

# Towards a Holistic Integrated Strategy for Pumped Hydro Storage, Water Safety and Biodiversity



Conseil Européen des Economistes de la Construction , October 3rd, 2025

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## Case study: Delta21



**Watersafety**  
**Energy storage**  
**Nature enhancement**

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# Agenda

- **Who is Who**
- Introduction
- Need to protect the Netherlands
- Delta21 concept
- Energy - Watersafety – Haringvlietmouth – Nature/biodiversity
- Collective challenge: Up to realisation !!

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# Who




Transition Delta21 Ltd  
to  
Delta21 Cooperative

- Huub Lavooij & Leen Berke: initiators Delta21
- HTS Flushing and TUDelft; coastal engineering



Volker Wessels, Royal Haskoning-DHV en  
Rijkswaterstaat, attaché China I&W

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## The Netherlands below sealevel

### Challenges:

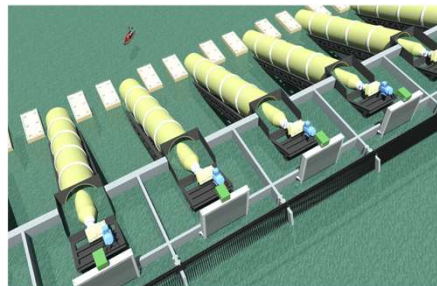
#### 1. Living safe Below Sea level:

- Rhine discharges low and extremes
- Sea level rise
- Storms at sea

#### 2. **Energy Transition**

#### 3. **Biodiversity**

#### 4. **Geopolitical**



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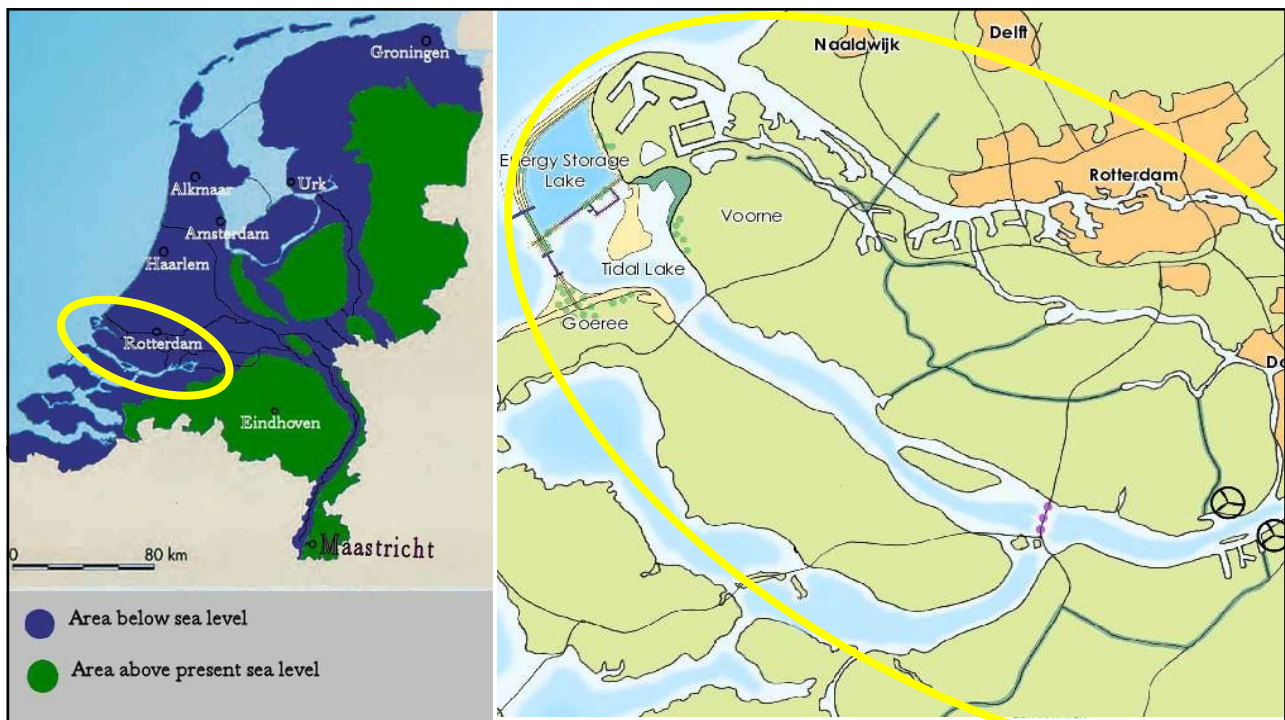
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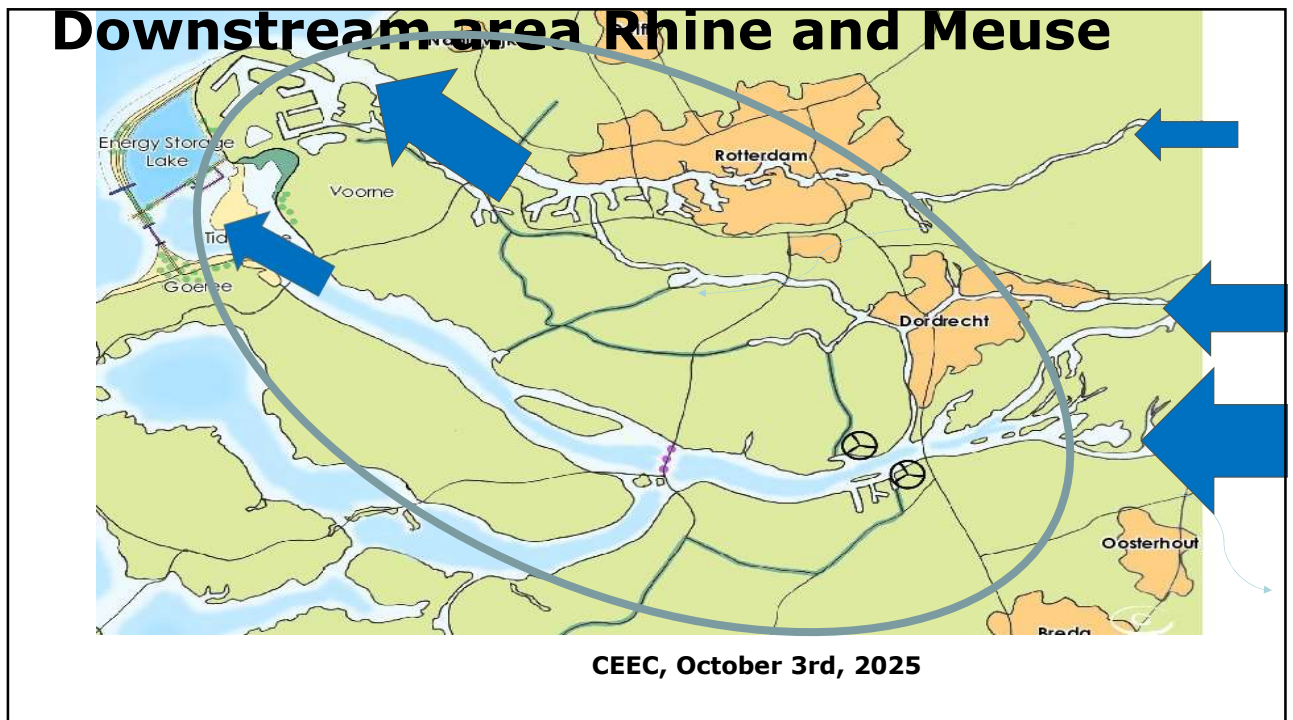


