



Vlaanderen
is water

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FROM MANAGEMENT PLAN TO A VISION FOR ESTUARY RESILIENCE

CASE OF THE UPPER SEA SCHELDT IN FLANDERS

Interreg
North Sea Region
IMMERSE

European Regional Development Fund



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- **Improved & Innovative River Management**
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Introduction

Scheldt river - Nature, navigation and flood protection functions

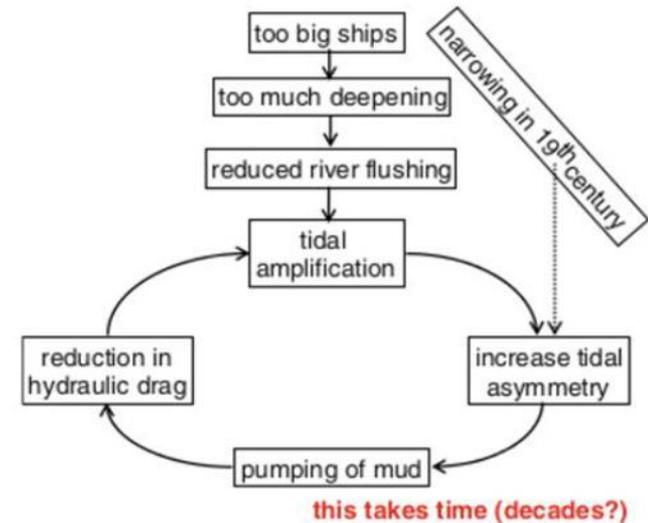
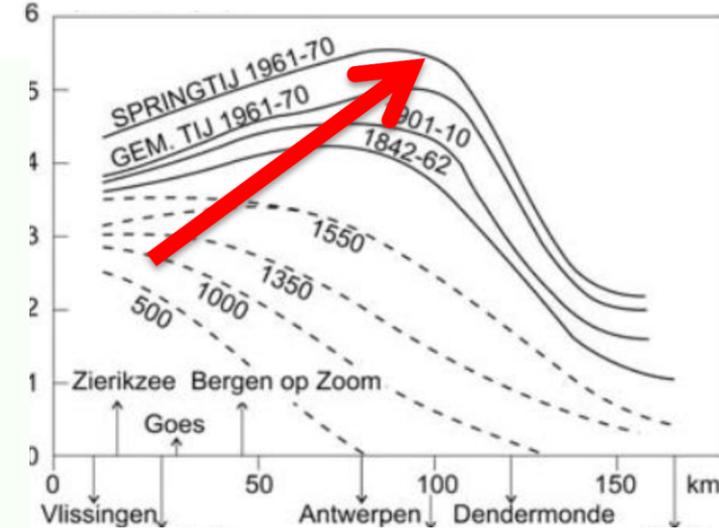


