Interreg
North Sea Region
IMMERSE
European Regional Development Fund

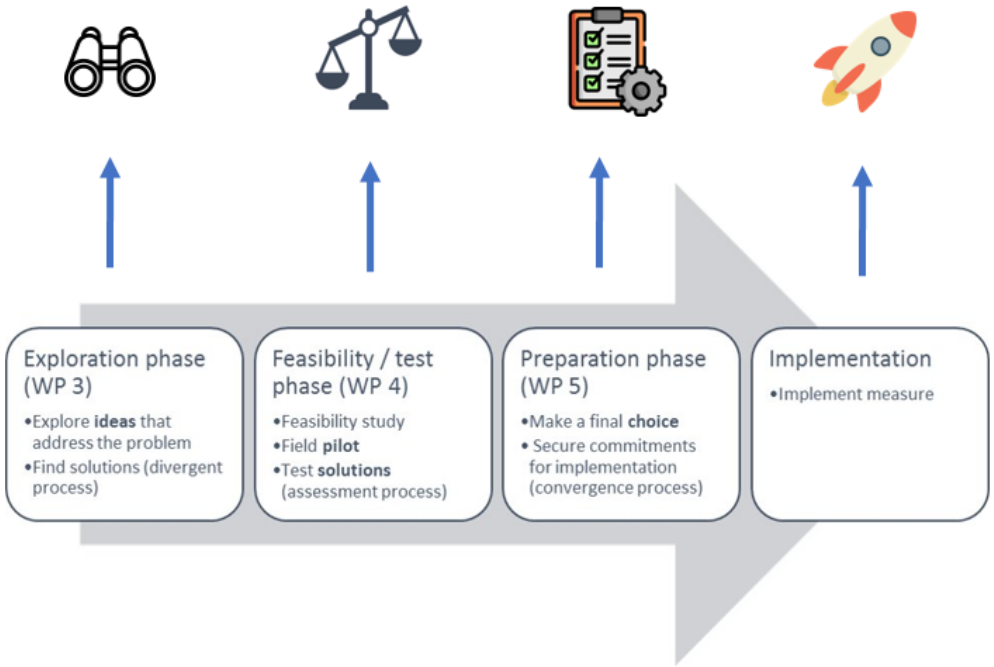
EUROPEAN UNION

Round 1: Session 2 - Sediments & Tides

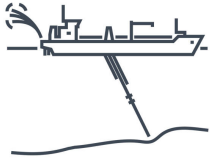
Develop a morphological management strategy

Cynthia Pauwels, Antwerp Port Autority

Lifecycle Assessment of IMMERSE Measures

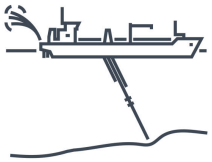


Round 1: Session 2



2. Sediments and tides (BAW)

- M1 Develop a morphological management strategy (APA)
- M9 Feasibility study on the reconnection of the Dove-Elbe (HPA / BAW, Holger Rahlf)
- M11 Pilot on cross-border solutions for maintenance dredging (MOW, Eline Van Malderen)



Estuary: Scheldt

Topic: Sediments & Tides

Partner: APA

Pressure:

- Tidal amplification
- conserve multiple channel system

Measure (M1):

Develop a morphological management strategy

-

Antwerp Port Authority

Benefit:

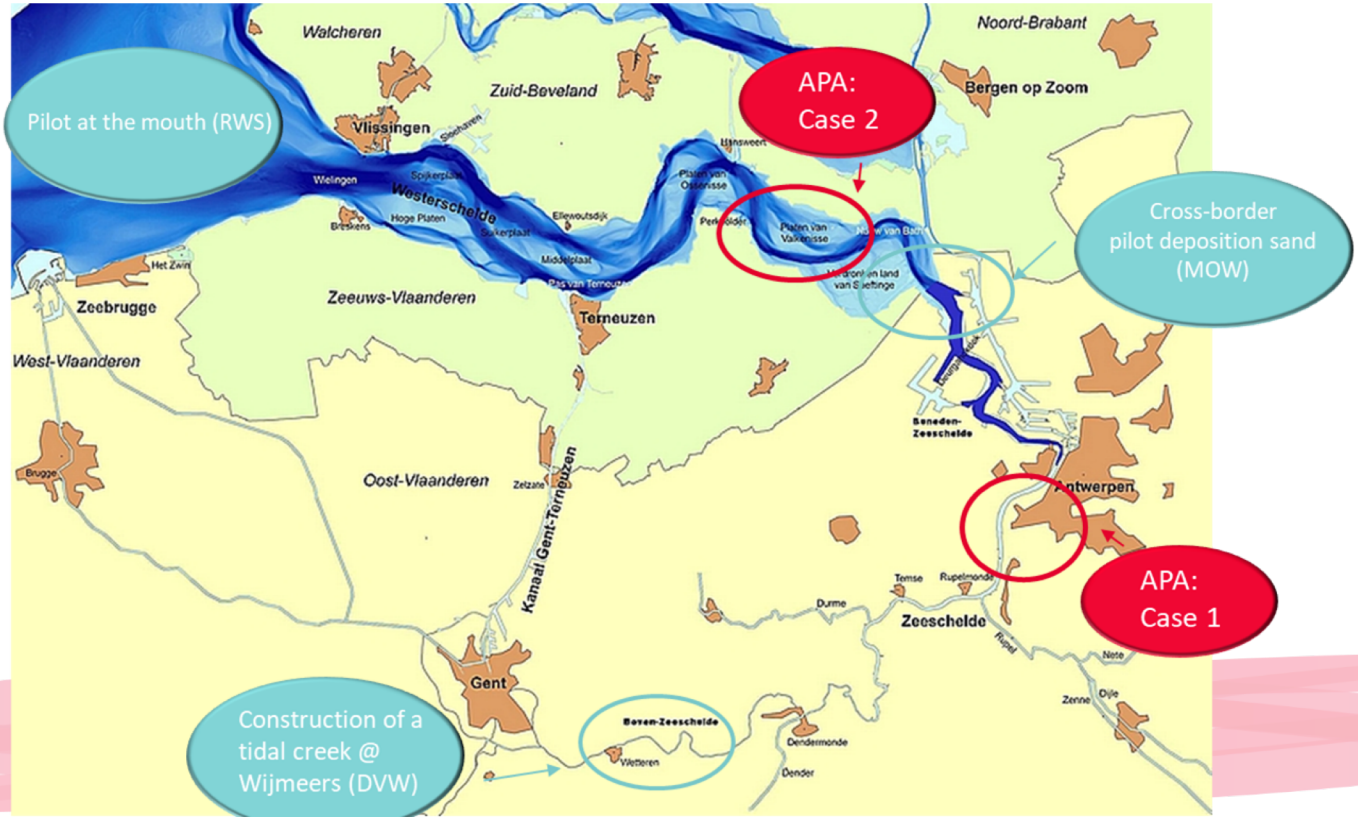
Reducing an estuarine pressure

Exploration


SAFETY AGAINST FLOODING
ECOLOGY
FISHERY
MORPHOLOGY
ACCESSIBILITY
TOERISM

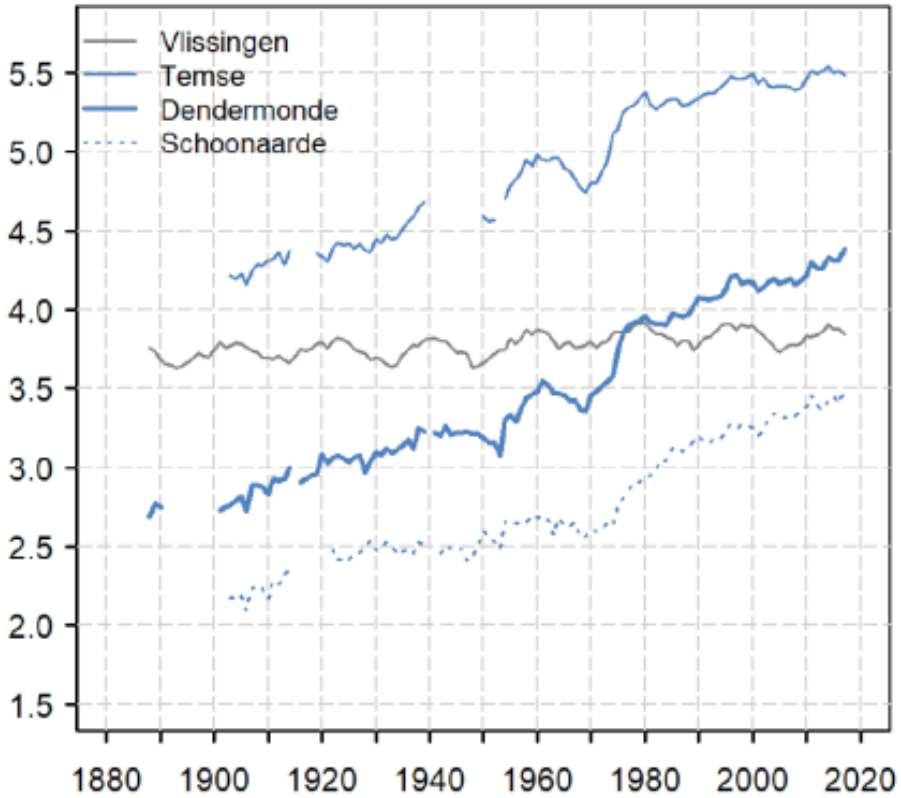
Morphological management @Scheldt

Measures being developed within IMMERSE by different partners



Case 1: Tidal dampening using sediments

Pressure: Increasing Tidal Range



Case 1: Tidal dampening using sediments

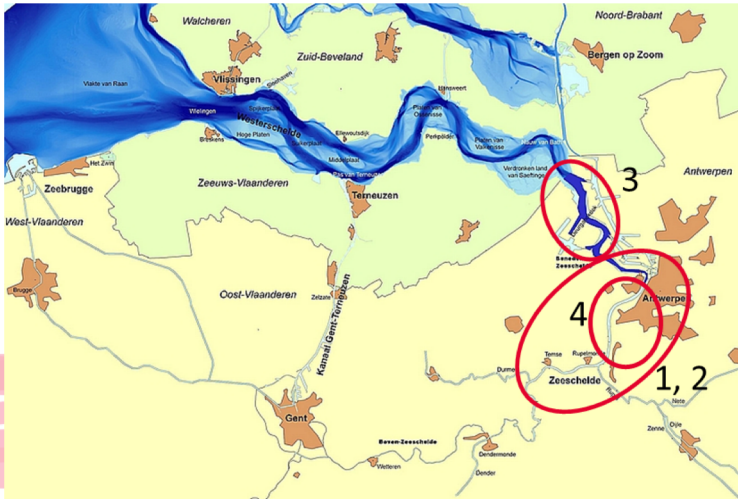
Consequence of increasing Tidal Range

- Safety against flooding
- Nautical accessibility
- Nature
    - Banks get steeper
    - Alternation plates, salt marches and mudflats decreases
    - Benthic species are dragged by the flow