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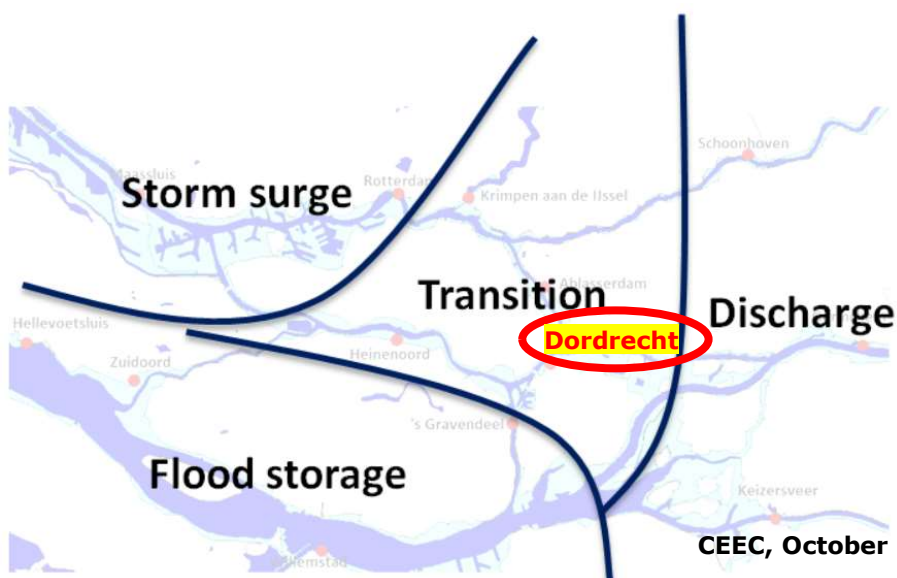
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## RHINE+MEUSE DISCHARGE DISTRIBUTION TO NORTH SEA



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## Influence river discharge and Storm Surge



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## Inundated areas in 1953 by heavy storm North Sea



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## Deltaworks: Protection against floods 1960-1990



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## **Maeslant barrier New Waterway (1990-2070)**



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## **Haringvlietdam + locks (1970-2070)**



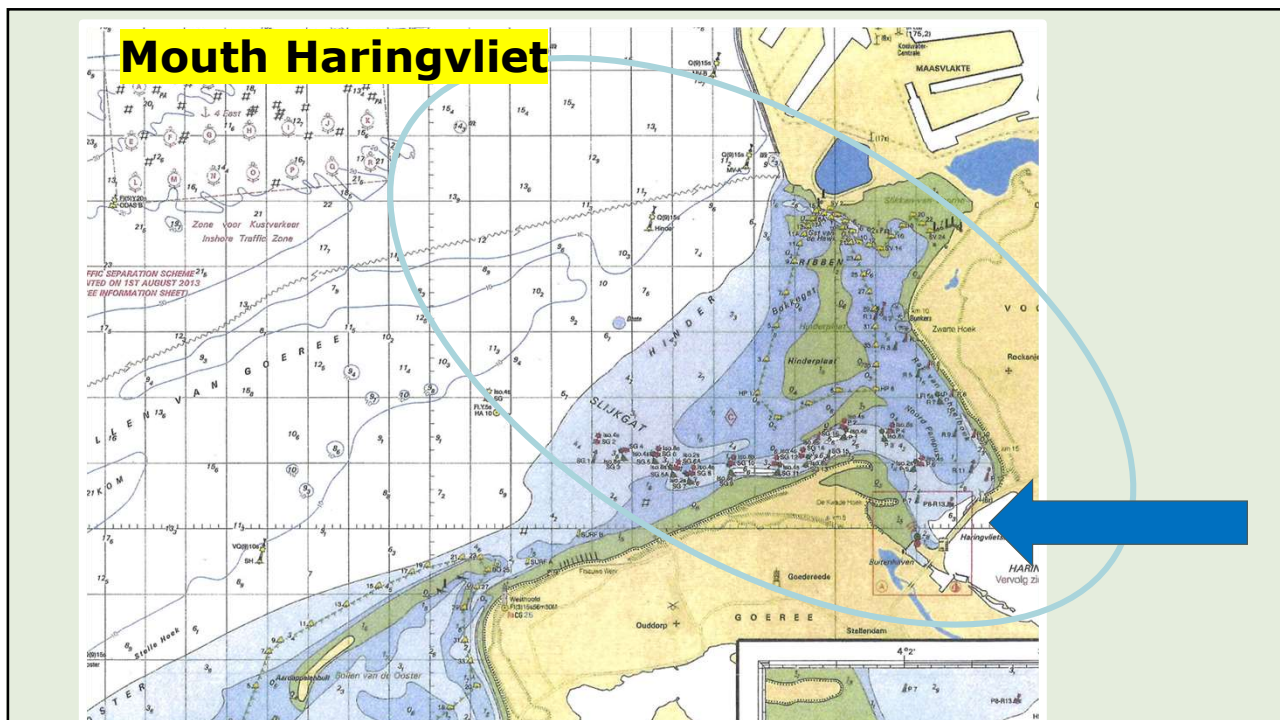
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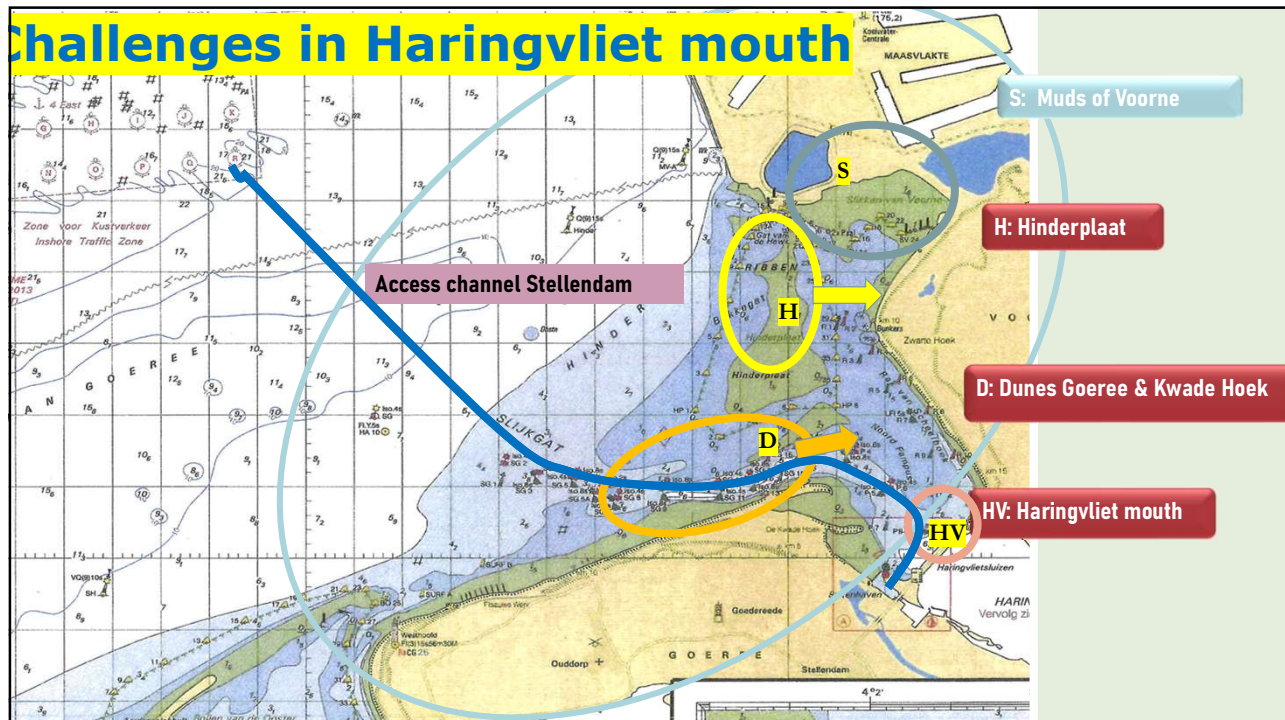
## Other Challenges in the Rhine-Meuse delta area

