Win-Win-Solutions between Sediment Management and Natural Developments in Tidal River Elbe
Heinz Glindemann, Hamburg Port Authority

Natura 2000 at the Elbe Estuary

1. Shock in 2004: “port a protected area?!”
Dredged Material Hamburg

Development of Dredged Material within the Port and the River Elbe in Hamburg 1996 - 2008

- Sand
- Land Treatment
- Relocation to North Sea
- Relocation in Hamburg
- Dredged Material in Sarn

2. Shock 2004: “Port drowns in sediments!”

Multiple Uses

- Traffic and Economy
- Nature Protection
- Flood Risk Management
- Tourism
- Fishery
The Estuarine System

Competent Authorities
The Port of Hamburg

→ 2nd in Europe (TEU)
→ 250,000 Jobs
→ 9.9 Mio. TEU in 2007
→ Forecast of 18 Mio. TEU in 2015
→ Fairwaydepth 12,50/13,50m
→ Deepening proposed to 14.5m

HPA-Tasks:

• Maintenance of Port Infrastructure and Waterways in Hamburg
• Ensuring competitiveness for the Future

Unfavourable Changes: Sedimentation
Decrease of Shallow Water Areas

Morphological Changes in the Anabranches

- Water Depth
- Areas
- Sum of Volumes

<table>
<thead>
<tr>
<th>Year</th>
<th>Area in Mio m²</th>
<th>Volume in Mio m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td></td>
<td></td>
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<tr>
<td>1992</td>
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<tr>
<td>1975</td>
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<td>1956</td>
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</table>

Changing Landscape

Mouth of Stör
1900

Mouth of Stör
1972

Mouth of Stör
today
Man made Changes

Land Reclamation and Dykes

Principle of Overview of Dykings:
- 1905
- 1925
- 1955
- 1960

Source: Information and Jurisdiction at the Lower and Upper Admiralty and Rendsburger Land.
Loss of Shallow Water Areas

Example: Reclamation of Land for industrial use (Airbus)

Sea Level Rise

- All SRES envelope including landIce uncertainty
- Several models all SRES envelope
- Model average all SRES envelope

Bars show the range in 2100 produced by several models

Scenarios
- A1
- A1T
- A1FI
- A2
- B1
- B2
Sea Level Rise over the last 10,000 Years

Dynamic River Mouth
In this Area 100 Mio m³ of Sediments got lost over the last 100 Years.
About 5 times that much were moved within.
Today mor Tidal Energy enters the Estuary.
Transport of Sediments

### Yearly Sums of Dredged Material in Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Sea</th>
<th>Inland</th>
<th>Sum</th>
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</thead>
<tbody>
<tr>
<td>Belgium / Flanders</td>
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<td>9,2</td>
<td>14</td>
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<tr>
<td>Denmark</td>
<td>4,5</td>
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<td>5</td>
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<tr>
<td>France</td>
<td>50</td>
<td>6</td>
<td>56</td>
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<td>Germany</td>
<td>41</td>
<td>5</td>
<td>46</td>
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<td>Ireland</td>
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<td>Netherlands</td>
<td>19</td>
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<td>28</td>
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<td>Portugal</td>
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<td>8,5</td>
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<td>UK</td>
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<td><strong>Sum</strong></td>
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Kappenberg 2007

Headwater Discharge

Relocation within Hamburg
Baggermengenentwicklung

Development of Dredged Material within the Port and the River Elbe in Hamburg 1996 - 2008

Tidalpumping

Nordsee

EBBE

Ebb Tide

Flood Tide

Nordsee

Flussbett
Moderation of the Tidal Curve

2006: Cornerstones of the Concept for the Tidal River Elbe

1. Attenuation of the Tidal Energy through River Engineering in the Mouth of the Estuary

2. More Room for the River between Glückstadt and Geesthacht

3. Optimisation of the Sediment-management considering the whole System of the Elbe
Elbe Estuary today

Elbe Estuary with Concept implemented

1. Conected Tributaries
2. Cleared and reconected Anabranches
3. Realignment of Dykes
4. New Tidal Capacity
5. Connection of Water Areas to the Tide

Winfried for Tidal River Elbe - Heinz Glindemann - Panama City 02.03.2009 03.02.2009   S. 29
Winfried for Tidal River Elbe - Heinz Glindemann - Panama City 02.03.2009 03.02.2009   S. 30
Geological Model of the Mouth

Moderation of the Tidal Range

- Shallow Water = Tidal Volume = Volume between High Tide and Low Tide
  - Best Effect around Hamburg
  - 1 Mio m³ Tidal Volume = 1cm Raising of Tidal Low Water
  - Delayed Discharge and High FG friction wanted (Spongetheffect)
Sponge Effect

Scenarios for new Tidal Areas in Hamburg
- Mud Removal in Speicherstadt and Oberhafenkanal
- Re-Connection of Alte Süderelbe
- Mud Removal in Spreehafen
- Mud Removal in Billwerder Bucht and Tidekanäle
- Connection of Quarry Pond via Tidekanal
- Conneation of Waterworks
- Billwerder Insel
- Re-Connection of Dovelebe
- Schaffung von Tidopotential Spadenlander Busch
- Realignement Spadenlander Ausschlag
- Connection of Neuländer Quarry Pond
- Re-Connection of Hohendeicher See
- Polder Altes Feld
Example Spadenland

Pilot Project Spadenlander Busch/Kretsand

ca. 47 ha | former Spoil Area | mean surface level +5.50 m NN
Tidal Areas in Coalition Agreement

Hamburg plant riesiges Süßwasserwatt

Climate Change: River Engineering and Flood Risk Management

1. Normal Tide

Current Situation

With additional Tidal Area
And submerged Shutter at normal Tide
2. Storm Surge

Today

Storm Surge Polder:
Shutter is raised until shortly before the Peak of the Surge

In Future?

Storm Surge Polder:
Shutter is lowered shortly before Peak of the Surge

Mud Removal of Harbour Basins

Steinwerder Kanal
Spreehafen
Saalehafen
Müggenburger Zollhafen
Kanäle Peute
Kanäle Billbrook
Fleete Hafen City
Billwerder Bucht
Mud Removal of Harbour Basins

Oberhafenkanal 2007

Spreehafen 2007

Dredging of Canals in Speicherstadt

Hamburg holt den Schlick aus den P�eten
Holistic Sediment Management

Avoidance

Port

Dredging

Relocation

Subaquatic Depot

Treatment

Drying

METHA

Cleaned Water

Disposal Site

Francoop

Feisthofe

Recycling

Sand and sealing material

Pollutants from Upstream → Remediation

Dredging

Avoidance

Recycling

Disposal Site

Port

Dredging
Relocation Strategy

Locations of considered Relocation Sites 1-4 for Dredged Material from Wedel

Relocation to the North Sea

Relocation Site 54° 03’ N, 07° 58’ E
Integrierted Management Plan Elbe Estuary

• 2008 – 2010
• Steering by Natura2000-Stearing Group
• Working Group and Consultants
• Stakeholder in Planing Groups
• Integrating of Sediment Management by WSV und HPA
• www.natura2000-unterelbe.de

Remediation of Sources in Elbe Catchment Area
Thank You for Your Attention!