TIDE
Tidal River Development

Project part-financed by the European Union (European Regional Development Fund)

The Interreg IVB North Sea Region Programme

# ‘Land treatment of dredged material including MEchanical Treatment and Dewatering of HArbor sediments (METHA)’

Measure analysis 11
in the framework of the Interreg IVB project TIDE

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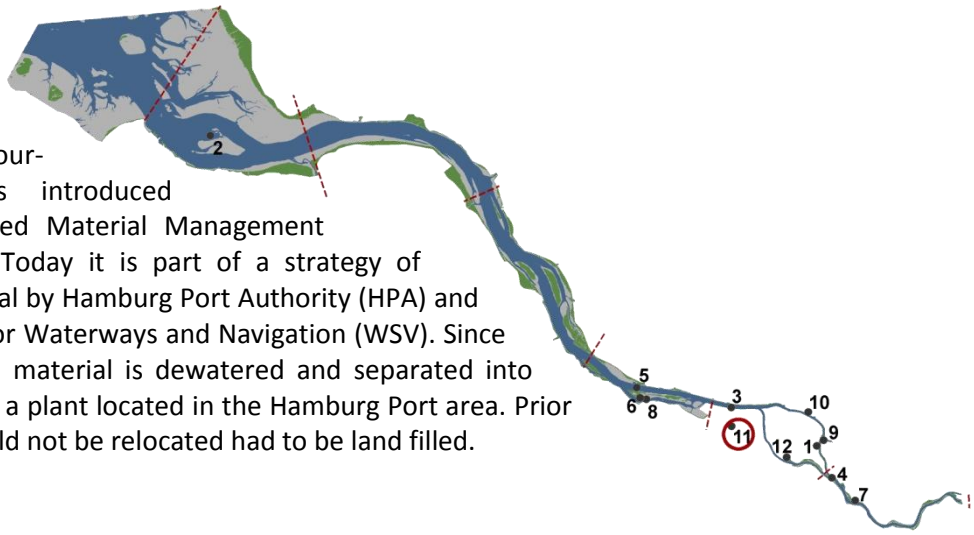
# Part 1: Measure description

| | |
|---|---|
| measure category | physical, chemical quality parameters |
| estuary | Elbe |
| salinity zone | freshwater |
| pressure | decrease of water and sediment chemical quality |
| | |
| status | running since 1993 |
| river km | - |
| country/location | Germany, Hamburg METHA plant close to Finkenwerder |
| responsible authority | Hamburg Port Authority |

## 1.1 Introduction




The measure "Land treatment of dredged material including Mechanical Treatment and Dewatering of HArbour-sediments (METHA)" was introduced within the Hamburg Dredged Material Management Concept in the late 80ies. Today it is part of a strategy of treatment of dredged material by Hamburg Port Authority (HPA) and the Federal Administration for Waterways and Navigation (WSV). Since 1993 contaminated dredged material is dewatered and separated into several grain size fractions in a plant located in the Hamburg Port area. Prior to that, the material that could not be relocated had to be land filled.

## 1.2 Objectives

The content of heavy metals and organic contaminants is primarily governed by the grain size. The finer the particles and the higher the content of organic matter in the sediment, the higher will be the content of contamination. Thus, the separation of the Elbe sediments into several fractions is required for reliable processing of dredged material taking into account the sediment particle size and the contaminant distribution. Hence the primary target is to dewater and separate Elbe sediments in order to reduce the total volume by separating the contaminated fraction. At the same time the fraction to be land filled is reduced in volume and weight. A secondary target is the improvement of the water and sediment quality of the Elbe estuary. Furthermore the material could possibly be used for other purposes e.g. as construction material. In this way the necessary area for a disposal site for dredged materials, could be minimized.

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*Figure 1 : METHA plant close to Finkenwerder*

## 1.3 Background and side conditions

Environmental problems have influenced dredging methods in recent decades. Therefore, in 1980 Hamburg introduced a Dredged Material Research Program in order to investigate the contamination problems of the Elbe sediment and to develop technologies for treatment, beneficial use, and disposal of dredged material while, at the same time, taking care of the environment.
Relocation of sediments is restricted to material fulfilling the criteria according to the ARGE Elbe assessment scheme of 1996. Sediments with contamination level acceding these threshold levels are treated on land.
The measure indirectly contributes to the requirements of the WFD, because the contaminated sediments are removed from the river. Therefore it contributes to the improvement of the water quality of the Elbe estuary, as requested by the WFD. The removal of contaminated sediments is part of the 'River engineering and sediment management concept' which was developed in 2008 by Hamburg Port Authority and the Federal Administration for Waterways and Navigation (WSV), and approved by the Senate of the City of Hamburg.