<b>Watersafety storms and rivers</b>	<b>Natura 2000 biodiversity</b>	<b>Salt water intrusion and fresh water supply</b>
<b>Sea level rise and higher river peak discharges</b>	<b>Maeslantbarrier 2060 + prob. of failure</b>	<b>Low river discharges</b>
<b>Sedimentation of Haringvliet mouth (channel + beaches)</b>	<b>Fish Migration stopped due to barriers</b>	<b>Extension Maasvlakte 2</b>

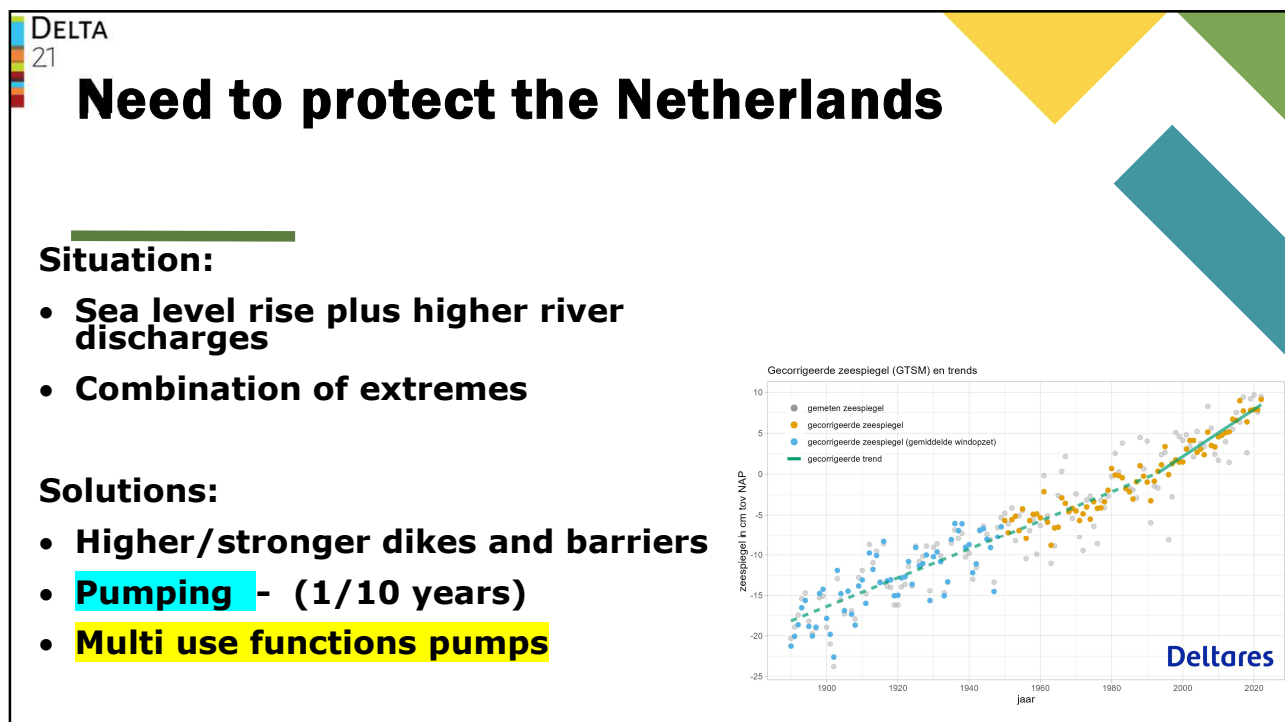
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## No room for pumps in New Waterway



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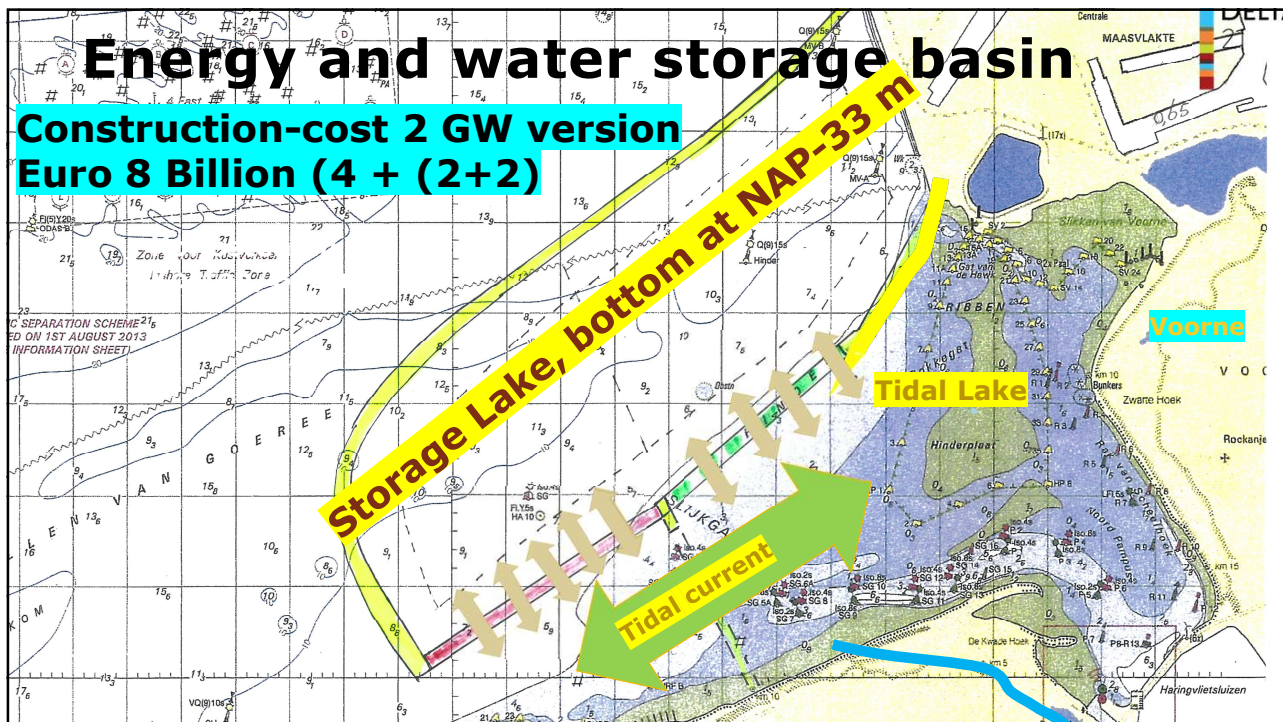
## Delta21: Integration 3 functions