Challenges



Tidal range Schelde

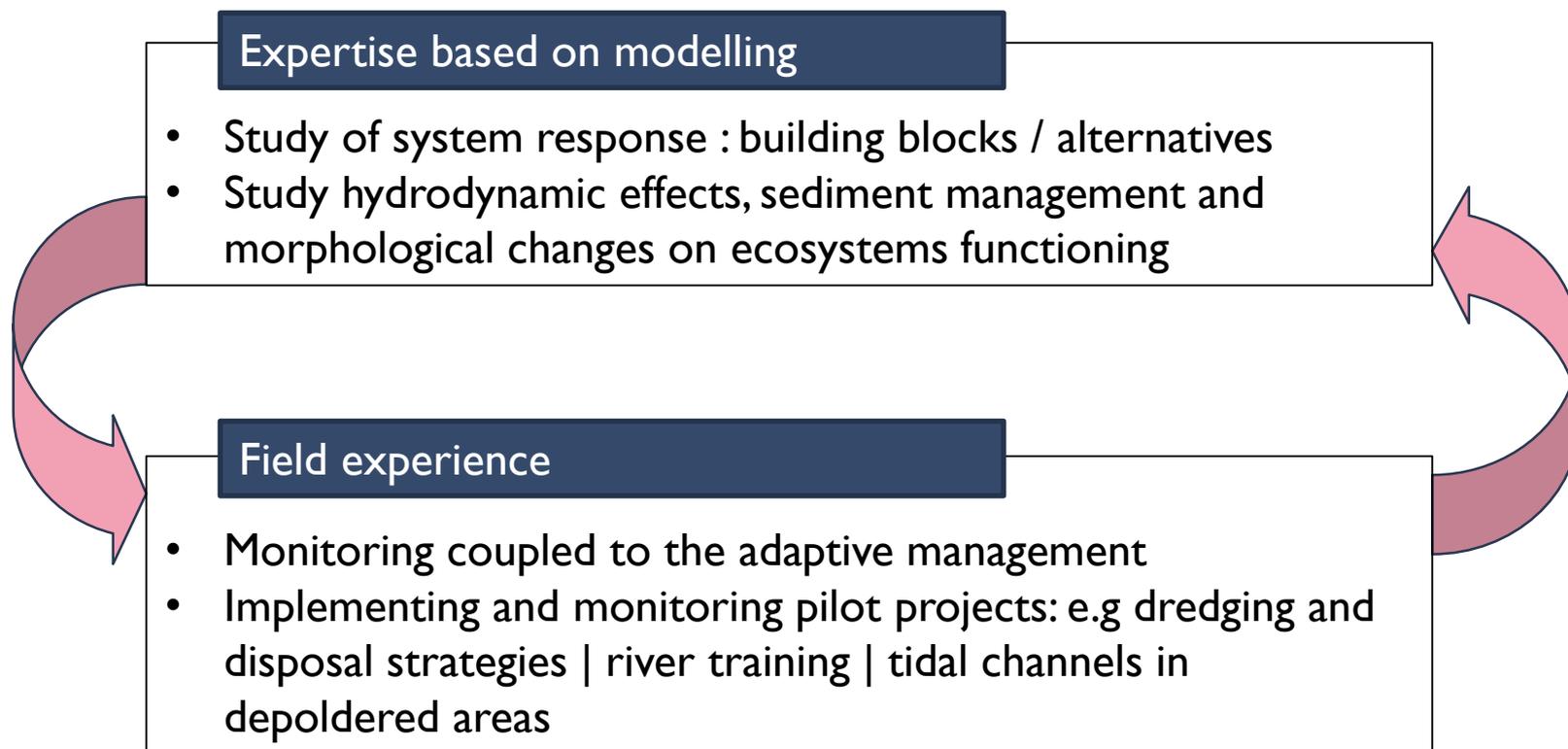
(Coen et al., 1988)



(Updated) Sigmaphan as partial answer to challenges



New approach to tackle challenges



Sustainable Management Plan (SMP)

• Before SMP (2016)

- Ad hoc, based on reported problems and accidents
- No predefined profile for maintenance and sand extraction

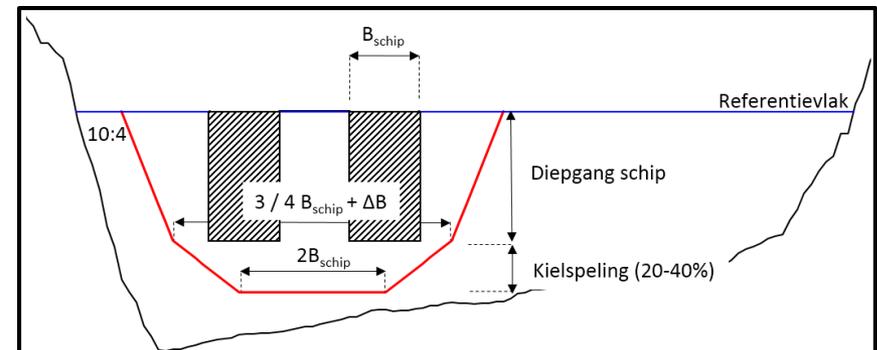


• After SMP (2016)

- Sustainable bathymetry
- Riverbank protection plan
- Tidal nature preservation plan
- Monitoring and evaluation plan



- **Goal** : maintenance of the navigation channel while limiting the impact on intertidal nature and the ecosystem