## 1.4 Measure

Contaminated sediments of the river and harbor basins are dredged and brought to the METHA plant where they are treated mechanically. The sediments of different origins are separated according to their grain size. The contaminated, mostly fine sediment is deposited on land. The coarse mostly clean fraction is used as construction material. The treatment is carried out since 1993. The total investment was 70 million €, including all mechanical, electro-technical, chemical facilities, costs for civil engineering, etc. annual operational costs are 13 mill. €.

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## 1.5 Expected effect

A monitoring of the effectiveness of the measure is not carried out. The concentration of pollutants in different samples of the final 'products', is measured continuously. In principle a 'kind' of monitoring concerning the suitability of the measure is conduced in every situation when material of the METHA plant is used. For example: In 1995 an international study on the use of contaminated Elbe sediments confirmed the concept of dredged sediment treatment and disposal as the 'right solution'.
Perennial experiments conducted by a commercial company proved the suitability of mud as a substitution of clay in the production process of bricks. Currently a research project investigates the potential use of METHA plant material in dyke construction. Additionally the use of the material from the METHA plant was tested for filling of harbor basins which are not used anymore.

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# Part 2: Execution of the main effectiveness criteria

## 2.1 Effectiveness according to development targets of measure

*Definition of development targets:*

- Improvement of water and sediment quality of the Elbe estuary by taking out contaminated sediments
- Dewatering and mechanical separation of contaminated Elbe sediments in order to reduce the total volume of the material which has to be land filled.

*Achievement of development targets*

- The plant is working since 1993 and it is meeting its targets to full extend.

## 2.2 Impact on ecosystem services

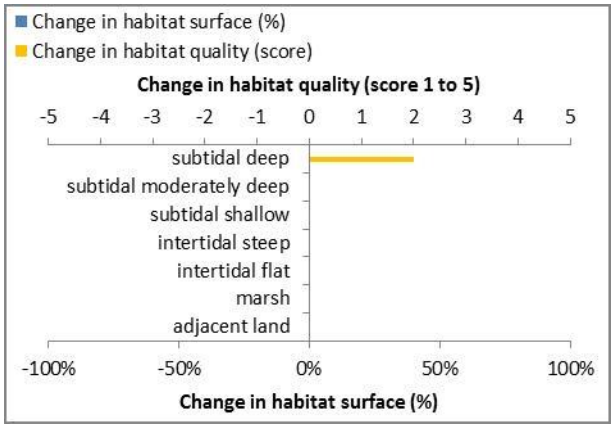


*Figure 2: Ecosystem services analysis for Land treatment of dredged material including MEchanical Treatment and Dewatering of HArbour-sediments (METHA): Indication of habitat surface and quality change, i.e. situation before versus after measure implementation.*

- From the ES assessment it is concluded that this measure generates overall a slightly positive expected impact for several ES.
  - "biodiversity"
  - Cultural services
  - Some regulating services: Erosion and sedimentation regulation (by water bodies); Water quality regulation: transport of pollutants and excess nutrients
  - Some provisioning services: water for industrial use and water for navigation
- The expected impact on the development targets ("Water quality regulation: reduction of excess loads coming from the catchment") is neutral.
- The expected impact for the different beneficiary groups is limited, with a slightly positive expected impact for indirect and future use and for local and region use.

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*Table 1: Ecosystem services analysis for Land treatment of dredged material including MEchanical Treatment and Dewatering of HArbour-sediments (METHA): (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.*

**Land treatment of dredged material including MEchanical Treatment and Dewatering of HArbour-sediments (METHA)**

| Cat. | Ecosystem Service | Score |
|---|---|---|
| S | "Biodiversity" | 1 |
| R1 | Erosion and sedimentation regulation by water bodies | 1 |
| R2 | Water quality regulation: reduction of excess loads coming from the catchment | 0 |
| R3 | Water quality regulation: transport of polutants and excess nutriënts | 1 |
| R4 | Water quantity regulation: drainage of river water | 0 |
| R5 | Erosion and sedimentation regulation by biological mediation | 0 |
| R6 | Water quantity regulation: transportation | 0 |
| R7 | Water quantity regulation: landscape maintenance | 0 |
| R8 | Climate regulation: Carbon sequestration and burial | 0 |
| R9 | Water quantity regulation: dissipation of tidal and river energy | 0 |
| R10 | Regulation extreme events or disturbance: Wave reduction | 0 |
| R11 | Regulation extreme events or disturbance: Water current reduction | 0 |
| R12 | Regulation extreme events or disturbance: Flood water storage | 0 |
| P1 | Water for industrial use | 1 |
| P2 | Water for navigation | 1 |
| P3 | Food: Animals | 0 |
| C1 | Aesthetic information | 1 |
| C2 | Inspiration for culture, art and design | 1 |
| C3 | Information for cognitive development | 1 |
| C4 | Opportunities for recreation & tourism | 1 |

| Beneficiaries: | |
|---|---|
| Direct users | 0 |
| Indirect users | 1 |
| Future users | 1 |
| Local users | 1 |
| Regional users | 1 |
| Global users | 0 |