### Water-Energy-Nature

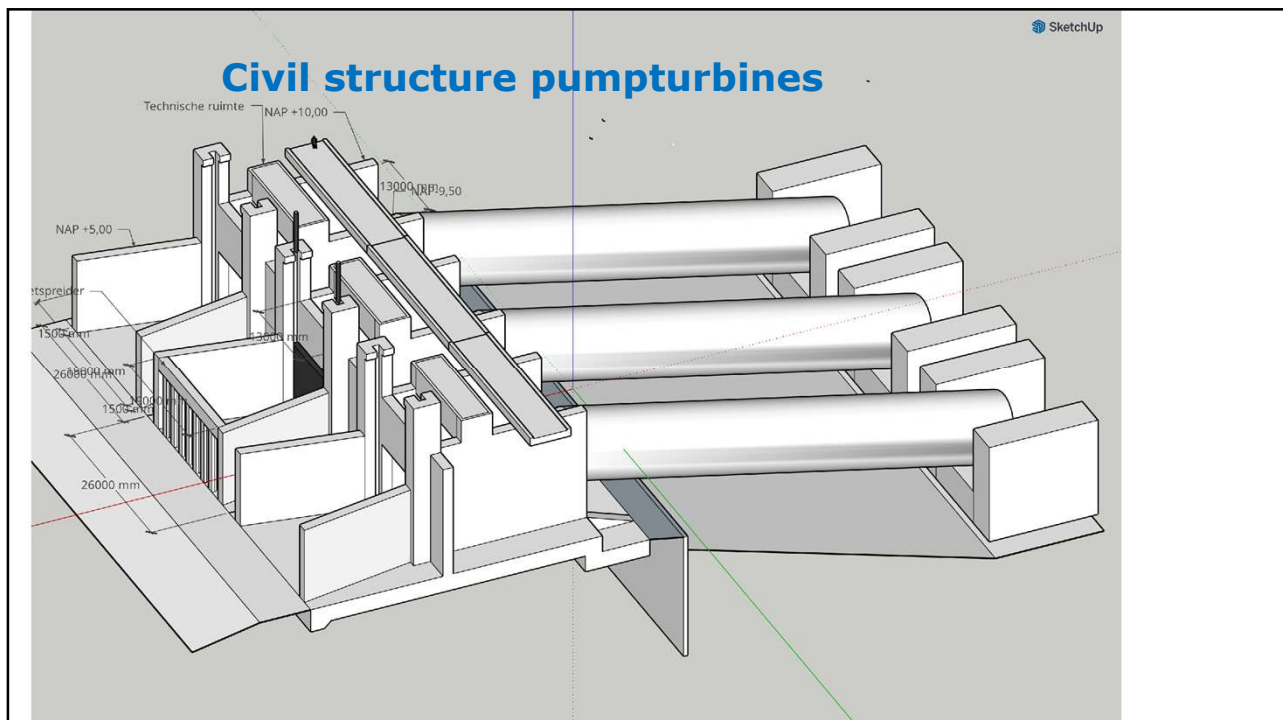
The diagram illustrates the Delta21 concept, showing the integration of three functions: Water, Energy, and Nature. The central feature is a 'Storage Lake' (circled in orange) which contains 'Pumpturbines'. A 'Spillway' connects the lake to the sea. A 'Tidal Lake' is shown further out, and a 'Barrier' is located at the mouth of the Haringvliet. Arrows indicate the flow of water and energy between these components.

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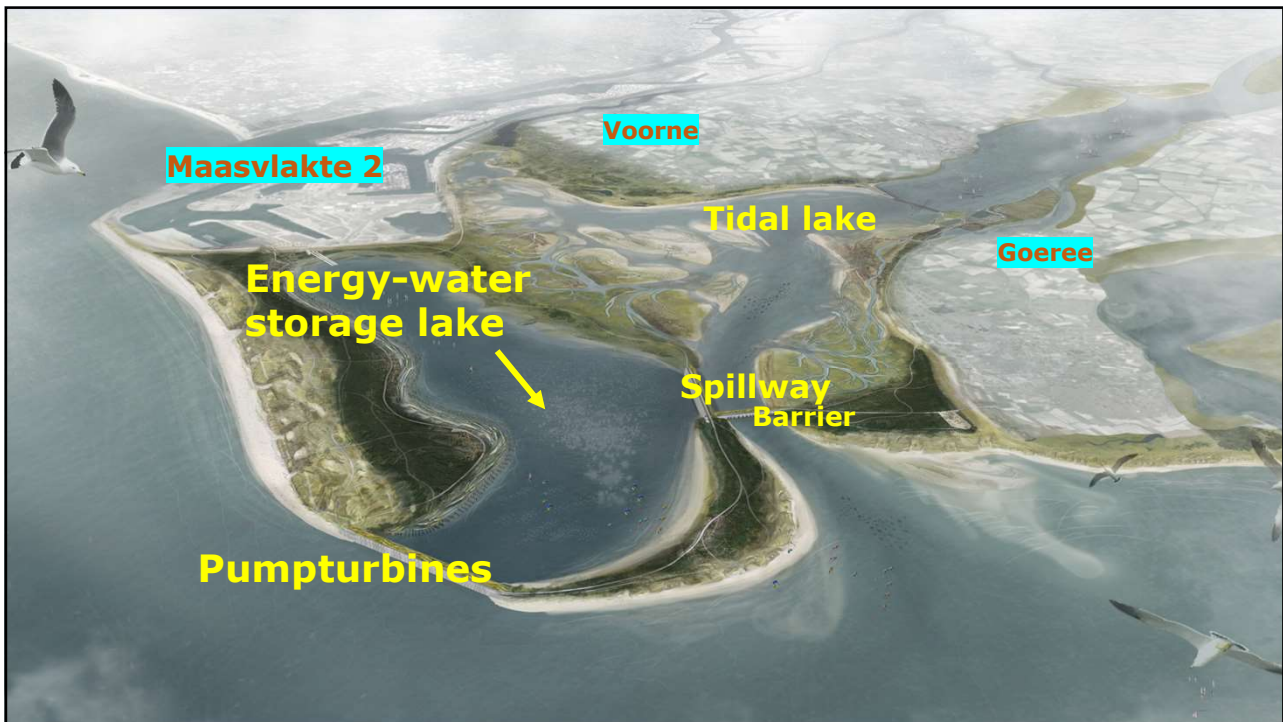




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## Delta21 offers:

