RESTCOAST Wadden Sea Pilot Workshop, 1 Dec 2023

Introduction: Strategy Development and interlinkage with Ecological sediment management strategy

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Strategy Development
and interlinkage with
Ecological sediment management strategy

Setting the scene…

Problem description, vision and aim for the area

Projects / Pilots

- Aims
- ESS + BDV or other targets (quantitative/qualitative)

Relation to REST-COAST WS-ED case description

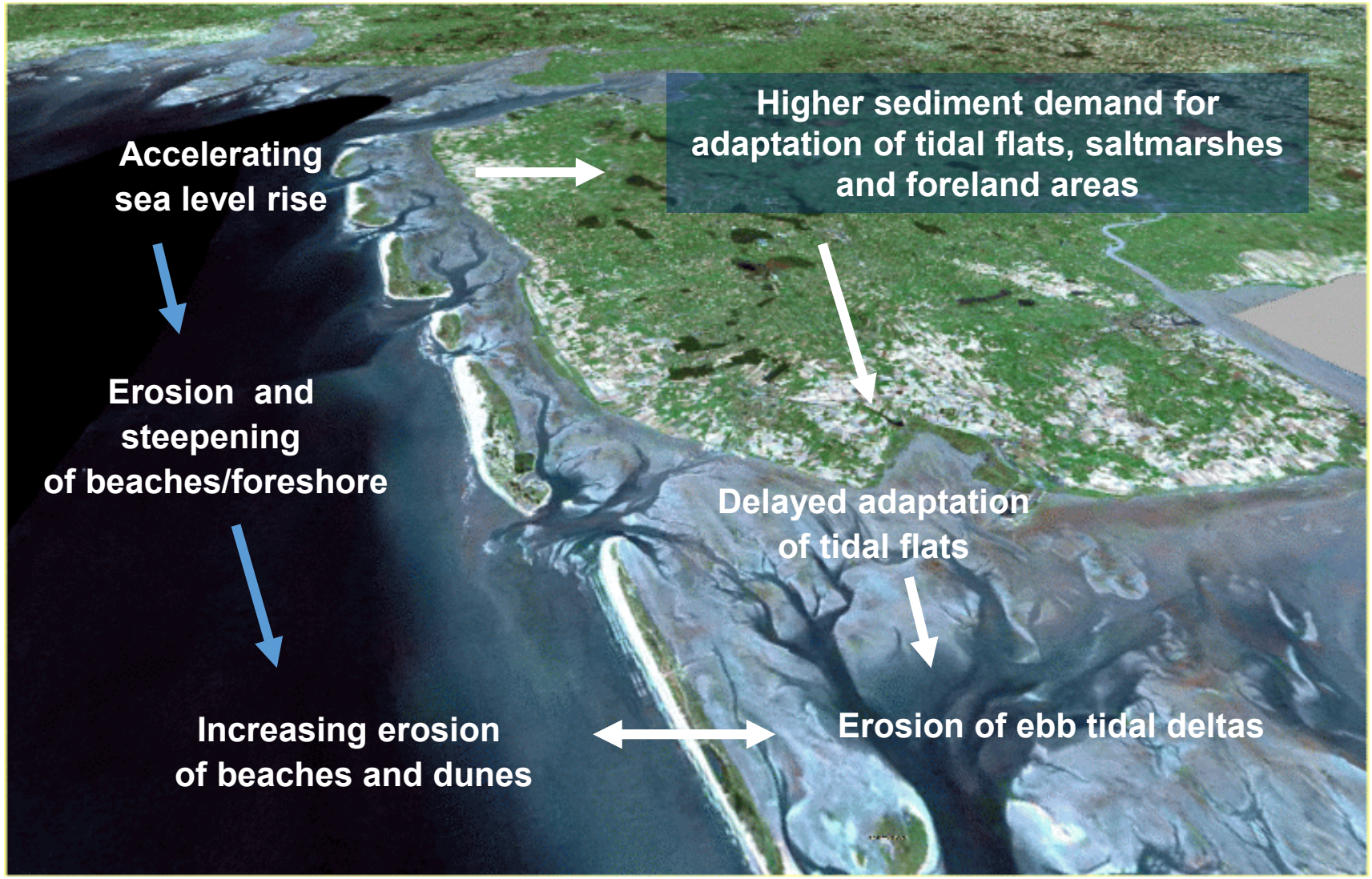
Setting the scene (1) - Morphological Implications of Accelerating Sea Level Rise

Accelerating sea level rise influences the overall morphdynamic equilibrium and <u>requires increased sediment import</u>

Implication on several levels

- Habitats
- Coastal protection of islands and mainland

Possible positive feedback loops?