Pilot projects

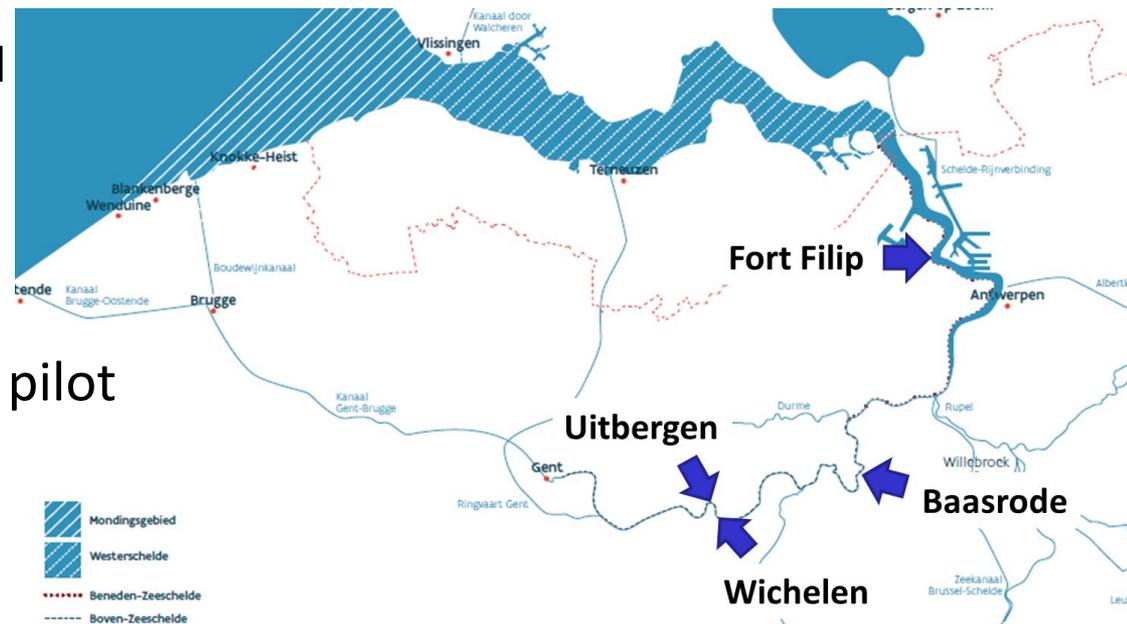
- **Aim :**

- Study **self-dredging technologies** to maintain a navigable fairway (Class Va)
- Explore building-blocks to **counter the rising tidal dynamics**

- **Techniques :**

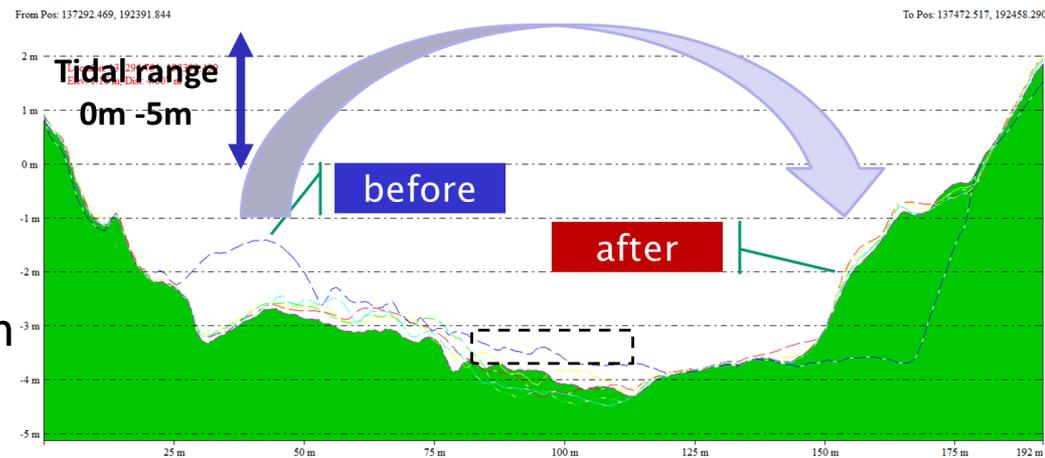
1. Willow mattress
2. Smart deposition of sand
3. Groyne
4. Flood channel