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- 1. 34 GWh Energy storage (windpark-solarpark-aquabatteries)**
- 2. Watersafety Rhine –and Meusedelta**
- 3. Contribution to recovery biodiversity**
- 4. Solution for Haringvlietmouth**

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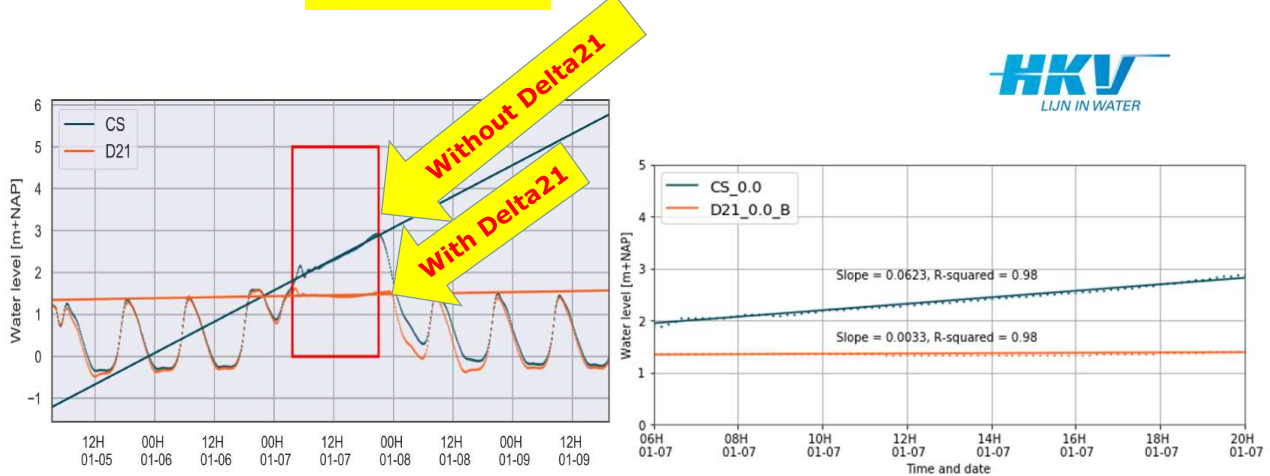
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## Waterlevel Dordrecht with and without Delta21



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## Wind Energy Programme Dutch offshore coast

**Red** : Windparks 2020

**Blue**: Wind parks route map 2023, 5 GW

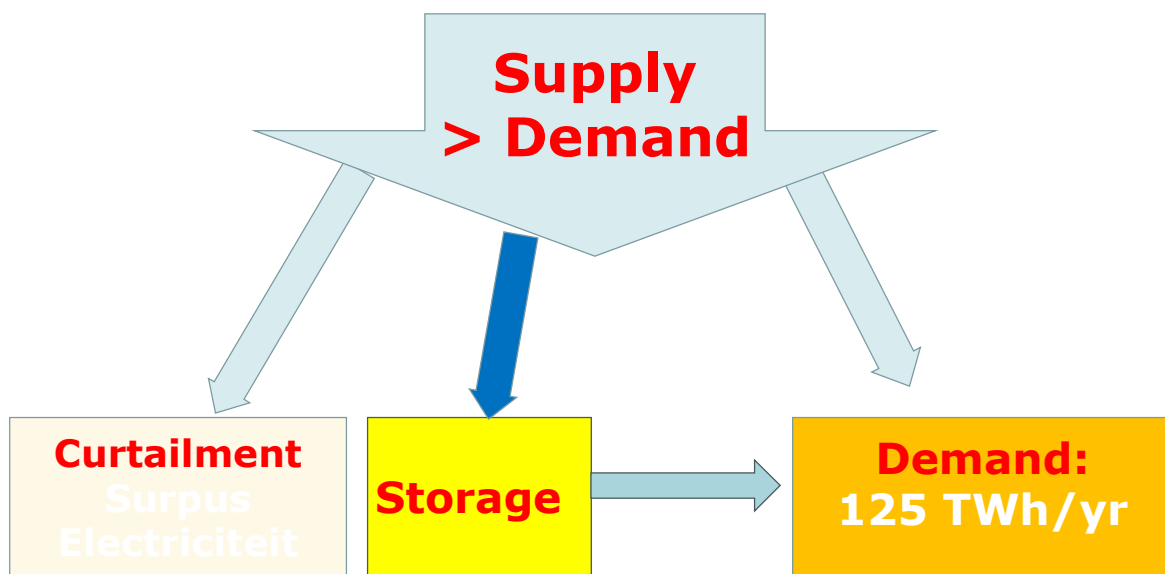
**Green** : Wind parks routemap 2030 21 GW

**Yellow**: After Ukraine: To 70 GW total in 2050



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## Energy storage model Netherlands Demand and Supply



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## Benefits energy storage by CEDelft:



- Day-ahead, unbalance- and FRR-market for **curtailment**
- Lower network reinforcement
- Contribution to security of supply
- **Lower energycost households max . € 1,8 bn/yr**
- Lower investments solar and wind: 0,5 - 4,5 GW wind or 3,5 - 28 GW solar-pv.
- Floating solar park windpark-aquabatteries
- Floating data center

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### Value 2 GW energy storage

- Tennet NorNed cable
- 700 MW HVDC , 580 km
- Dollard - Feda (Norway) transformatoren
- Investment € 600 mln,
- ROI period 6 years