Case 1: Tidal dampening using sediments

Description measure APA

- Conceptual exploration of possibility of reducing tidal propagation using sediments (infra projects)
- Reduction of cross-section along reaches of the Scheldt-estuary
- Study potential effects on:
  - **Water & sediment dynamics**
    Reduced Scaldis-model/ Delft 3D-NeVla-model
    3D 5 layers
    executed by IMDC/FHR
  - **Ecology**
    OMES - Primary productionmodel
    executed by University of Antwerp



Case 1: Tidal dampening using sediments

Description measure APA

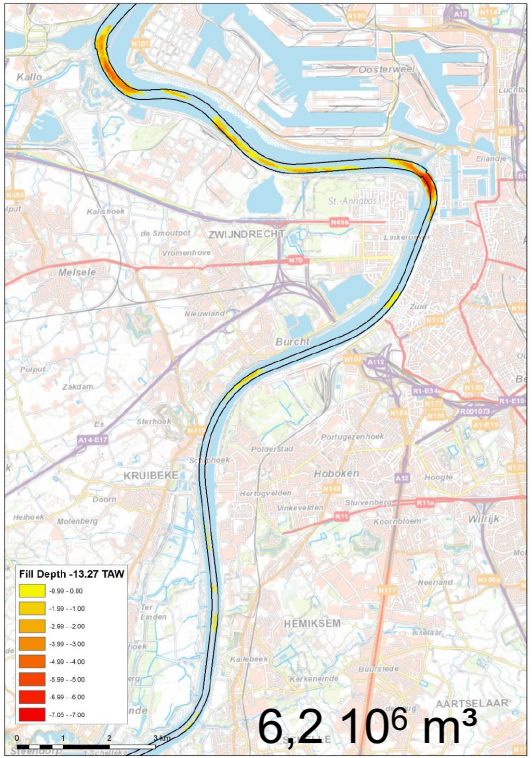


Figure 4-1 Fill depth [m] for scenario 1.

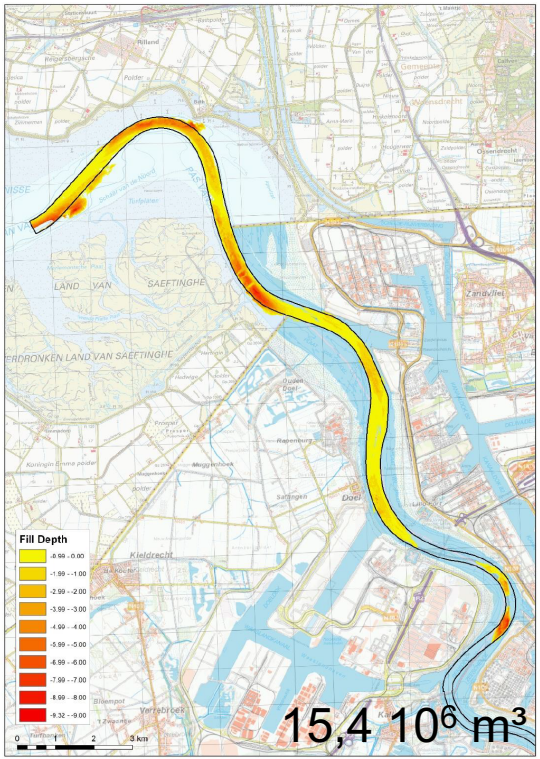
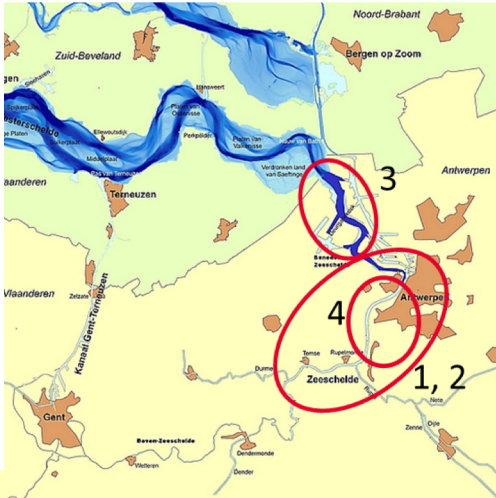


Figure 4-3 Fill depth [m] for scenario 3.