Setting the scene (2) - Long-term net sediment import of the Ems estuary

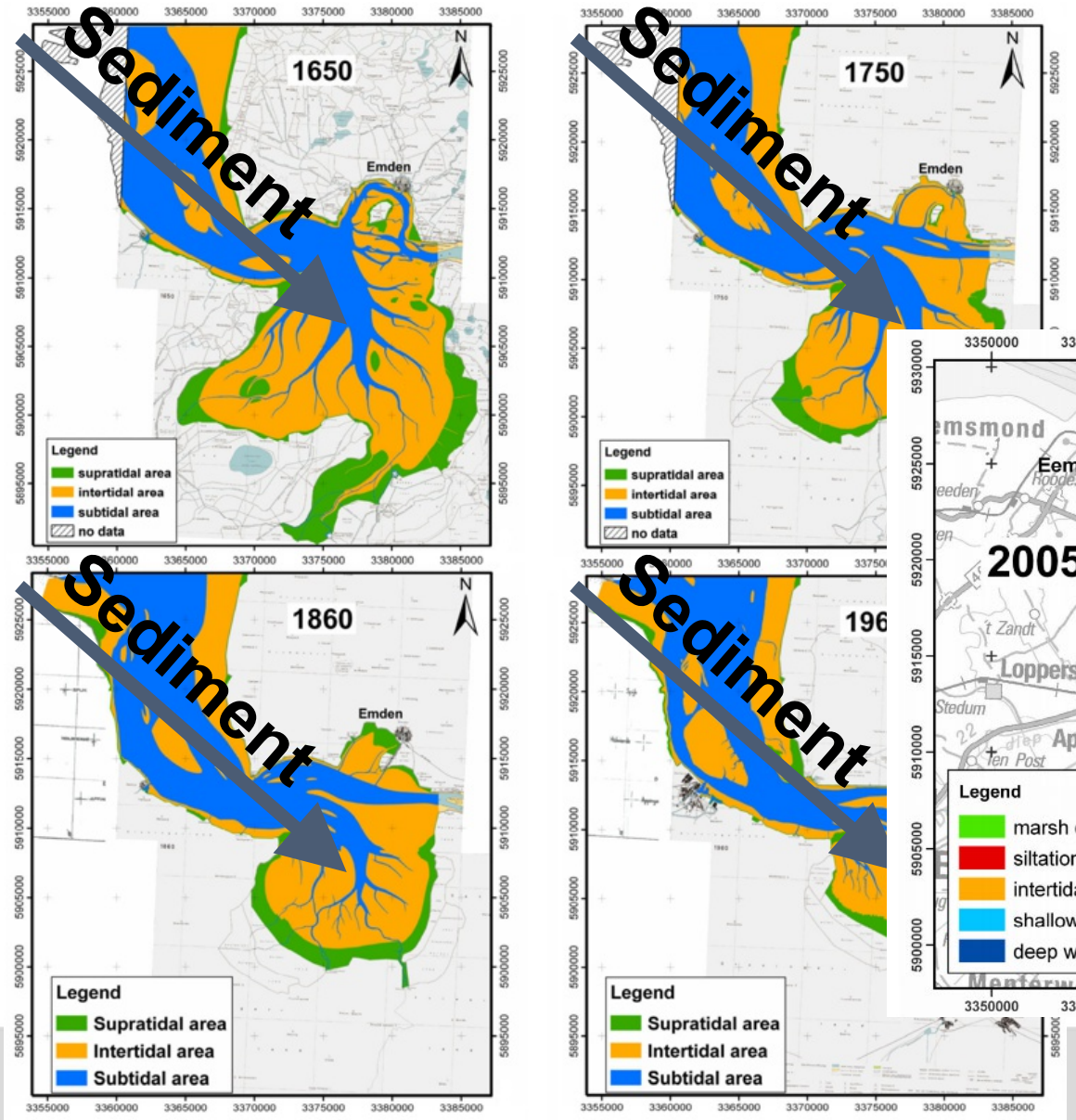
Ems estuary imports (fine) sediment

Historically used for land reclamation (Dollart)

Major sediment source for lower Ems fluid mud problem

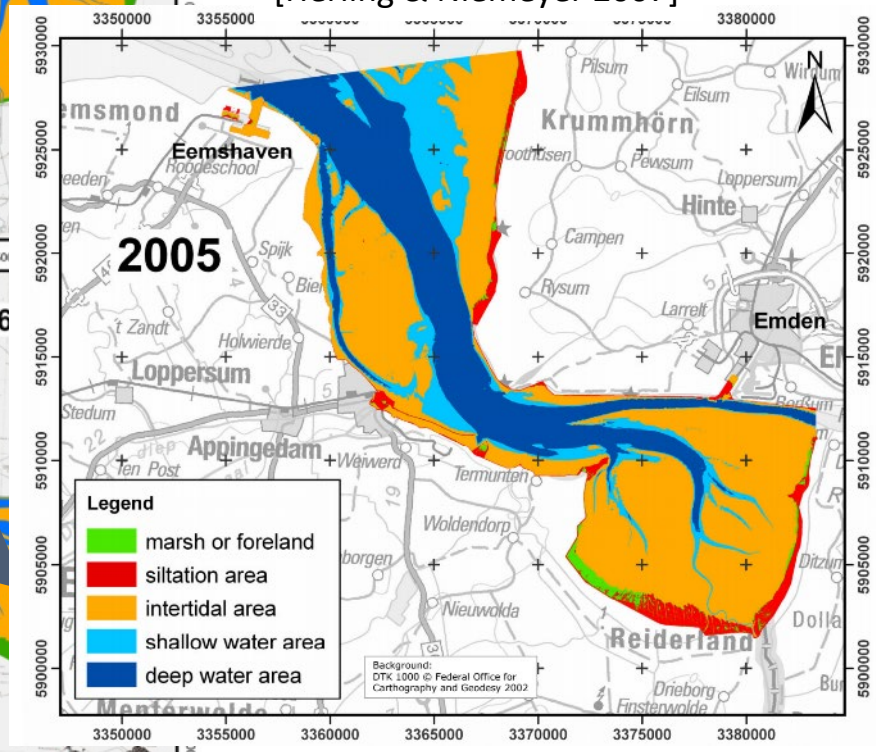
Salt marsh areas strongly reduced over time

And behind every new dike line …



Reconstruction of historical topographies [Homeier 1962]

[Herling & Niemeyer 2007]



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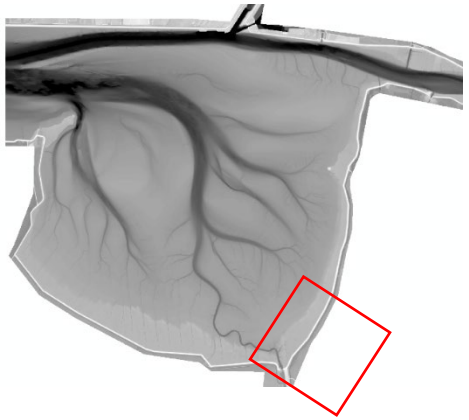
Setting the scene (3) - Long-term effect of diking w.r.t. the protected area