- Efficiency evaluated by frequent monitoring of each pilot



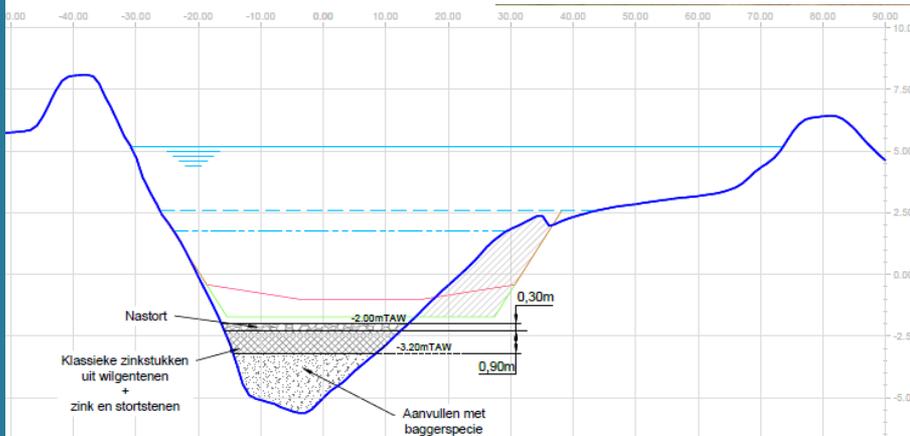
Pilot I : Baasrode – Oude Briel

- **Goal** : stabilise fareway & create favourable habitat for nature development
- **How** : dredging + deposit in adjacent lee area
- **Monitoring evaluation:**
 - Deposit very stable, some migration of sediments.
 - Aimed section within design limits after 1 year
 - Habitat increasing downstream because of natural sedimentation



Pilot 2 : Uitbergen

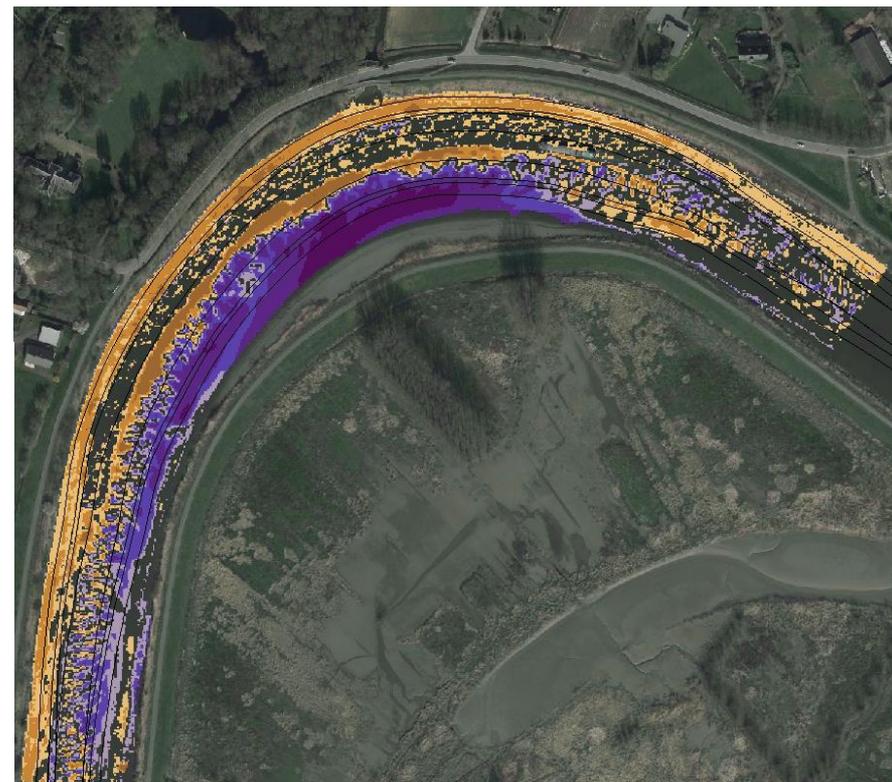
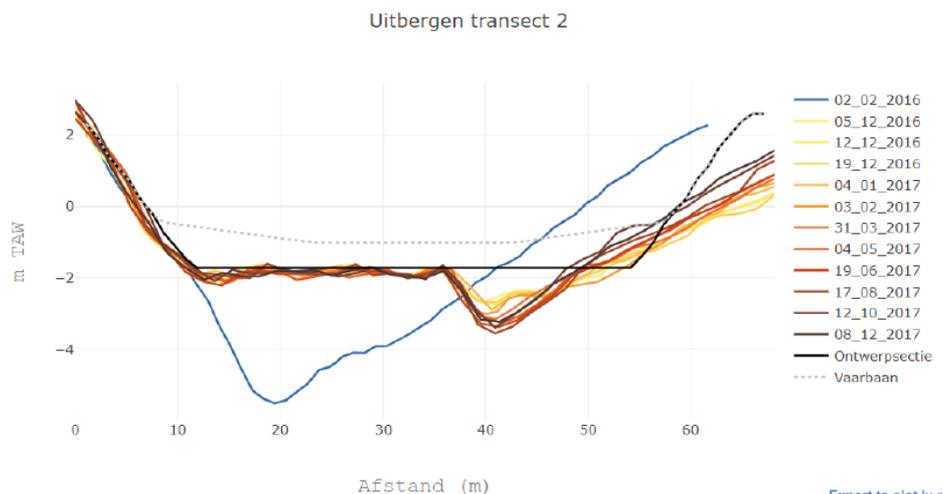
- **Goal** : Stabilise the fareway
- **How** : deposit sediment inner bend to outer bend + willow mattresses fixation covered with carried rock