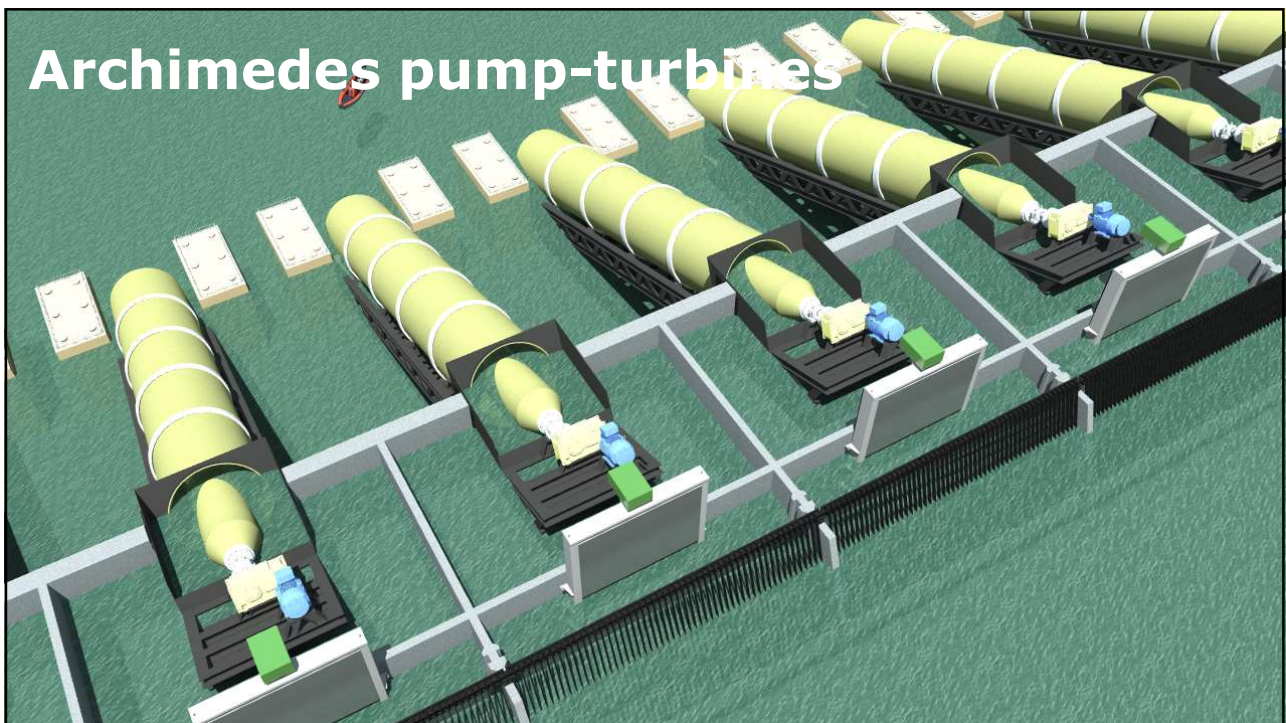
### Delta21-Arbitrage



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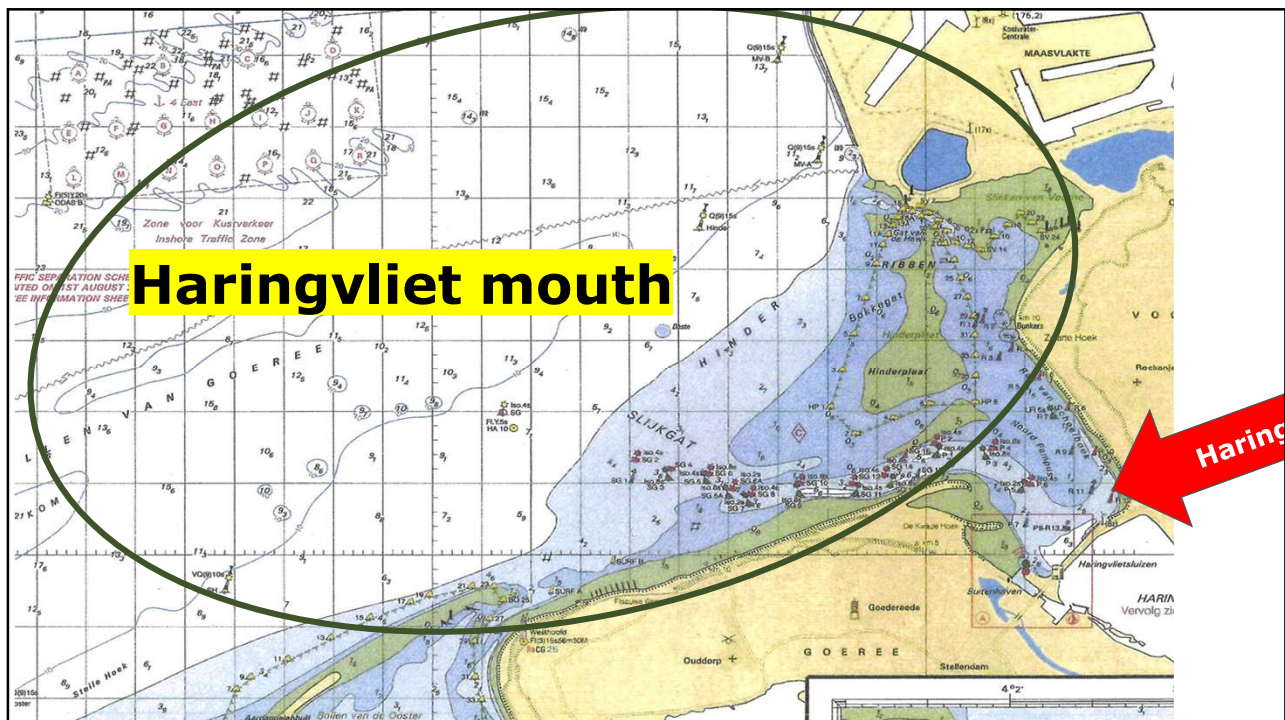
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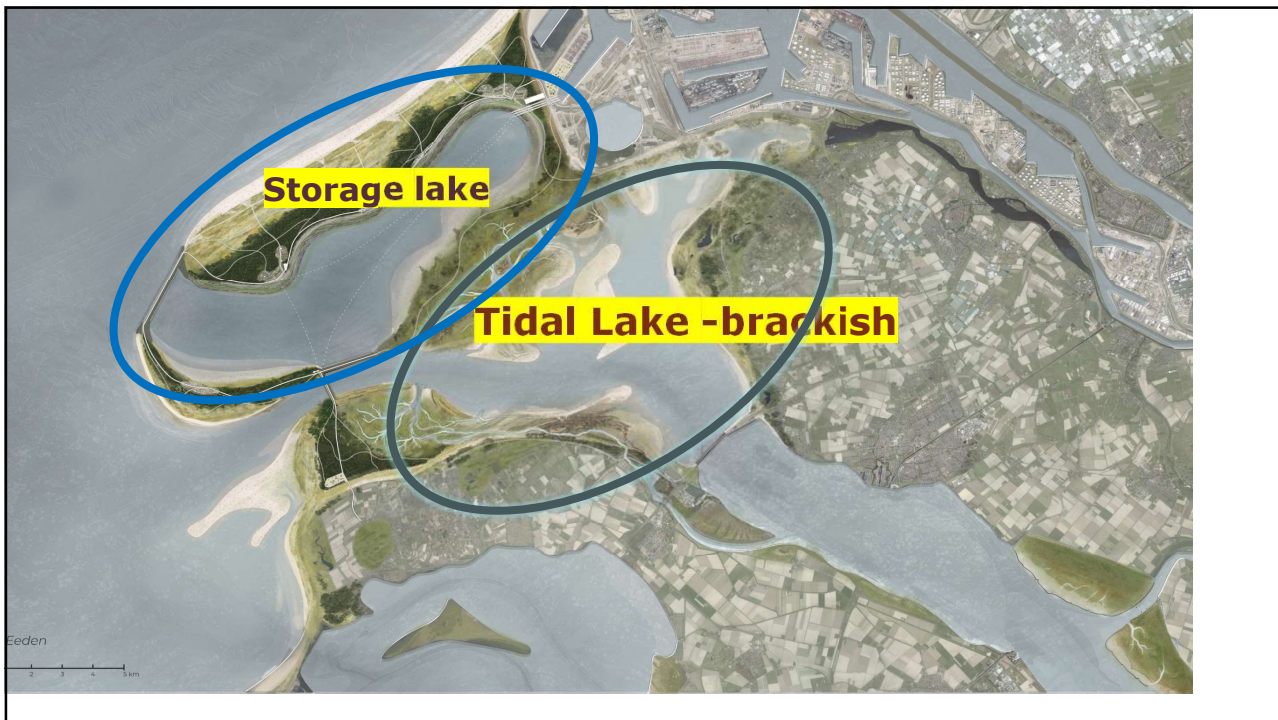
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## Haringvlietmouth