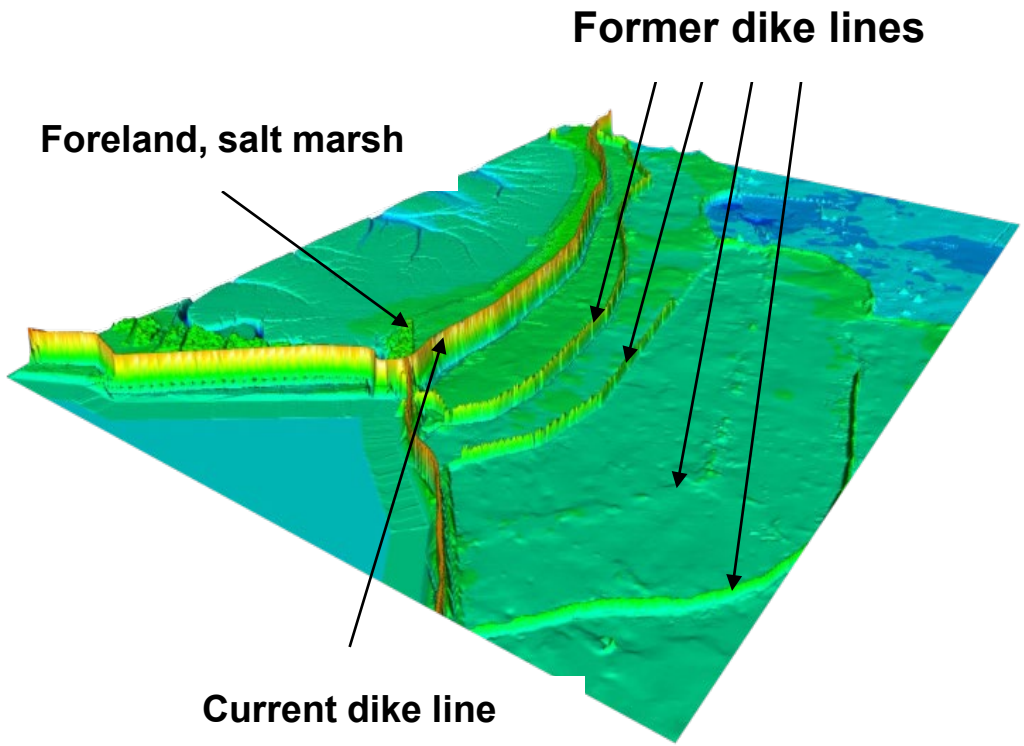


Diked areas stop growing with sea level rise:

- Growing sea level lets foreland, salt marsh and tidal flats grow higher than protected area (by means of sedimentation)
- In the long run problematic for
  - Dewatering
  - Salinisation
  - No more supply of soil-improving fine sediments (agric.)

The remaining sediment (import) in the estuary causes

- High dredging/maintenance efforts
- Lower Ems fluid mud problem …

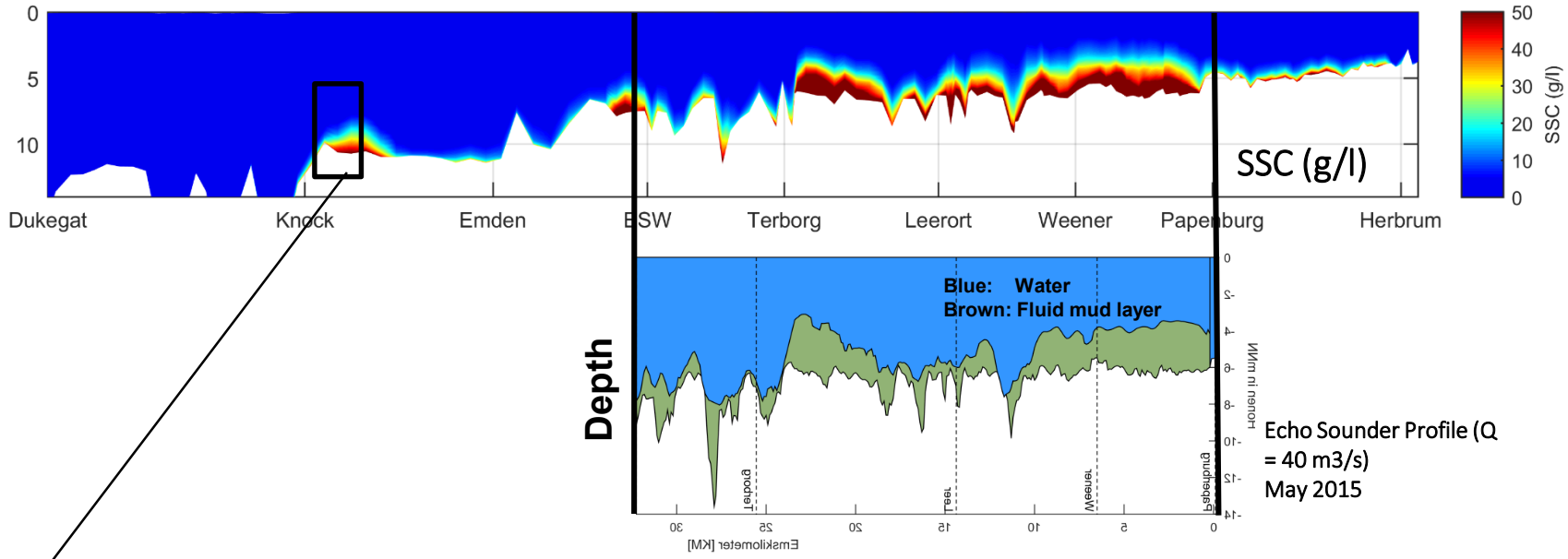


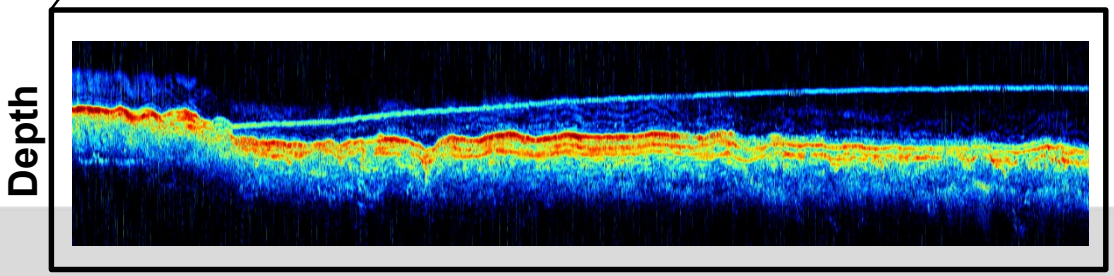
Setting the scene (4) – Fluid mud occurrence in Lower Ems

Lower Ems has significantly increased fine sediment budget since ~ two decades.

- Extreme turbidity
- Almost anoxic conditions during summer months
- Increased salinity in upstream reach

- Improvement of current situation based on technical approach (Tidesteuerung, Masterplan Ems 2050)
- Necessity for dredging





Sub-bottom profile at the mouth of the Emder fairway (Q = 80 m3/s)
Oct. 2017

Comparison of measured and predicted **longitudinal fluid mud layer distribution** around high water in the deep channel from Knock to Papenburg.