Pilot 2 : Uitbergen

• Monitoring evaluation:

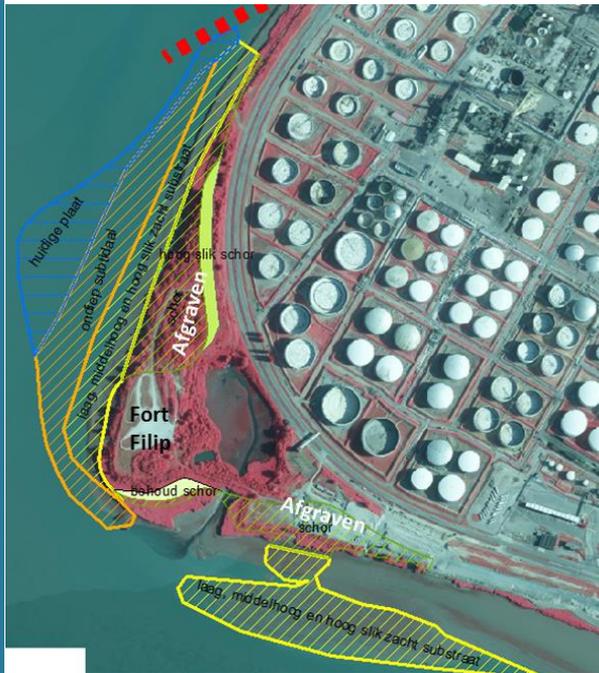
- Filled channel in outer bend stable
- Minor scour detection on the side: mattresses stable
- Very slow growth of the inner bend
→ no dredging till now +4years



Differential bathymetry (m) between December 2016 and 2017 (purple: shallowing; brown: deepening)

Pilot 3 : Fort Filip

- **Goal:** create valuable tidal flat/mudflat area in the inner bend
- **How:** groyne protected by geobags, willow mattresses and rip-rap.
- **Status:** Works and monitoring ongoing.



Pilot 4 : Wijmeers

- **Goal** : Limit tidal penetration and reduction habitat of mides
- **How** : Flood channel creation in the reclaimed polder area of Wijmeers
- **Status**: Works and monitoring ongoing



Conclusion Pilots & Sustainable Management Plan

• Sustainable maintenance

- Allows for adaptive management
- Guarantees safe shipping
- Monitoring is essential part
- Effectively reduces
 - maintenance effort
 - impact on nature

• Pilot projects

- Promising first results
- Success depends on
 - Execution technique: willow mattresses > geo-containers
 - Hydrodynamics of sediment disposal site
- Installation cost are low (sediment is reused on location)