Case 1: Tidal dampening using sediments

Description measure APA

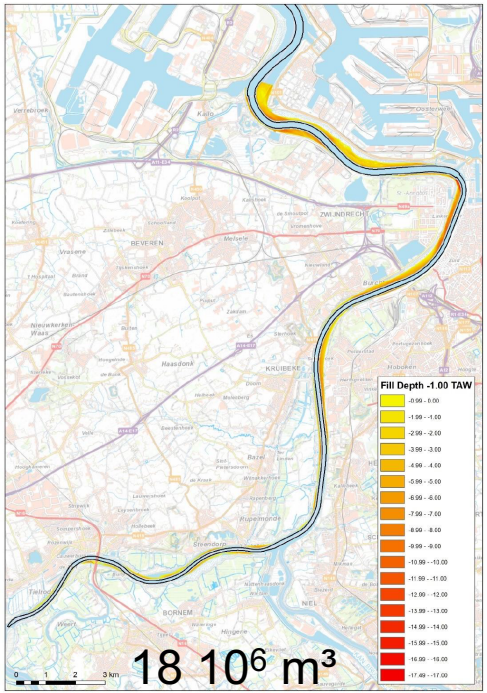


Figure 4-2 Fill depth [m] for scenario 2.

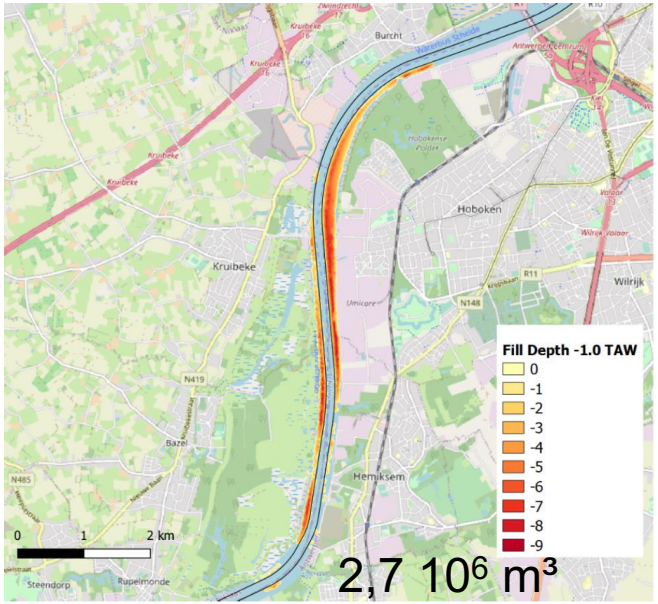


Figure 4-4 Fill depth [m] for scenario 4.

Case 1: Tidal dampening using sediments

Impact scenarios on tidal range

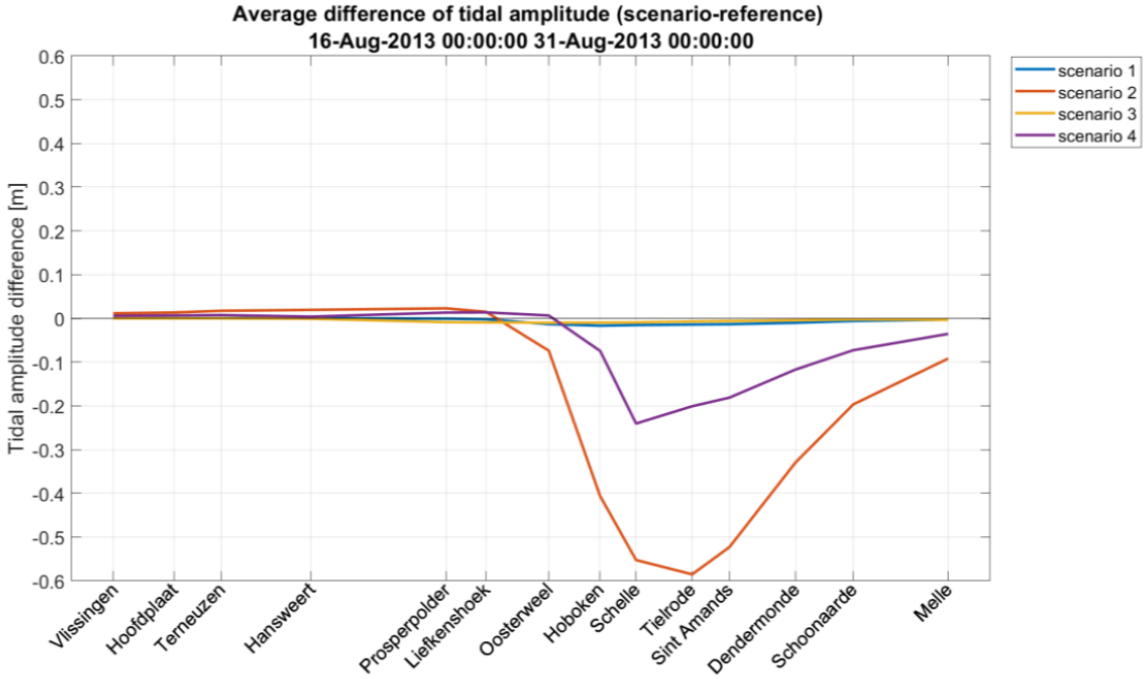


Figure 5-1 Difference [m] in tidal amplitude along the Scheldt estuary between the different scenarios and the reference run