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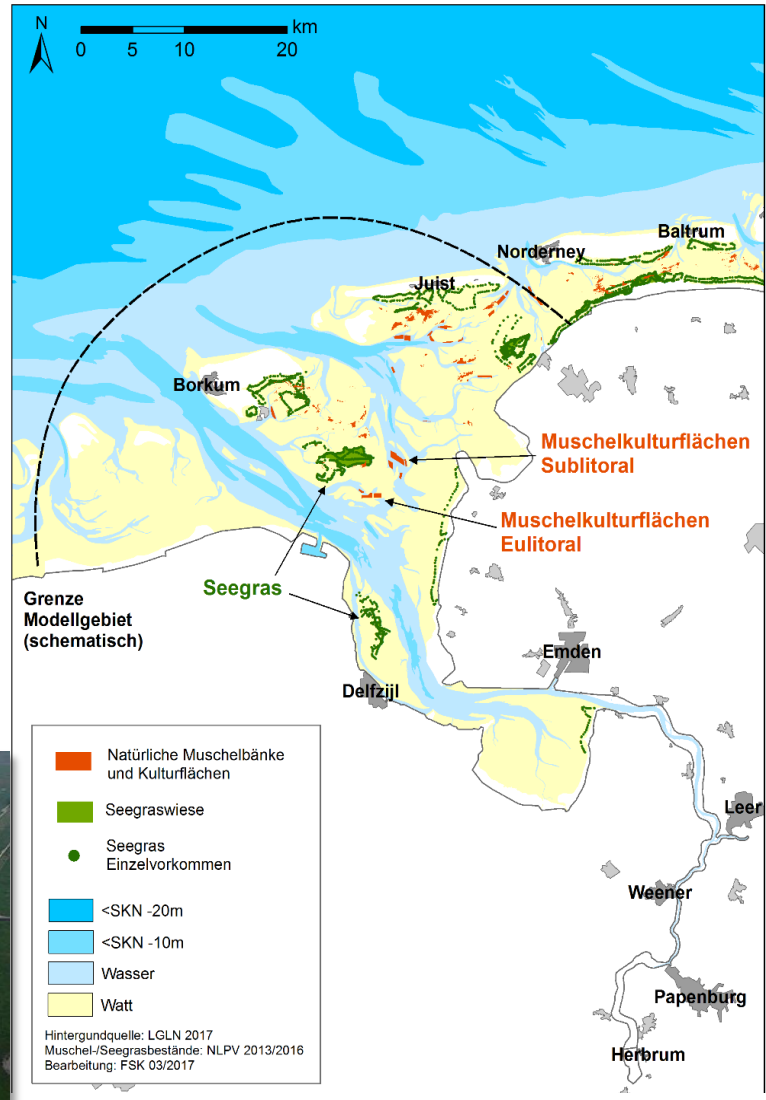
Guiding principle for ecological sediment management strategy

Sectoral approaches

- Ecological approach (federal states)
  - Reduction of environmental loads due to sediments (e.g. fluid mud)
  - Amplification/restoration of natural dynamics (growing of floodplains and wadden sea sediment import)
  - In a broader sense: usage of dredged matter in ecologically useful / less disturbing manner
  - Inherently anticipate climate change effects and use natural transport processes for mitigation where possible
- Fairway and harbor maintenance optimization (WSV, harbor administrations)

Dutch-German overall guiding principle officially established in spring 2019



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Actions within ANK-Programme

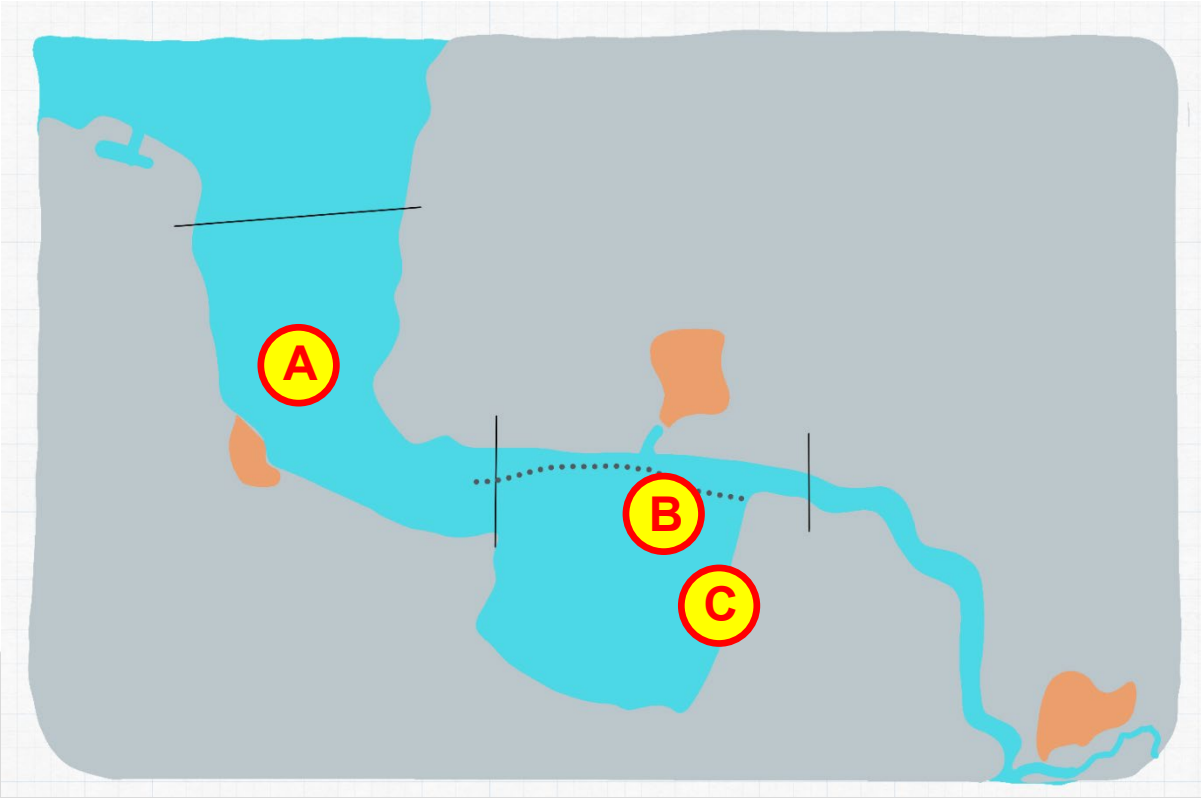
Ensuring the growth of the mudflats and forelands

Improving the quality of seagrass and salt marshes

Removal of fine sediment from the system for turbidity reduction - also precautionary for MSLR

Sustainable protection of existing protected areas

Measures to reduce fine sediments in the inner estuary



Aims

Pilot Actions

A) 3.1-2 Ecological sediment management Hund and Paapsand - restoration of seagrass meadows

B) 3.1-4 Bird‘s Island Dollart – Initiation of a natural process to strengthen the salt marshes

