge institutes
  - Universities, research institutes
  - Contractors
  - Shipyards
  - Suppliers of ancillary equipment
  - Service providers (banks, law firms, insurers, etc.)
- They all share a passion for dredging



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CEDA Environment Commission

- Environmental policy work
- Workshops/seminars conferences
- Publications

Current Working Groups

- WG on Beneficial Use of Sediment (WGBU)
- WG on Seafloor Integrity

Forming Working Groups

- WG on Guidelines for assessing and evaluating environmental turbidity limits for dredging operations
- WG on energy efficiency

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WGBU Members

Name	Organization	Country
Eldert Besseling	Netics	Netherlands
Todd Bridges	U.S. Army Corps of Engineers	USA
Nick Buhbe	Mission Environmental LLC	USA
William Coulet	Exzo Environmental	UK
Heinz-Dieter Detzner	Hamburg Port Authority	Germany
Rebecca Gardner	Anchor QEA	USA/Norway
Dafydd Lloyd Jones	Marine Space	UK
Joost Koevoets	Royal IHC	Netherlands
Helmut Meyer	Federal Waterways and Shipping Agency	Germany
Cristian Mugnai	ISPRA-Rome	Italy
Ivo Pallemans	Jan De Nul / Envisan	Belgium
Davide Sartori	ISPRA-Livorno	Italy
Colin Scott	ABPMer	UK
Peter Seymour	IOL	Ireland
Luca Sittoni	EcoShape	Netherlands
Eric Stern	Tipping Point Resources Group, LLC	USA
David Tenwolde	Dredging Marine Offshore Services	Netherlands
Chris van Schalm	Rijkswaterstaat	Netherlands
George Yesu Vedha	Independent Consultant	India
Thomas Vijverberg	Boskalis	Netherlands
Marco Wensveen	Port of Rotterdam	Netherlands
Arjan Wijdeveld	Deltares / TU Delft	Netherlands

AMORAS (Antwerp)

Slufter (Rotterdam)

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Scope of WGBU

- Prepare two publications on the beneficial use of sediment in the context of sustainability and working with nature practices
  - Information Paper focused on recent advances and best practices in the beneficial use of sediment
  - Position Paper supporting a risk management approach to promote the beneficial use of sediments not suitable for open-water disposal

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Why do we dredge?

- Navigation infrastructure
  - Commercial ports and waterways critical to keep commerce and trade functioning
  - Recreational uses
- Environmental remediation
- Restoration of coastal areas and wetlands
- Flood control
- Mining

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Dredged material management considerations

- Most economical solution is for offshore placement beyond coastal zone
  - Evolving policy is limiting approvals
  - Sediment is permanently removed from the system, working *against* nature
- Sediment dredged in urban areas is likely to have some level of contaminants
- Geotechnical properties
- Landfills fees are increasing, synergistic projects make beneficial use options more cost effective

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Sediment is a resource

- Use of sediment as an alternative to virgin materials supports a range of projects
  - Redevelopment: Brownfield development, manufactured building materials
  - Remediation: closure of landfills and mines
  - Restoration: creation of habitat to support aquatic organisms and wetlands to improve water quality
  - Resiliency: shoreline nourishment and reinforcement for climate change
  - Reclamation: increasing or raising lands