- Sedimentation and siltation of coastal area – sedimentation access channel and recreation (beach width and quality)
- Push back saline seepage water, damage to agri- and horticulture
- Commitment to European fishmigration recovery
- Natura2000 being depleted– positive impact on biodiversity
- Opportunities region for nature- & recreation

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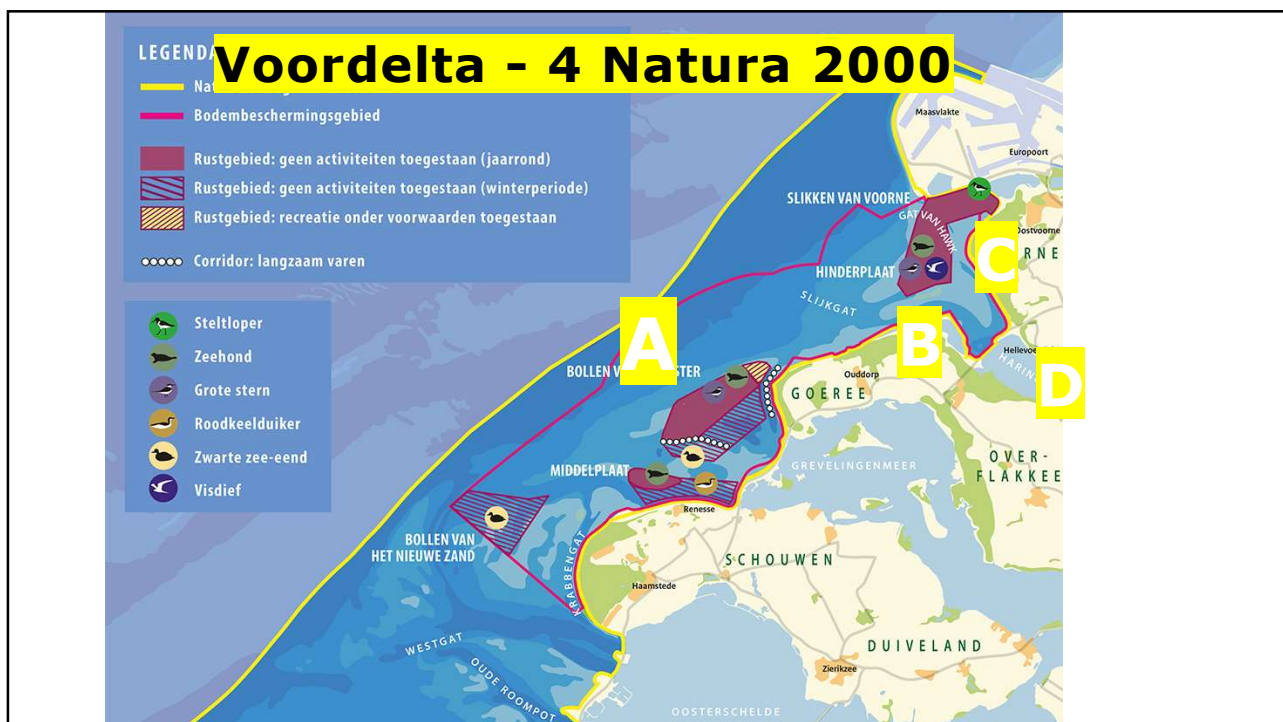
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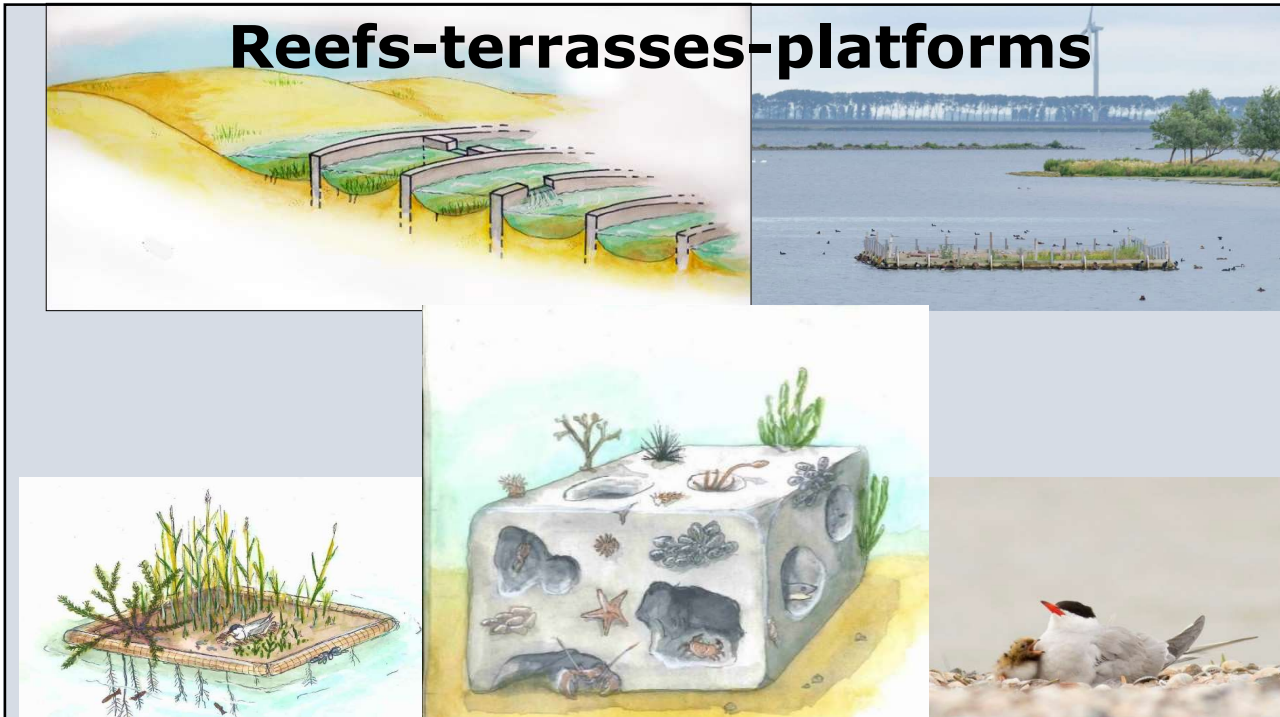
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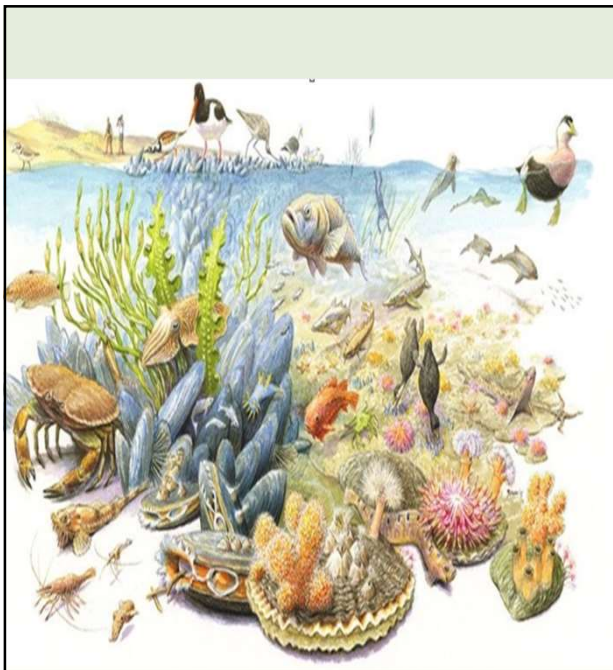