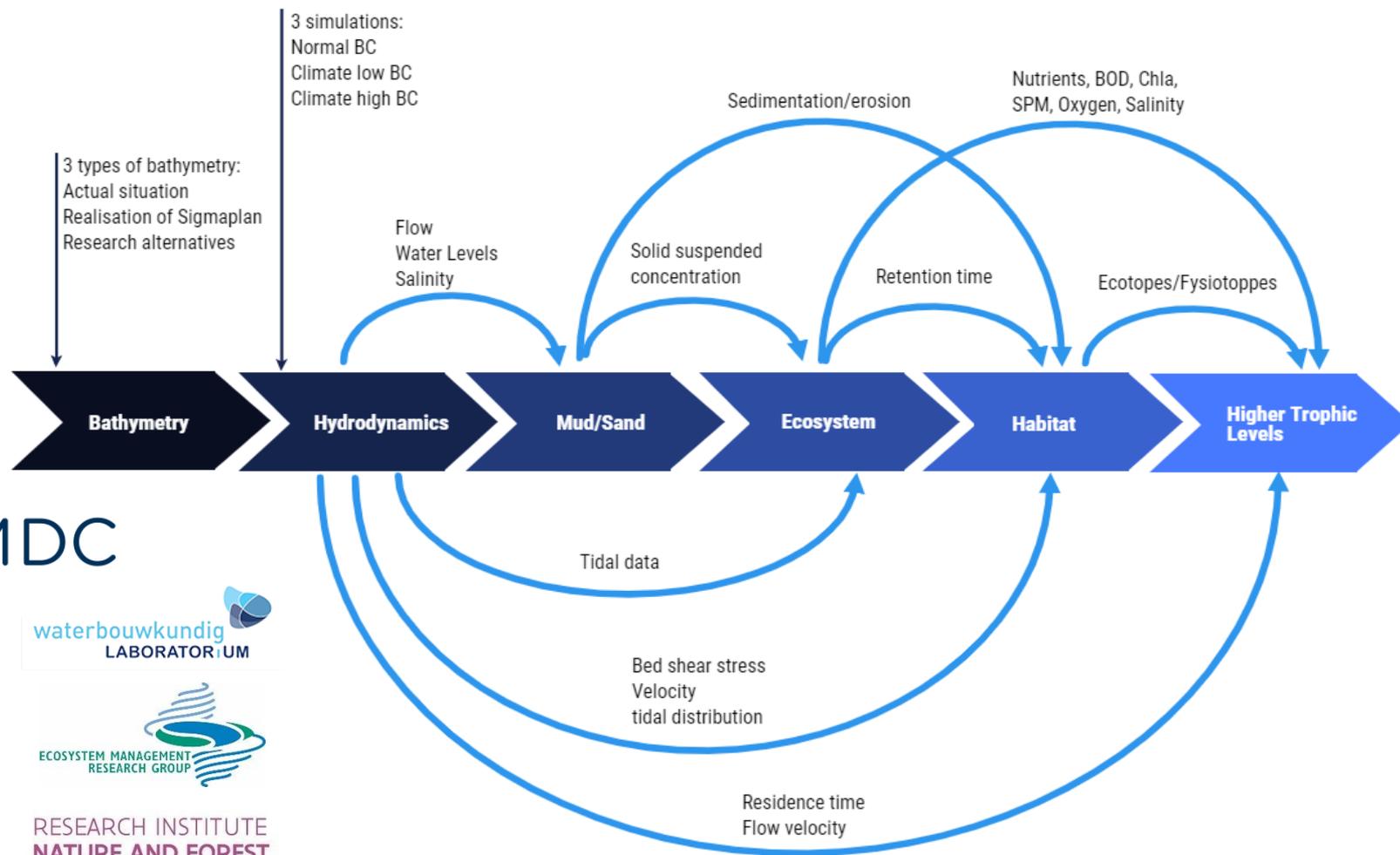


Today/Future = Integrated Plan

- Integrated Plan
 - How to counteract undesired developments?
 - How to strengthen the system in the future without jeopardizing its functions?
- **Step 1** : Applied scientific system research
- **Step 2** : Combining measures and study of alternatives
- **Step 3**: Define vision for the estuary



Step I : development of model tools



Partners:



RESEARCH INSTITUTE NATURE AND FOREST



Step 2 : Building Blocks

- **Building blocks**

- **Type-measures** bend straightening, depoldering (managed realignments), flood channels (*pilot Wijmeers*), FCA, FCA-CRT, groynes (*pilot Fort Filip*)
- **Location selection** based on social evaluation by consulting responsible authorities and representative of social groupings (agriculture, nature, ...)
- **Investigate system-level effects** varying scale and location in the estuary