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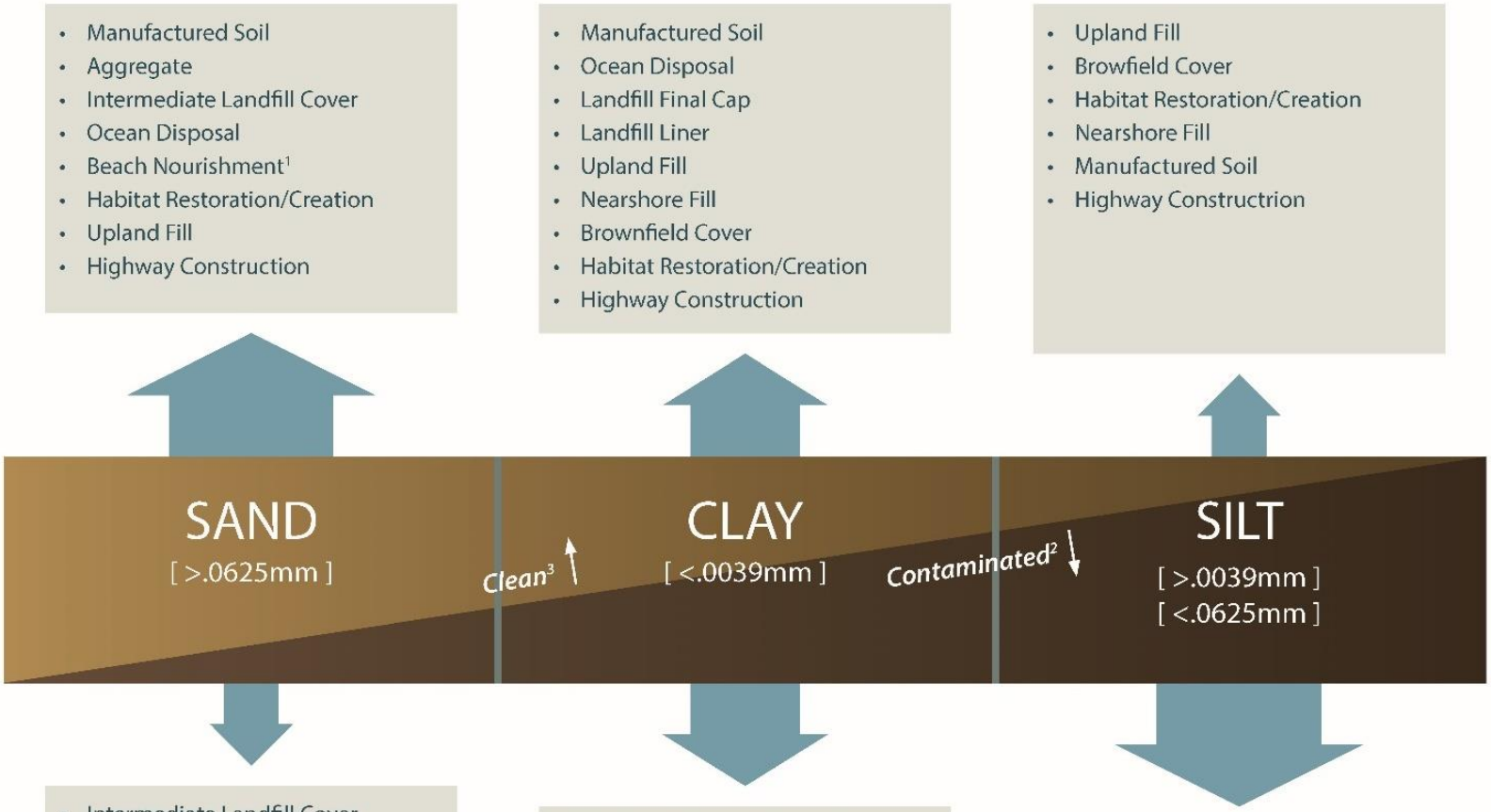

1. 75% Sand; grainsize distribution must be equivalent to existing conditions
2. Uses assume no decontamination
3. Uses assume clean or decontaminated