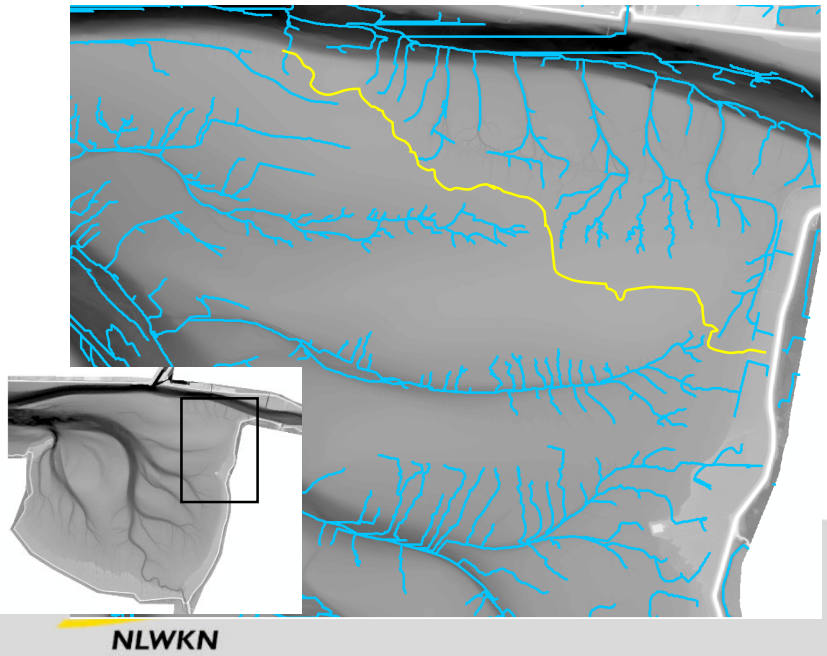
C) 3.1-3 Improvemnt of coastal climate resilience – salt marsh development / clay pits

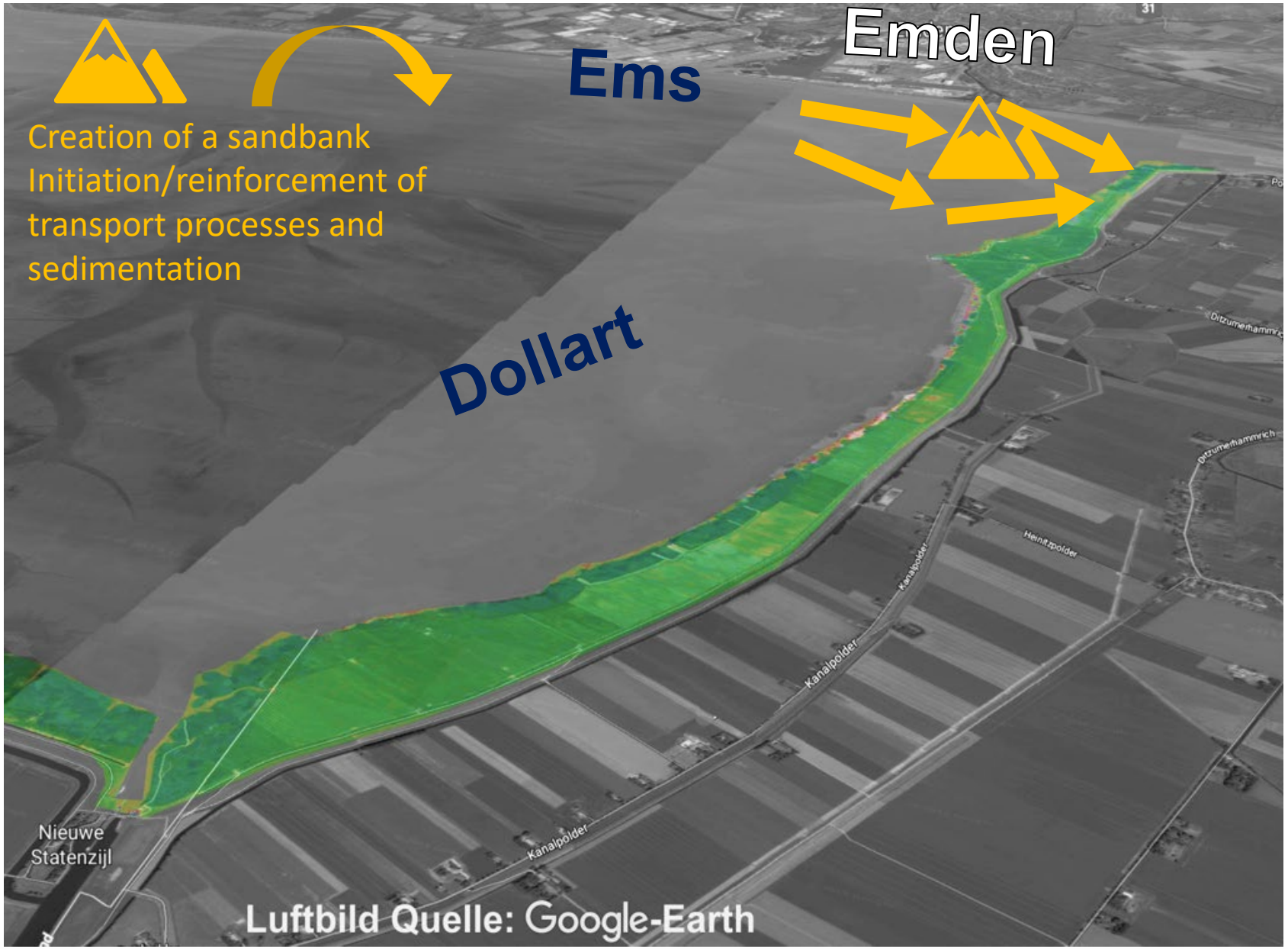
ANK Action 3.1-2 (A) Ecological sediment management Hund and Paapsand - restoration of seagrass meadows

Aims	• Creation of a carbon sink [t/y] • Reduction of eutrophication through natural decomposition of nutrients (t/y) • Restoration of benthic habitats [ha] • Reduction of suspended matter content in the water column (turbidity) [visual depth] • Reduction in the amount of maintenance dredging required in the Ems estuary [m^3/y] • Attenuation of the increased energy input due to deepening • Mitigation of the consequences of accelerating sea level rise

ANK Action 3.1-4 (B)
Bird‘s Island Dollart – Initiation of a natural process to strengthen the salt marshes

- Morphodynamical model based pre-analysis
- Realization of artfical sand bank (pilot) and monitoring





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ANK Action 3.1-4 (B) Bird‘s Island Dollart – Initiation of a natural process to strengthen the salt marshes