- **Alternative** : Combination of multiple building Blocks

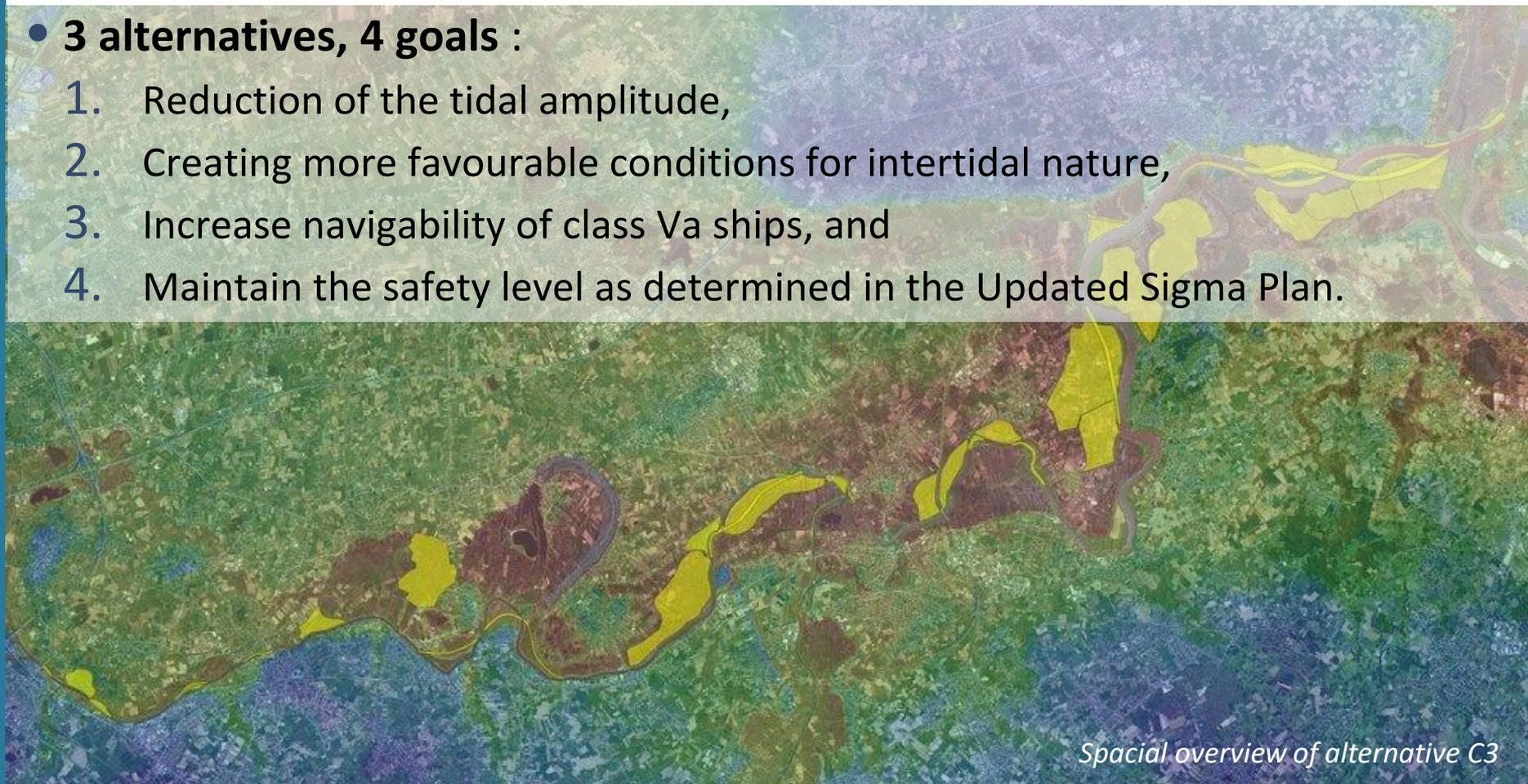
- ➔ Alternatives defined keeping challenges in mind