Case 1: Tidal dampening using sediments

Results scenario 4

- **Water & Sediment dynamics**
  - Decrease of tidal range in the Upper Seascheldt (up to 15 cm)
- **Ecology**
  - Creation of extra intertidal habitat
  - Primary production increased locally around the pilot zone and as a consequence also oxygen concentrations
  - Possitive effect on entire ecosystem because increase is at zo where nowadays the lowest oxygen concentrations occur
- **LT Stability**
  - Only initial effect is estimated
  - Sediment stability is a potential issue

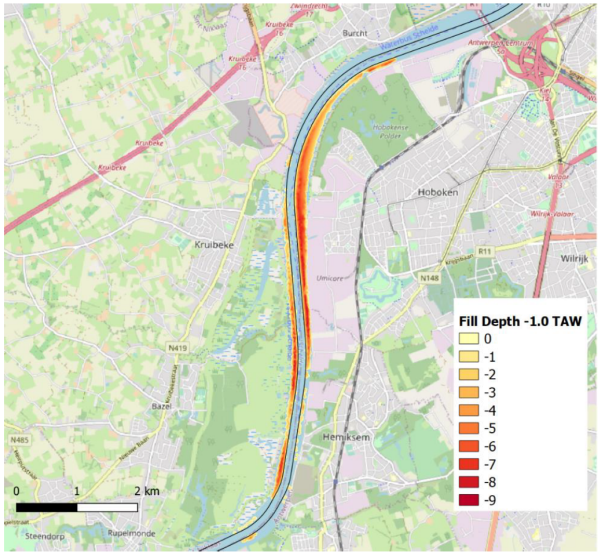


Figure 4-4 Fill depth [m] for scenario 4.

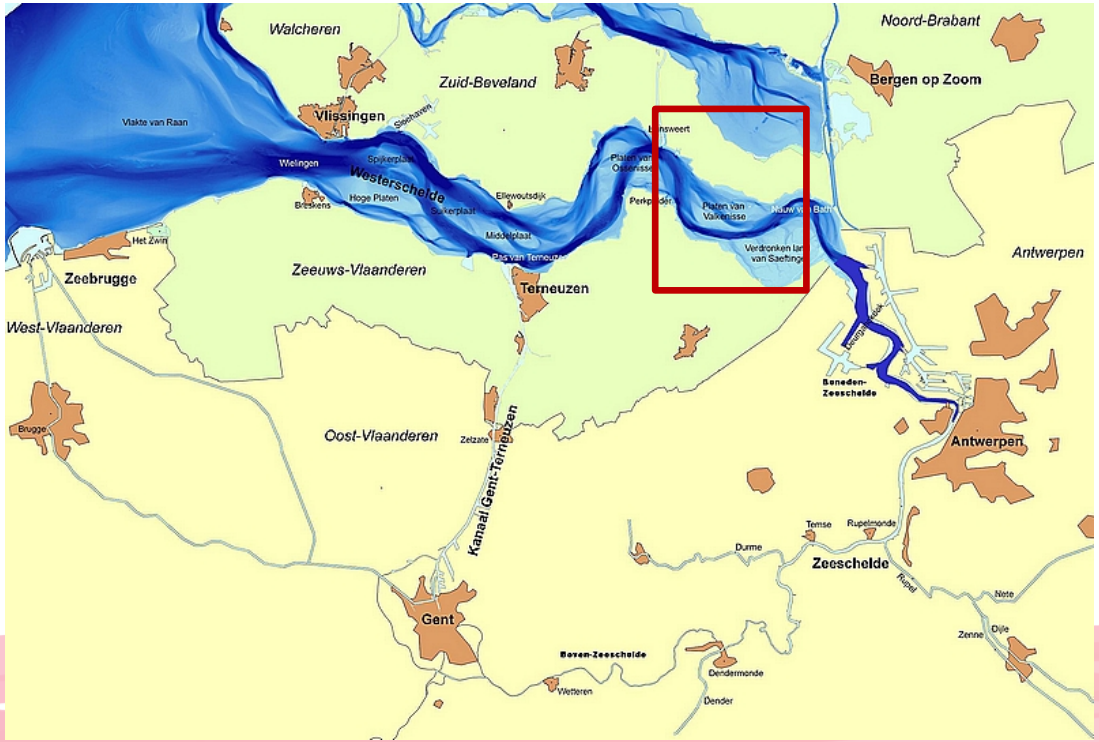
Case 1: Tidal dampening using sediments

Lessons Learned

- High level insights in the feasability of tidal demping using sediments
- Using the whole train of available models: hydrological, morphological, sedimentation & ecological model
- Challenge remains to model the complex processes on the Scheldt estuary