Adapted from New Jersey Transportation Department BU Guidance, 2015

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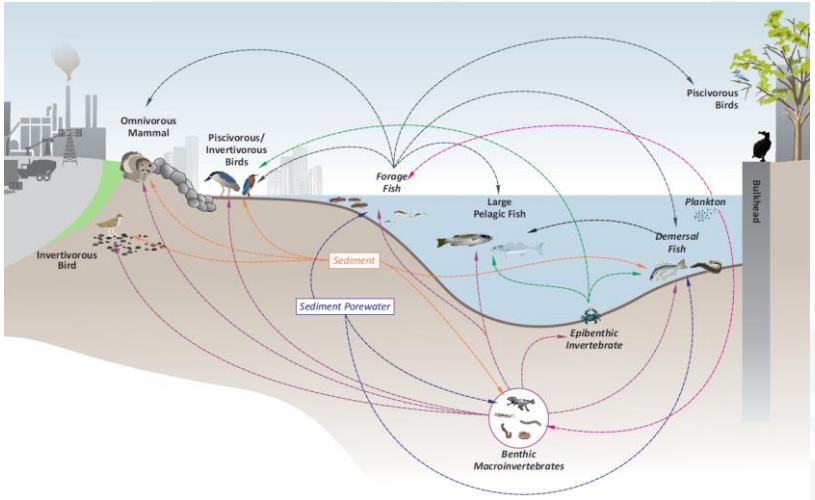
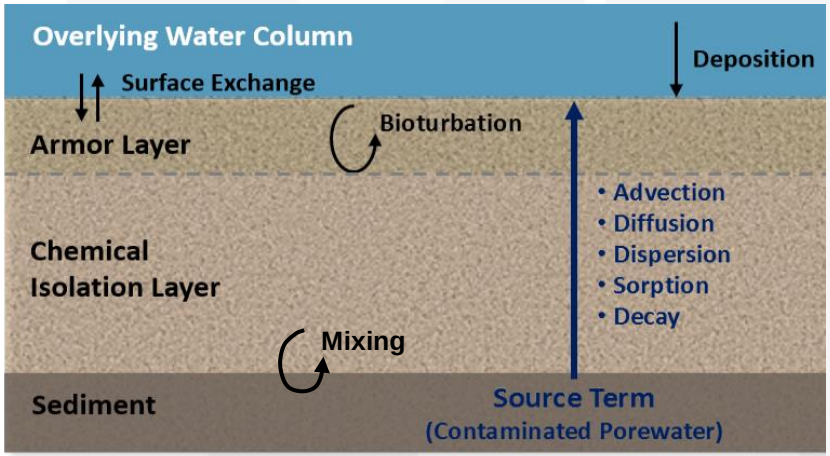
Considering contaminants

- Important to understand current and future site conditions
- Technical tools
  - Risk assessment
  - Contaminant migration and coastal/hydrodynamic modeling
  - Contaminant treatment and stabilization studies
- Focus on managing risk and address uncertainty with adaptive management
- Engage stakeholders and policy makers
- Evaluate all benefits





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Case Studies

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Case Study: Poplar Island, USA

- Restore eroded island in Chesapeake Bay back to 1800s footprint using about 52 million m^3 over 3 decades
- Varied habitat
  - tidal flats
  - bird islands
  - low/high marsh
- Designed capacity
  - 12.200 m of earthen dikes
  - 297 ha of wetlands
  - 340 ha of uplands
  - 57 ha of open water embayment

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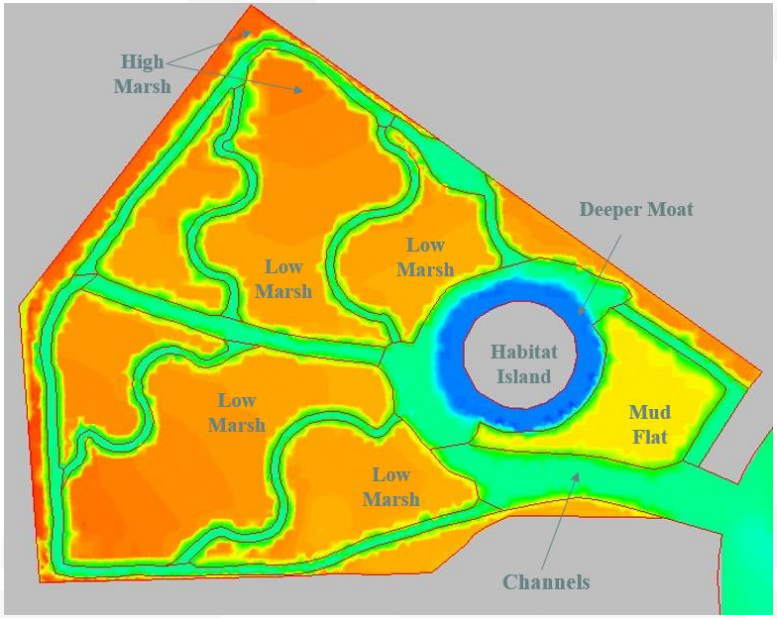
Testing the concept