- ➔ Study of alternative with modelling tools from step 1

Step 2 : Alternatives 2050

- **3 alternatives, 4 goals :**

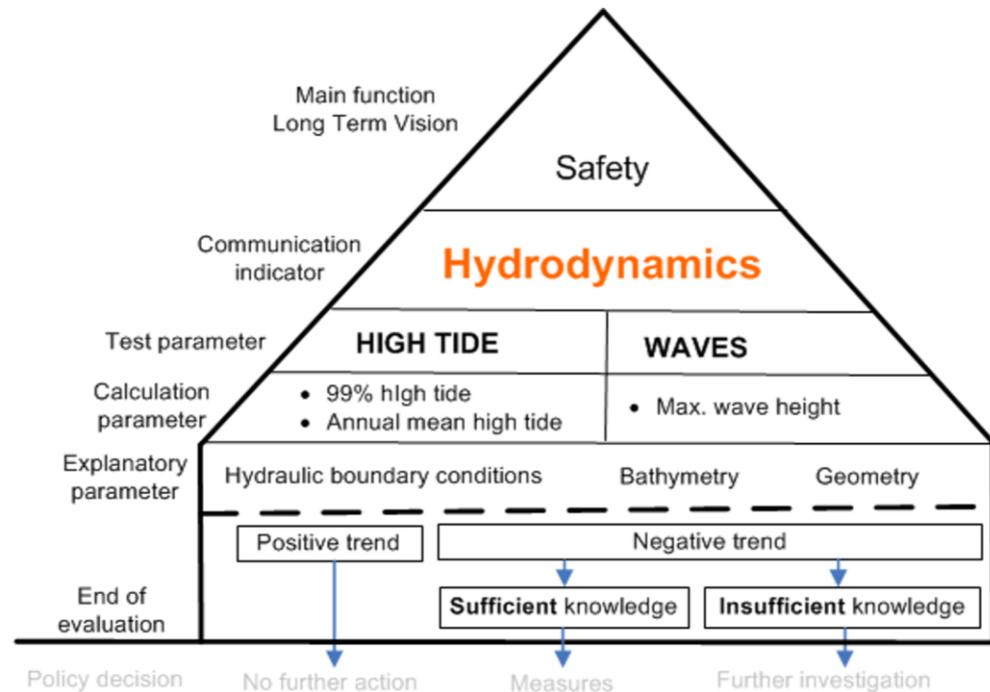
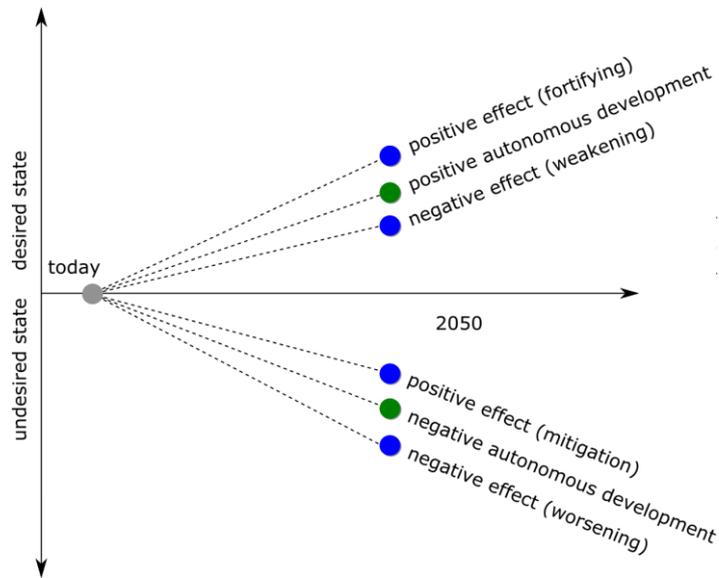
1. Reduction of the tidal amplitude,
2. Creating more favourable conditions for intertidal nature,
3. Increase navigability of class Va ships, and
4. Maintain the safety level as determined in the Updated Sigma Plan.



Spatial overview of alternative C3

Step 3: Towards a vision

- Evaluation of the alternatives using **evaluation framework** on key parameters (Oxygen level, habitat area, SSC, high water level,...) based on modeling and expert knowledge
- Identify sustainable and multifunctional building blocks to be combined in a vision for the estuary



Conclusion

- **On the Short term**, maintenance of navigation channel while limiting the impact on intertidal nature and the ecosystem is tackled by
 - **The Sustainable Management Plan**
 - Limiting the dredging activities and impact on estuarine nature.
 - **The realisation and monitoring of several pilot projects**
 - Self-dredging capacity of multiple measures (willow mattress, smart deposition of sand, groyne and floodchannel) is investigated in practice.
- **On the Long term**, Expert insight combined with simulations show the need for additional measures to tackle negative impact
 - The research on the alternatives being done in the **Integrated Plan**, taking into account results from the Pilot Projects and the Sustainable Management Plan.
 - Formulating a **Vision** that entails a sustainable and balanced multifunctional system towards 2050 and beyond.



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