Case 2: Conserve multi channel system with sediments

Pressure: conservation multi channel system



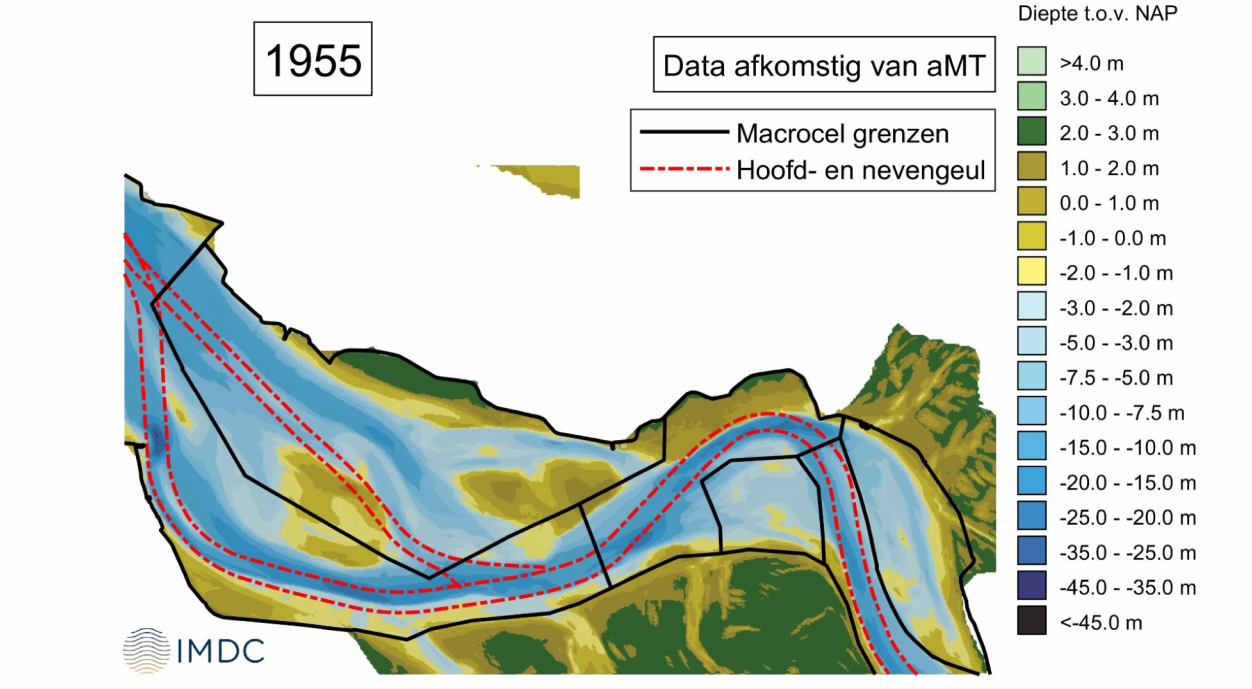
Case 2: Conserve multi channel system with sediments

Consequence of changes multi channel system

- Safety against flooding
- Nautical accessibility
- Nature

Case 2: Conserve multi channel system with sediments

Pressure: conservation multi channel system



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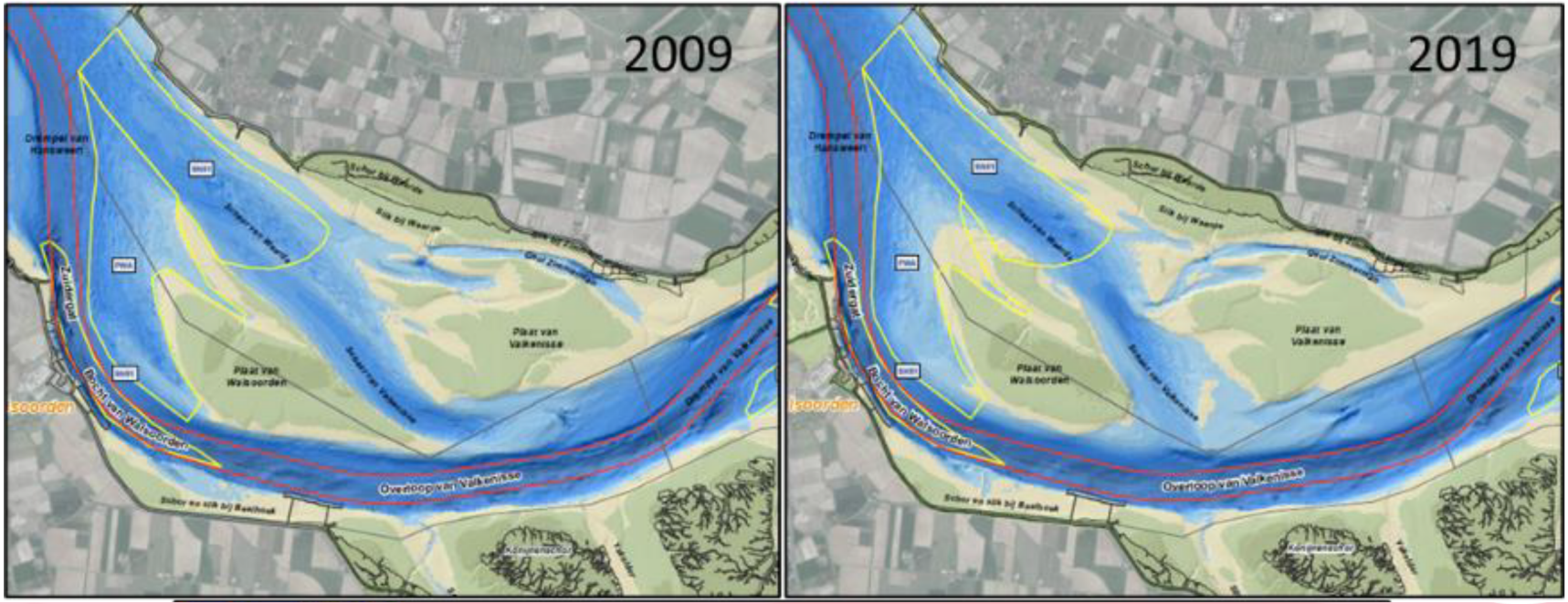