- Pre-design sampling, testing and modeling
- Bulking and shrinkage evaluation
- Bathymetric surveys and fill placement monitoring – test thin layer approach
- Adaptive management
- Vegetation surveys
- Verification of PSDDF settlement estimates and hydrodynamic modeling



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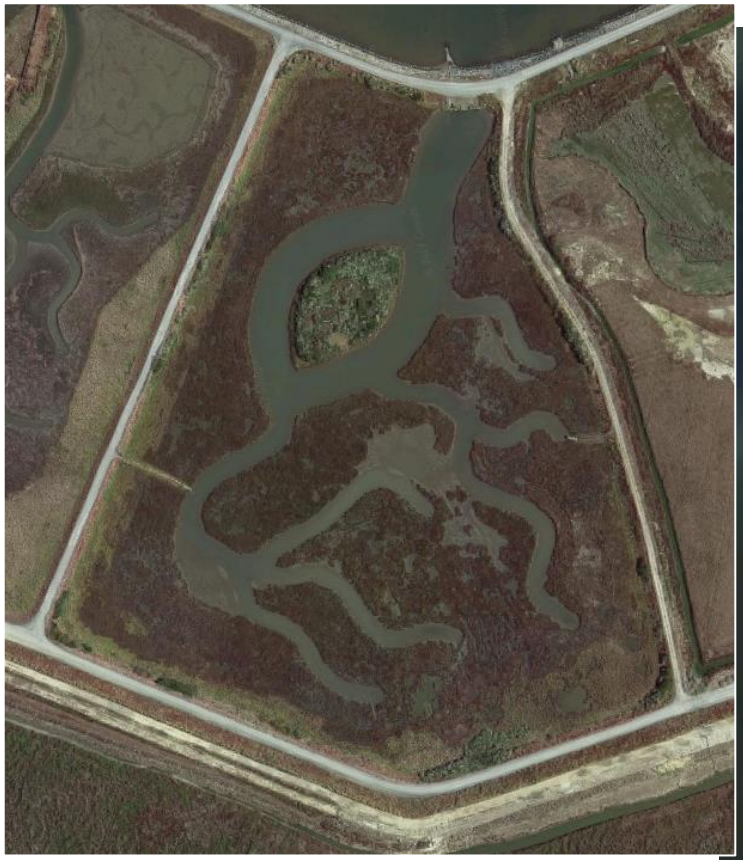
Poplar Island – recent progress