Aims	• Enlargement of foreshore areas (ha) • Reduction of the excessive suspended matter content in Unterems/Dollart (m^3) • CO2 storage (t) • Dynamisation of foreshore development - Improvement of biodiversity • Growth of areas in line with sea level rise (ha x cm)

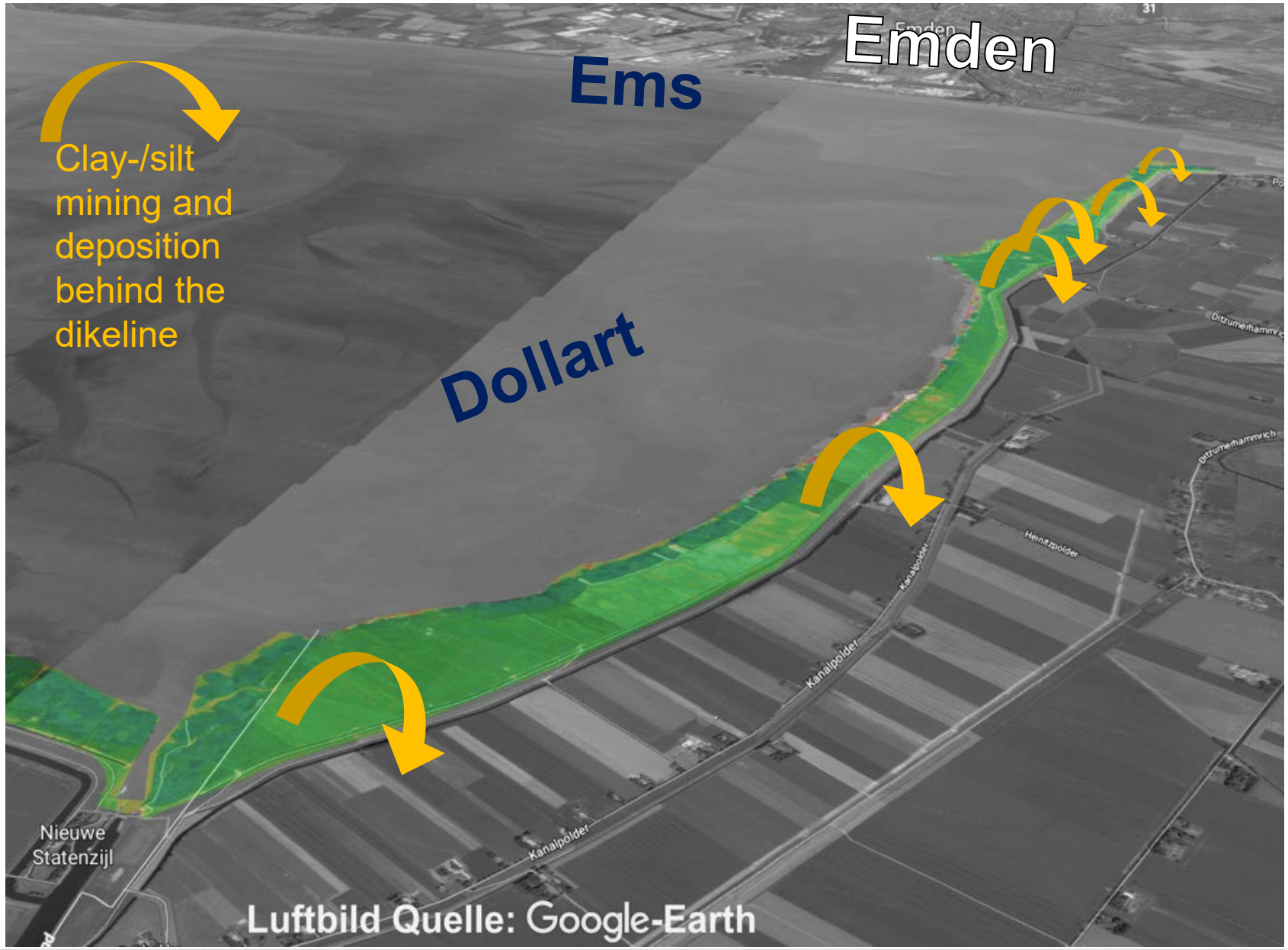
ANK Action 3.1-3 (C)

Improvement of coastal climate resilience – salt marsh development / clay pits

To be investigated:

- Sedimentation potential of cohesive fines in sand pits
- Optimization of dredged matter disposal w.r.t. this

2021-23 pilot action:
Disposal of dredged matter on agricultural areas (Rheider Deichacht, NLWKN Aurich)



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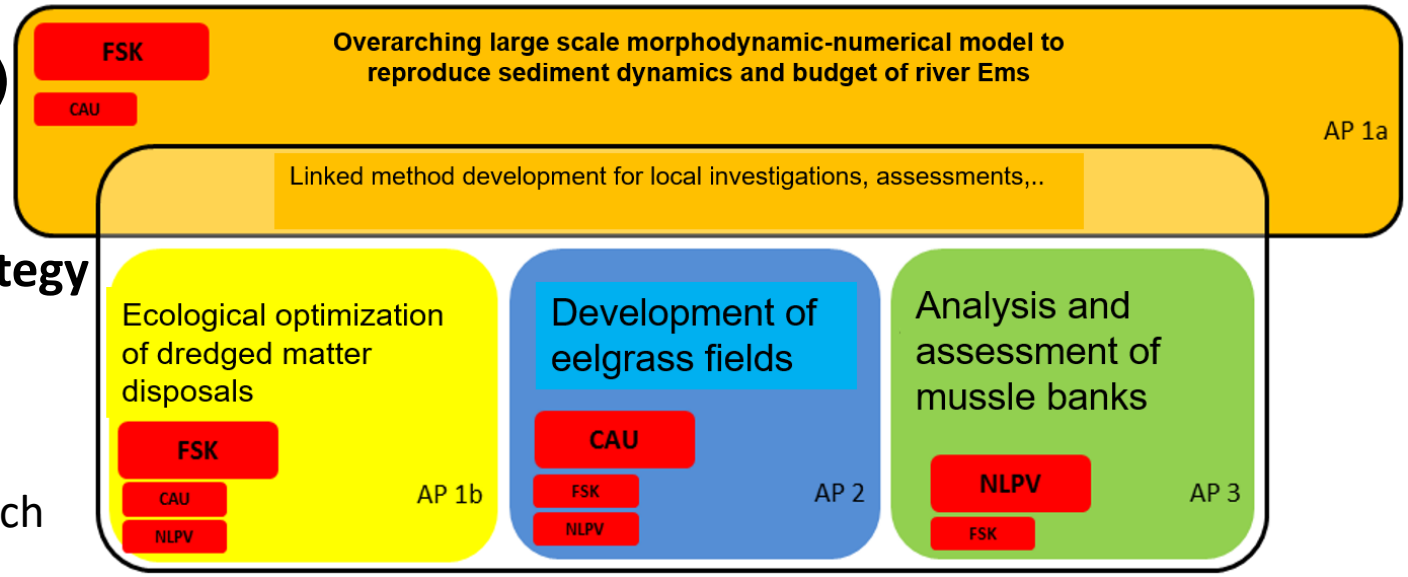
ANK Action 3.1-3 (C) Improvement of coastal climate resilience – salt marsh development / clay pits