Case 2: Conserve multi channel system with sediments

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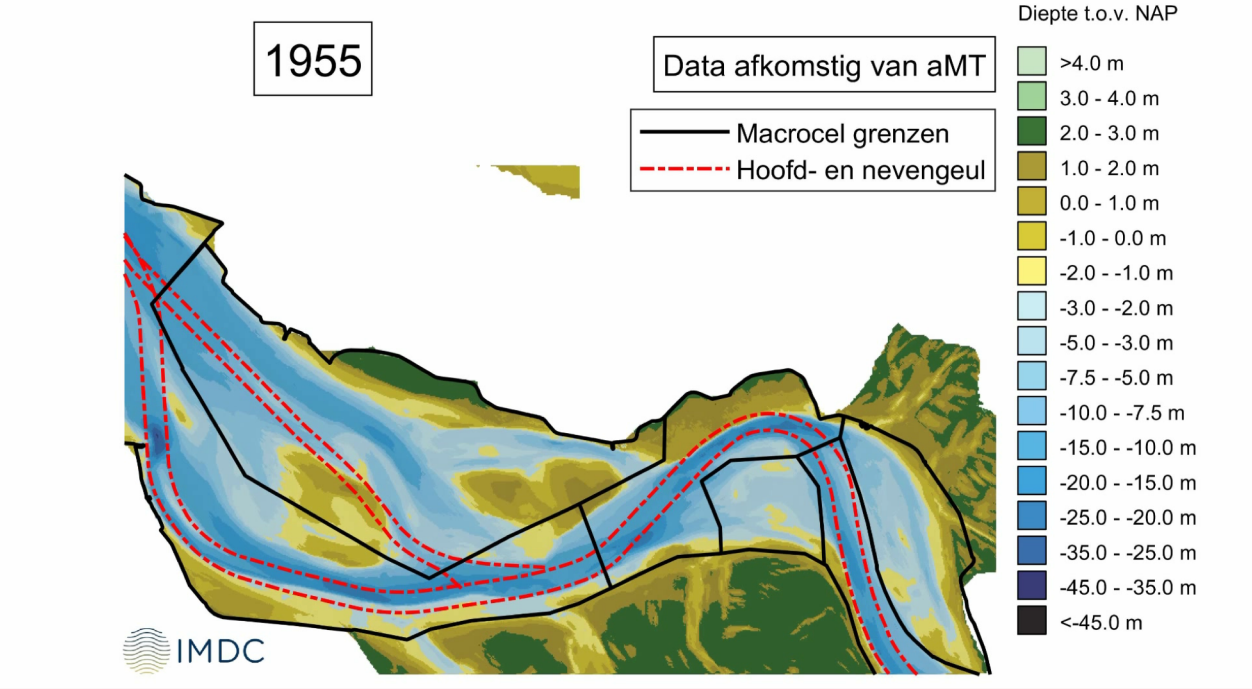
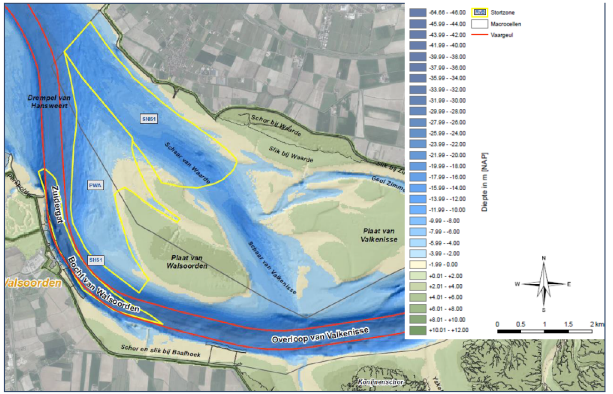