Google maps image – November 2017

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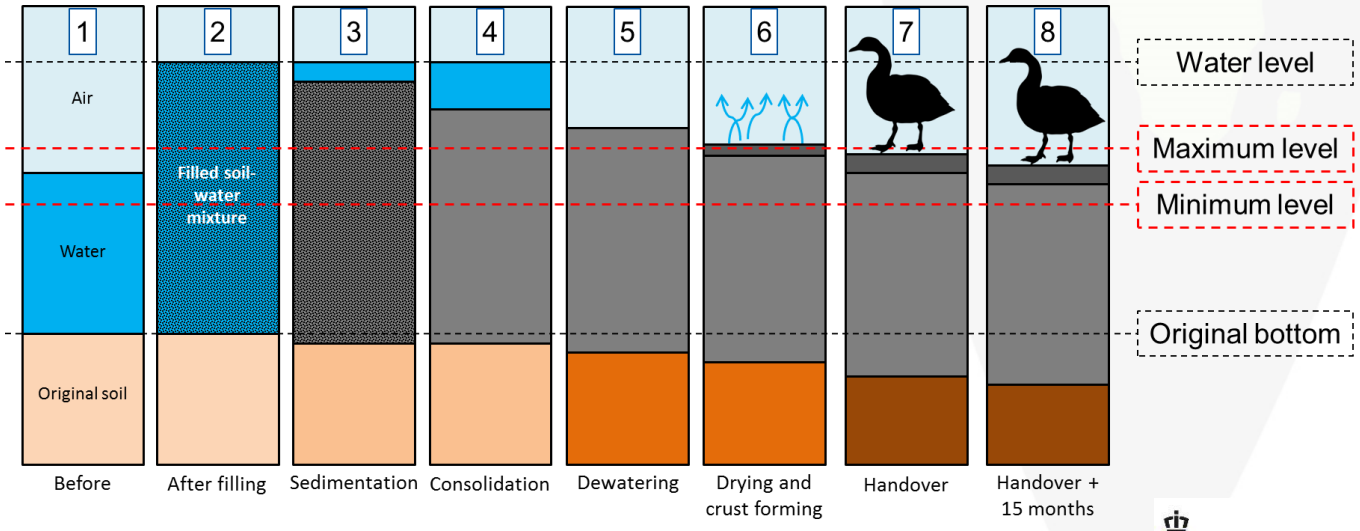
Case Study: Marker Wadden, NL

- Lake Markermeer – former tidal area, damed to create shallow lake now protected under Natura2000
- Nature reserve island built to improve water quality and increase habitat diversity using soft clay causing high turbidity
- Geotechnical issues resolved through lab testing, large scale pilots and numerical modeling



Boskalis
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Marker Wadden recent progress

Boskalis
Dredging & Marine Experts

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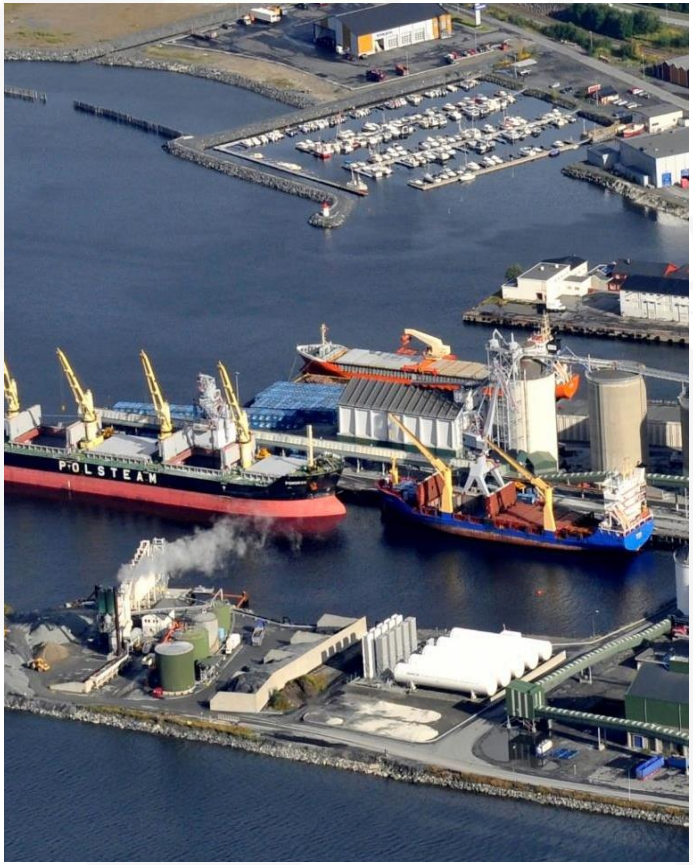
Case Study: Mosjøen, Norway