Aims	• Strengthening climate resilience • Strengthening the biodiversity of salt marshes [ha] • Reduction of suspended matter content in the water column (turbidity) [visual depth] • Reduction in the amount of maintenance dredging required in the Ems estuary [m^3/y] • Mitigation of the consequences of accelerating sea level rise within the dyke • Improvement of the soil quality of the cultivated areas

Lower Saxony Project SediEms (since 2019)

Basic information and understanding for a sustainable ecological sediment management strategy

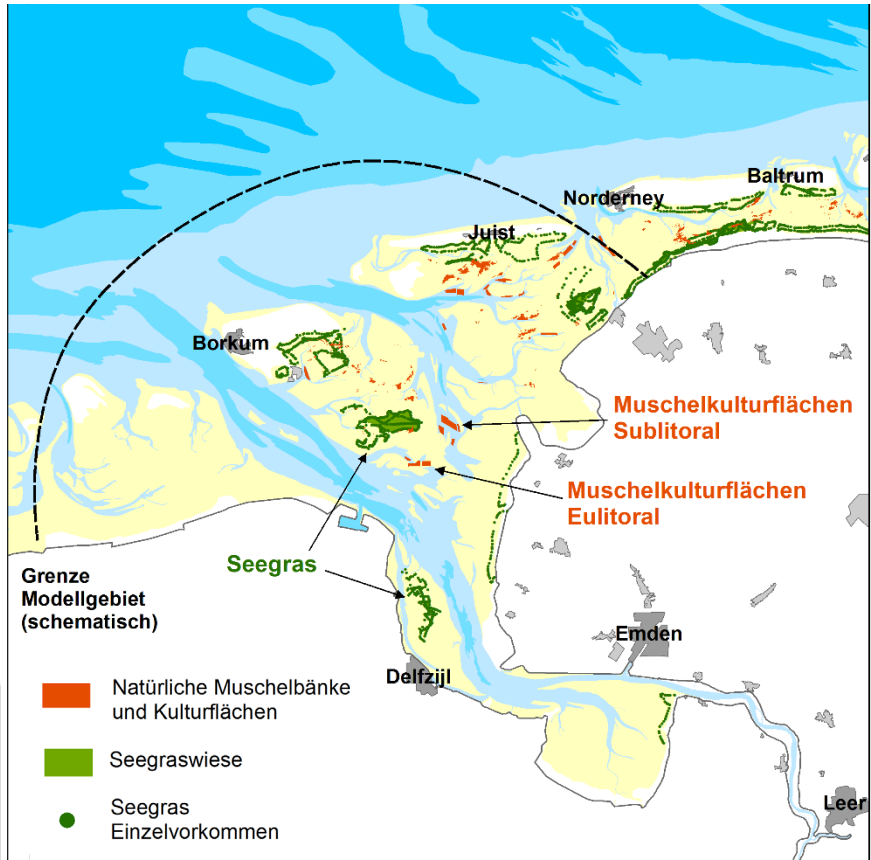


Important accompanying activity

Basic approach: Morphodynamic numerical model, which

- describes the recent state with sufficient precision ,
- gives a qualitative und quantitative description of sediment transport within the area,
- allows qualitative und quantitative assessment of interventions/measures which influence the sediment budget
- Results allow development and application of measures/methods for ecological improvements

The application cases within the project are exemplary realizations. The modelling tool is intended to be consistently applied to further measures/questions.



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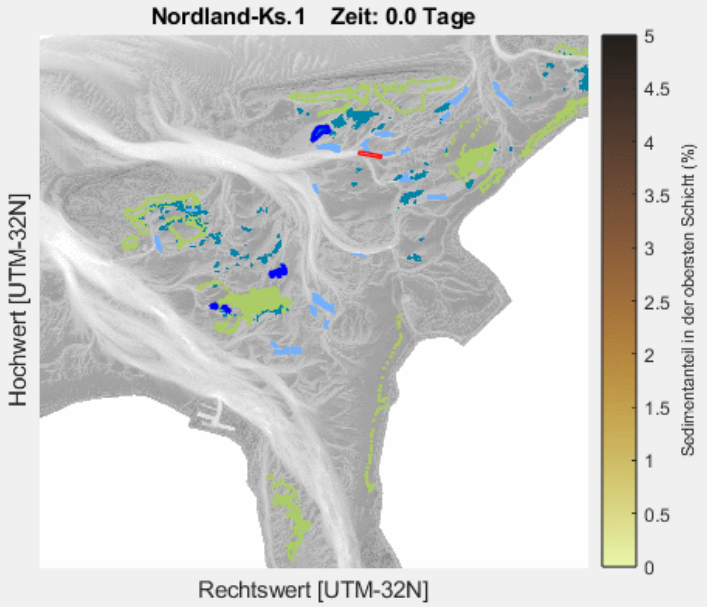
Examplary results: Fate of fine sediments disposed at three different locations around Nordland

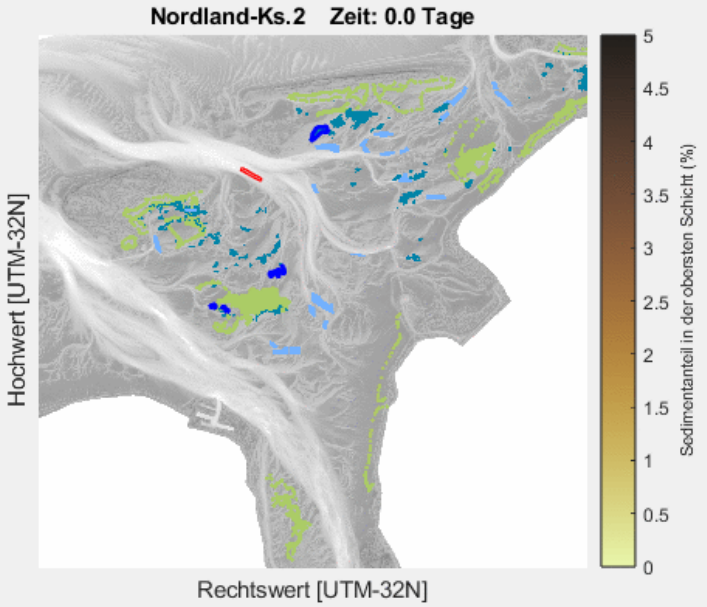
Sediment disposal scenario 1, Approach: Disposal sites in deep water, easy accessible