X Targeted ES

| Legend: expected impact* | |
|---|---|
| 3 | very positive |
| 2 | positive |
| 1 | slightly positive |
| 0 | neutral |
| -1 | slightly negative |
| -2 | negative |
| -3 | very negative |

*: Indicative screening based on ES-supply surveys and estimated impact of measures on habitat quality and quantity. Quantitative socio-economic conclusions require local supply and demand data to complement this assessment.

The screening of the ecosystem services (ESS) that were effected by the measure `METHA` showed no clear results. Some ESS will be influenced positively; the targeted ESS will not be effected. This outcome made clear that the screening of the effects on the ESS is not applicable on every type of measure executed in the TIDE project.

## 2.3 Degree of synergistic effects and conflicts according the uses

Several international studies have been conducted in order to study the options for using the remaining material that has to be land filled. One possibility is to use the material in production processes for bricks or for dyke construction purposes.

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# Part 3: Additional evaluation criteria in view of EU environmental law

## 3.1 Degree of synergistic effects and conflicts according WFD aims

*Table 2: Effect of the measure concerning the main pressures in the freshwater zone of the Elbe estuary*

| Indicator Group | Code | Main pressures freshwater zone Elbe | Effect? | | | | | Description: Aim of the measure 'METHA Plant' |
|---|---|---|---|---|---|---|---|---|
| | | | -- | - | 0 | + | ++ | |
| S.I. | - | Habitat loss and degradation during the last about 100 years: Subtidal | | | 0 | | | |
| S.I. | 1.1 | Habitat loss and degradation during the last about 100 years: Intertidal | | | 0 | | | |
| S.I. | 1.4/ 1.5 | Gross change in morphology/hydrographic regime during the last about 100 years | | | 0 | | | |
| S.I. | 3.1/3.2 | Decrease of water and sediment chemical quality | | | | | ++ | Reduction of heavy metals and other contaminants in the sediments |
| D.I. | 2.3 | Discharge of nutrients or harmful substances | | | 0 | | | |
| D.I. | 1.3 | Land claim during the last about 100 years | | | 0 | | | |
| D.I. | 2.6 | Capital dredging | | | 0 | | | |

S.I. = state indicator; D.I. = driver indicator

The operation of the METHA plant leads to an improvement of sediment quality in the port of Hamburg.

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## 3.2 Degree of synergistic effects and conflicts according NATURA 2000 aims

*Table 3: Effect of the measure concerning the main conservation objectives in the operational area 2.*

| Operational area (zone) | Natura 2000 conservation objectives | Effect of Measure on conservation objectives | | | Description |
|---|---|---|---|---|---|
| 2 | | Positive | No effect | Negative | |
| 2 | Prevention of further increase and/or reduction of tidal range (energy) | | - | | |
| 2 | Conservation and development of primarily floodplain/alluvial forest (*91E0) | | - | | |
| 2 | Conservation and improvement of alluvial meadows of river valleys (6440) and lowland and hay meadows (6510) | | - | | |
| 2 | Conservation of the primarily 'Elbe Water Dropwort' (*Oenanthe conioides*) with species specific dynamic, development of further habitats to improve the habitat network | | - | | |
| 2 | Conservation and development of spawn and growth habitats for asp, ensuring the habitat potential for the twaite shad | | - | | |
| 2 | Conservation and development of the transition functionality between the Middle Elbe and the Estuary downstream for migratory fish species of Annex II BHD | | - | | |

The measure METHA plant has no positive or negative effect on the specific NATURA 2000 development targets for zone 2 where it is located. Nevertheless the measure indirectly contributes to improve the sediment quality, especially in the area of the port of Hamburg (zone 2).

# Part 4: Crux of the matter

The separation and the dewatering of Elbe sediments are considered to be a good tool to reduce the total volume of the material which has to be land-filled. The quality of the clay is good enough for the usage for dyke construction purposes or for the coverage of dumping grounds. Additional alternative uses for the material should be developed.

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