- Facility constructed in 1958
- Property is adjacent to town and municipal port
- Two operating harbors – both crucial to plant operations and local economy
- Harbor area is extremely restricted
- Evaluated synergistic alternatives to expand port and dispose of sediment



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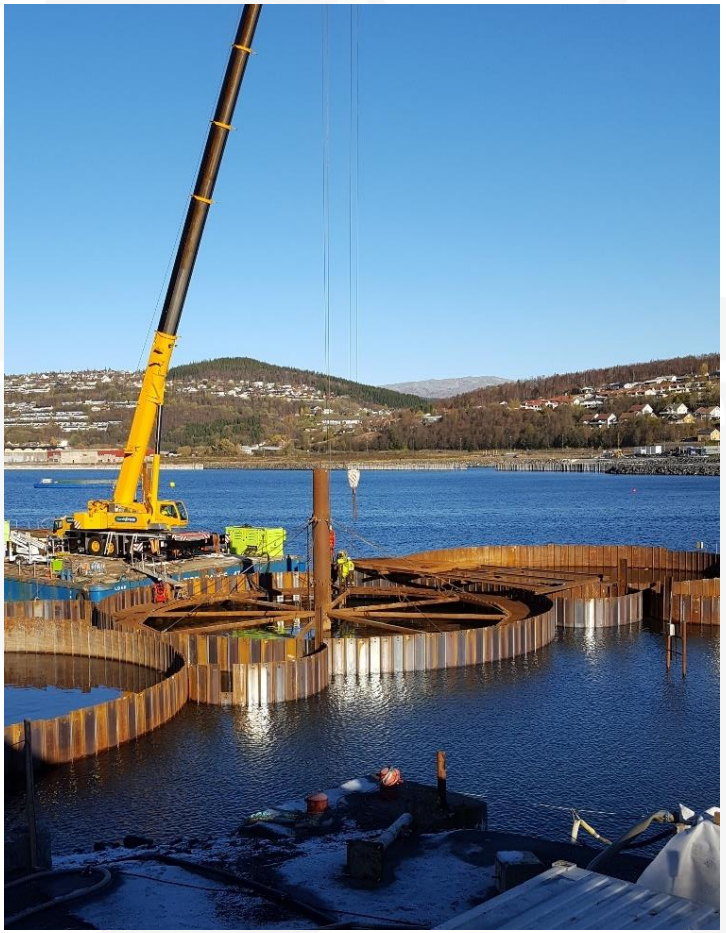
Project Feasibility Considerations

- Future use of harbors
- Cleanup is required to address historical discharges
  - 30,000 m^3 of PAH-impacted sediment dredged
- Disposal options considered
  - Non-adjacent confined disposal facilities (CDF)
  - CDFs adjacent to private and municipal harbors
  - Existing inland landfill
- New cofferdam structure and sediment stabilization



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Stabilization Approach

- Stabilization by traditional *in situ* soil mixing with cement
- Improved geotechnical properties
  - Increased density and strength
  - Reduce settlement potential
- Improved environmental properties
  - Limits PAH migration

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Closing thoughts

- Sediment is a valuable resource for sustainable development, including climate adaptation
- Beneficial use of sediments should be based on the ability to create socioeconomic values, manage risk, and encourage natural functions
- Regulations that govern sediment management have not evolved at the same rate as sustainability policies
- Stakeholder engagement is key to gaining project acceptance and identifying cost-effective opportunities

We invite the community to reach out and contribute with additional case studies.

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Thank you.

Questions?