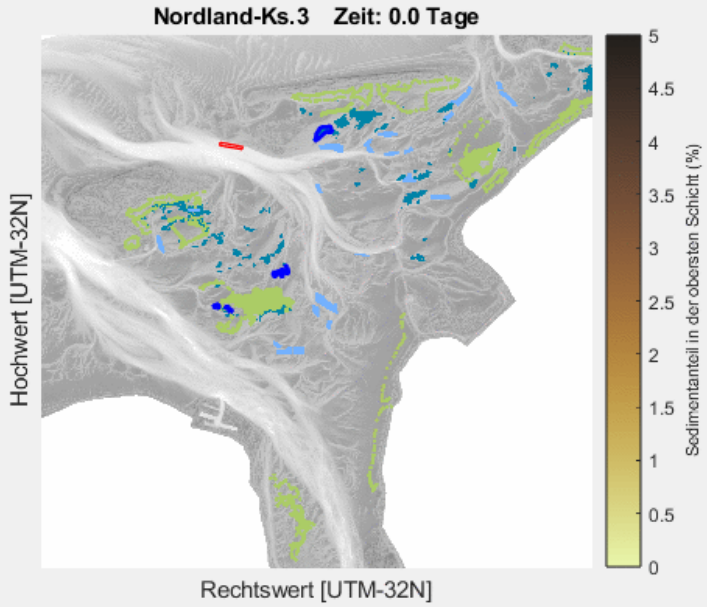
- 10.000 m³/d sediment disposal (first 120 days of 180 day simulation) 5 sediment fractions
- 30% silt (shown in animations)
- Animations show influence of disposal site location

Three different locations relatively close to each other - very different results!

green polygons: sea grass
blue polygons: mussle/oyster fields/ banks





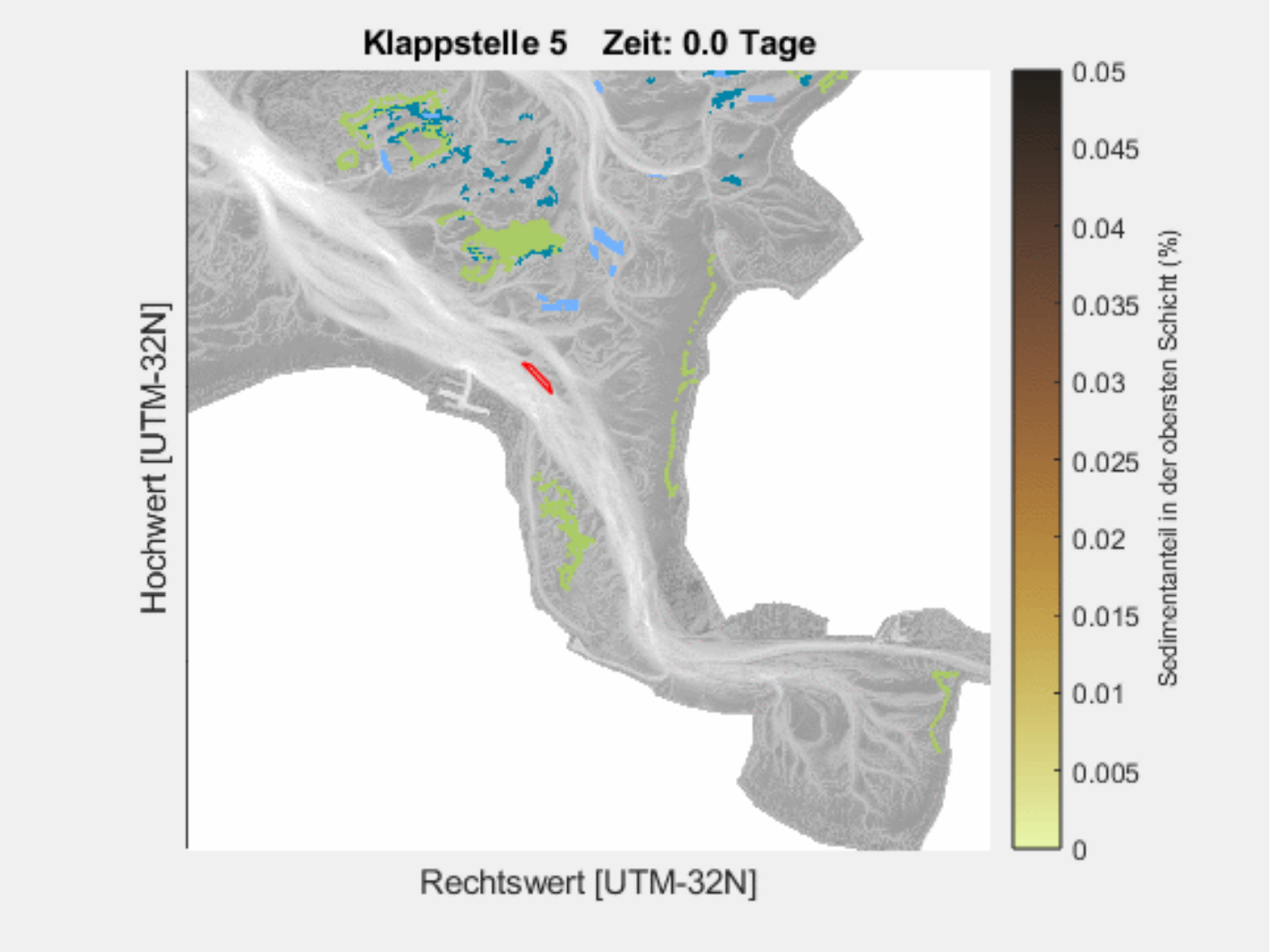


Second example: Disposal location 5 scenario – Distribution of disposed sediment in sea floor sediment

Scenario: 10.000m³/d disposal for 120 Days, after that only spreading by natural dynamics

Animation shows dredged dredged fine sediment inside the uppermost soil layer.

High relevance of realistic interaction with natural (soil) sediment in order to realistically assess long-term fate of disposed matter and speed of spreading




Thanks for your
Attention!