Case 2: Conserve multi channel system with sediments

Description measure APA

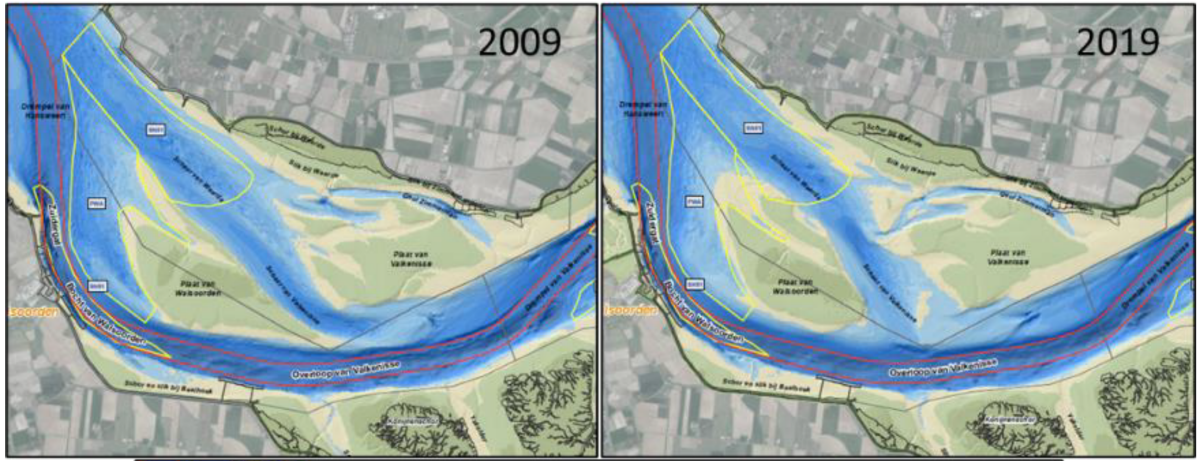
- Conceptual exploration of possibility of increasing accessibility by dredging and deposition of sediments (infra projects)
- Reshaping section along Schaar van Waarde/Valkenisse
- Study potential effects on:
  executed by IMDC
  - **Water & sediment dynamics**
    numerical morphodynamical Scheldt-model
    Telemac - 3D 5 lagen – NT/ST-1year
  - **Ecology**
    mapping ecotopen (high/low dynamical areas)
  - **Nautical accessibility**
  - **Tidal Range**

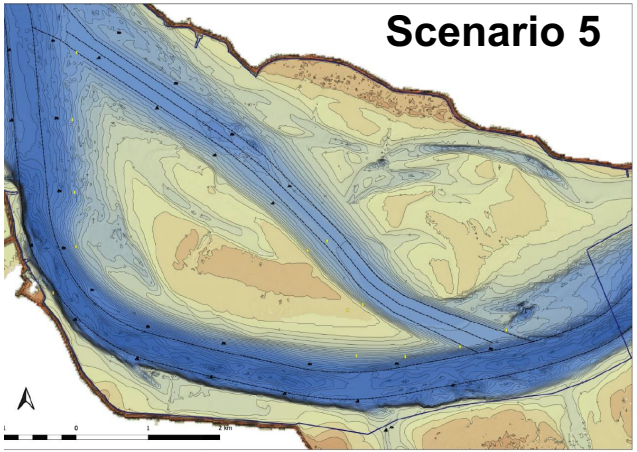


Figuur 1-1 Overzichtskaart projectgebied (1 van 2). Bron: (IMDC, 2020).

Case 2: Conserve multi channel system with sediments

Description scenario 5

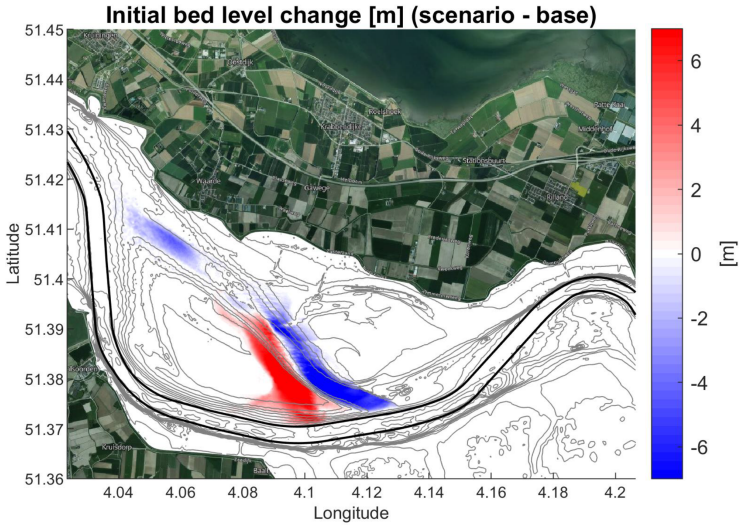




Case 2: Conserve multi channel system with sediments

Results scenario 5

- **Water & Sediment dynamics**
  - Increased flow rate through side channel during eb
  - No difference during flood
- **Ecology**
  - Increase of low dynamic area + intertidal habitat
- **Nautical accessibility**
  - Max. cross current = ok
  - Max. longitudinal current = only ok if sufficient width
- **Flooding**
  - Increase of tidal volume of whole estuary
  - Increase tidal range max.: +2,7cm (unfeasable)
- **LT Stability**
  - After 1 year: relatively stable; min. nautical depth is still ok



Case 2: Conserve multi channel system with sediments

Lessons Learned

- High level insights on how to influence the hydromorphological processes in the Scheldt estuary

- More research needed:

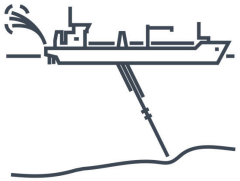
  - on the effect of the cross current perpendicular to the main channel
  - The hard structures influencing the Zimmerman channel
  - The historical development of the bathymetry & autonomous developments
  - Impact of measures downstream of the side channel

Morphological management

Conclusions

Morphological management is important for estuaries trying to cope with future challenges:

- Understanding of system functioning
- Holistic approach (HD, sediments, ecology)
- Each system is unique … but there are similarities
- Soft (reversible) measures should be preferred (not against nature)
- More strategies to be explored (e.g. adaptation hard bordering)



Does your estuary face similar pressures?

Could the presented solution(s) be applied in other estuaries?