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Send us your case study

Case Study Beneficial Use of Dredged Sediments

Project	*Marker Wadden*
Location	*Markermeer (Lelystad), The Netherlands*
Volume	*Area: 800 ha*
Technique	*Land reclamation: sediment from Lake bottom dredged with Cutter dredger, hydraulically pumped to fill area*
Geology	*N/A*
Granulometry	*Clay and sand*
Scale	*Real project scale*
Client	*Rijkswaterstaat and Staatsbosbeheer*
Consultant	*Arcadis, Royal Haskoning DHV, Witteveen + Bos*
Contractor	*Boskalis*
Research institute	*TU Delft, University of Utrecht, Wageningen University, Nijmegen University, Deltares*
Research program	*Smart Sanding* *Natuur in productie* *NKWK / KIMA*
Contact	*Thomas Vijverberg (Boskalis)*

Description of the project

Lake Markermeer, is an artificial shallow fresh water lake in the Netherlands, which was formerly part of the Zuiderzee (tidal bay). After the area was closed off with dams it became a fresh water lake with unique ecological values (Natura2000 area). Over the past decades, several ecological problems have arisen related to, amongst others, high turbid water, decrease in biodiversity and change in nutrients. One of the solutions is to increase the habitat diversity, which is rather limited now, due to the size and shallow character of the lake, and also the hard infrastructural elements at the borders (dikes). Nature reserve areas at the east side will enhance the diversity.

The Marker Wadden project was set up to develop such areas. The basic idea is to build islands with Holocene and soft fine clay material from the lake. By using this material, the total amount of fine sediments available in the lake for resuspension will reduce, improving the light climate. The islands are designed to be an ideal habitat for birds, due to the shelter and the typical vegetation (reed).

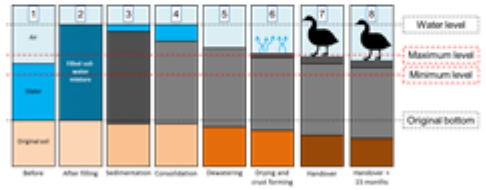
The client defined stringent project requirements with respect to final elevations of the marsh area and strength. These requirements are challenging due to the difficulty to predict self-weight consolidation of the soft material, characterised by large volume variations which are rather sensitive to the varying local sediment characteristics.

The landscape design of the Marker Wadden was made by Vista Landscape Architects, as part of the Boskalis project consortium. This design was integrated during a iterative design process allowing for a high-quality, economical design and operational work method. One of the important design items was the consolidation and crust formation behavior of the soft material. At a final stage, vegetation (reed) will grow on top of the crust. During the design phase of the project, lab testing, large scale pilots and numerical modelling has been carried out to understand the consolidation behavior.

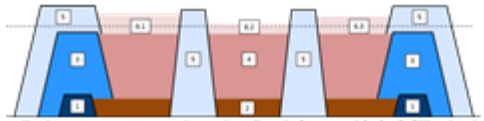
In April 2016, Boskalis started the construction of the Marker Wadden. The area is constructed in a number of steps and layers, as indicated in figure below. Field monitoring is carried out frequently, to monitor, amongst others, the consolidation behavior of the material in the compartments during and after construction. Because of the knowledge gained during preparation and execution, combined with the integrated adaptive management process, the work method was continuously optimised due to reduce the risk of not fulfilling the project requirements.

Graphical information

Location of project in Lake Markermeer (left) and artist impression of the design (right)



Process from reclamation to final strength



Indicative steps to construct the project (bunds from sand [1,3,5], filling by clay [2,4,6]).

Situation of Marker Wadden during a public event in September 2016 (left) and June 2017 (right)

References/web links

1. https://www.natuurmonumenten.nl/marker-wadden
2. http://magazine.boskalis.com/issue04/marvelous-marker-wadden
3. http://www.markerscience.com/
4.

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Publication timeline

- January 2017 – first WG meeting in Delft
- In-person meetings:
  - June 2017 – meeting at Antwerp (AMORAS)
  - September 2017 – meeting in Rotterdam (Slufter)
  - January 2018 – meeting in Hamburg
- November 2017 – CEDA Dredging Days
- February 2018 – Draft papers
- April 2018 – Final Paper

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