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## Reefs-terrasses-platforms

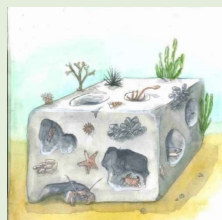


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### Compensation measures:

- Wetland Park in Tidal Lake
- Voornse muds
- 1000 Reefs
- Fish migration river
- Creeks and gullies
- 500 Terrasses + Floating platforms
- New Dune area



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## Options Fish Migration river



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## Fish Migration river: option North



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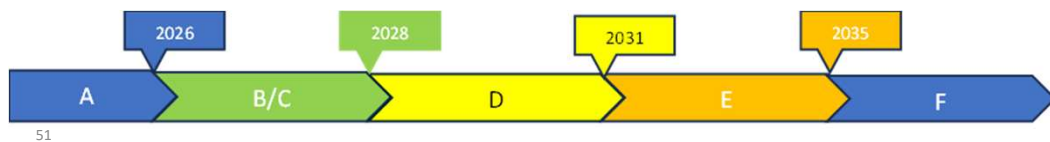
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## Process

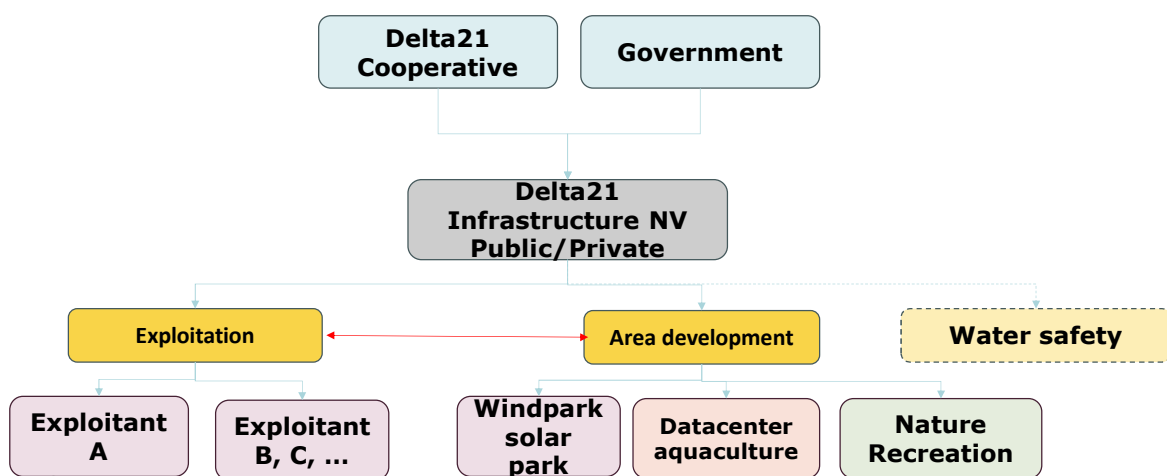
- **Delta21 cooperative May 2025**
- **SB feasibility KGG-I&W-LVVN**
- **Research subsidies**
- **Pilots**
- **Stakeholders**
- **Partners**
- **Politics-lobby-Europe**
- **Permits**



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## Delta21 Cooperative to Public/Private NV



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## Delta21 concluding

**Integrated approach Flooding, Energy Storage and Nature restauration**

- **Environment:** fish migration, Tidal Lake, fishfriendly pumps, local materials, > lifetime, < CO2 , biodiversity, Haringvlietmouth
- **Discharge of surplus river water – surplus of water storage, water safety, lower salinity intrusion, fresh water supply**
- **Energy Storage:** 34 GWh, 2-8 GW, curtailment, energy-balancing, netcongestion lower investments in wind- en solar parks, floating wind and solar park
- **Synergy with port extension**
- **100% Dutch product and proven technology**
- **Robust – attack proof**

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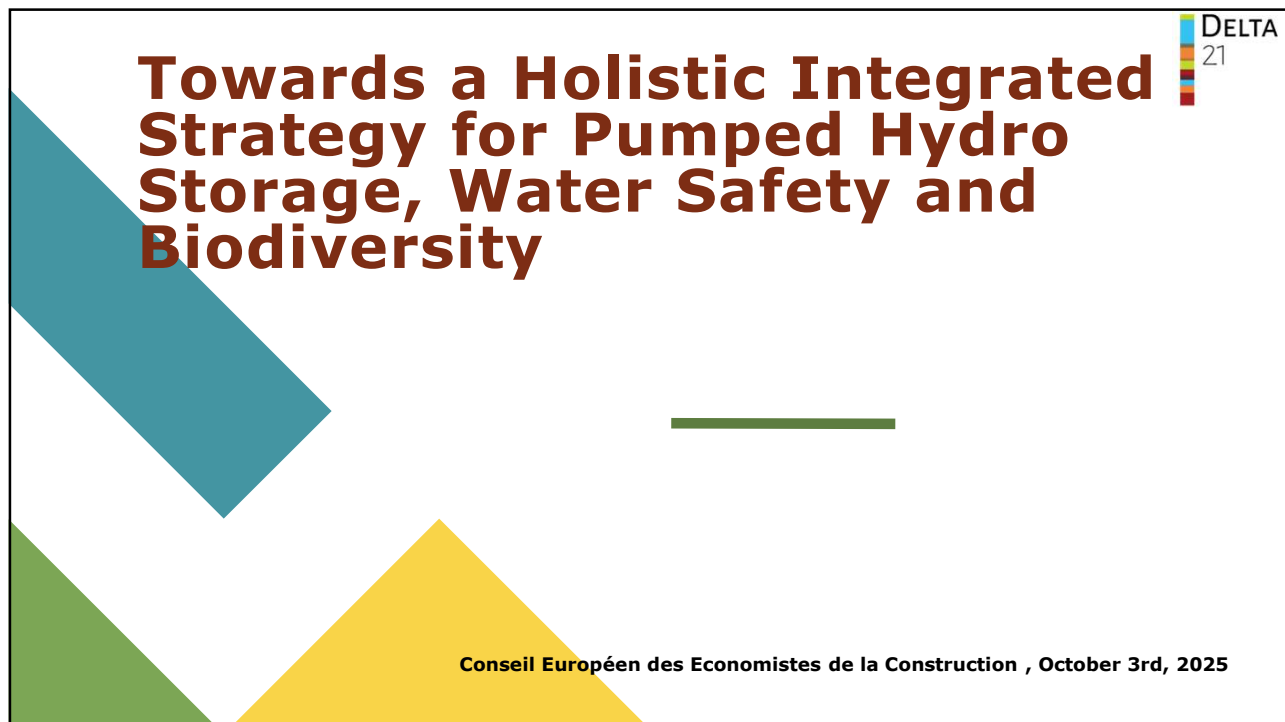
# Thanks

Huub Lavooij  
Delta21 bv Cooperative Delta21

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