adaptive water management under climate change

The Dutch Deltaprogramme

from Knowledgebase to Advice and Programme

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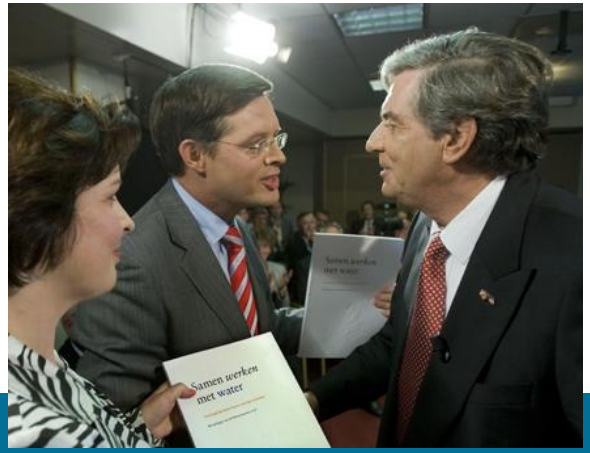
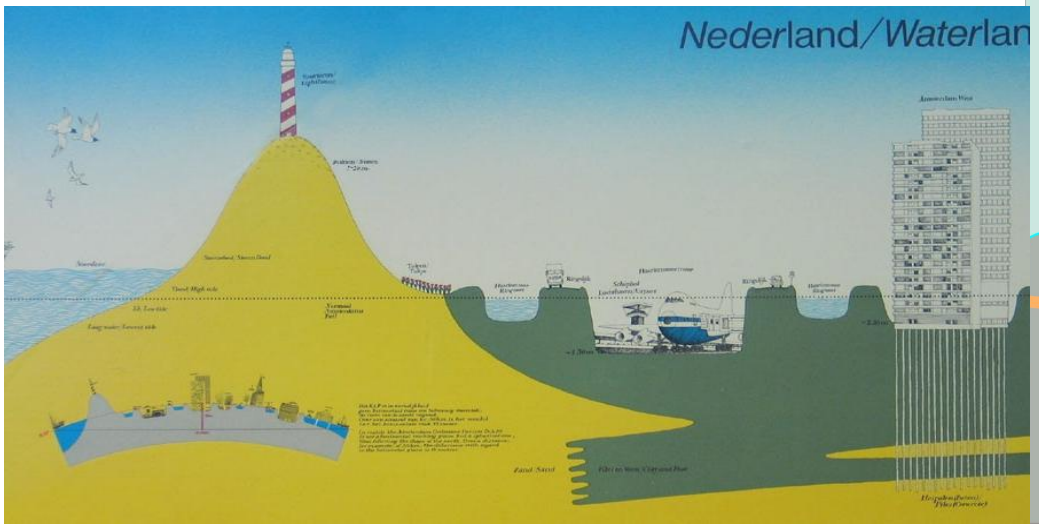
Climate change and it's consequences for water management in the Netherlands

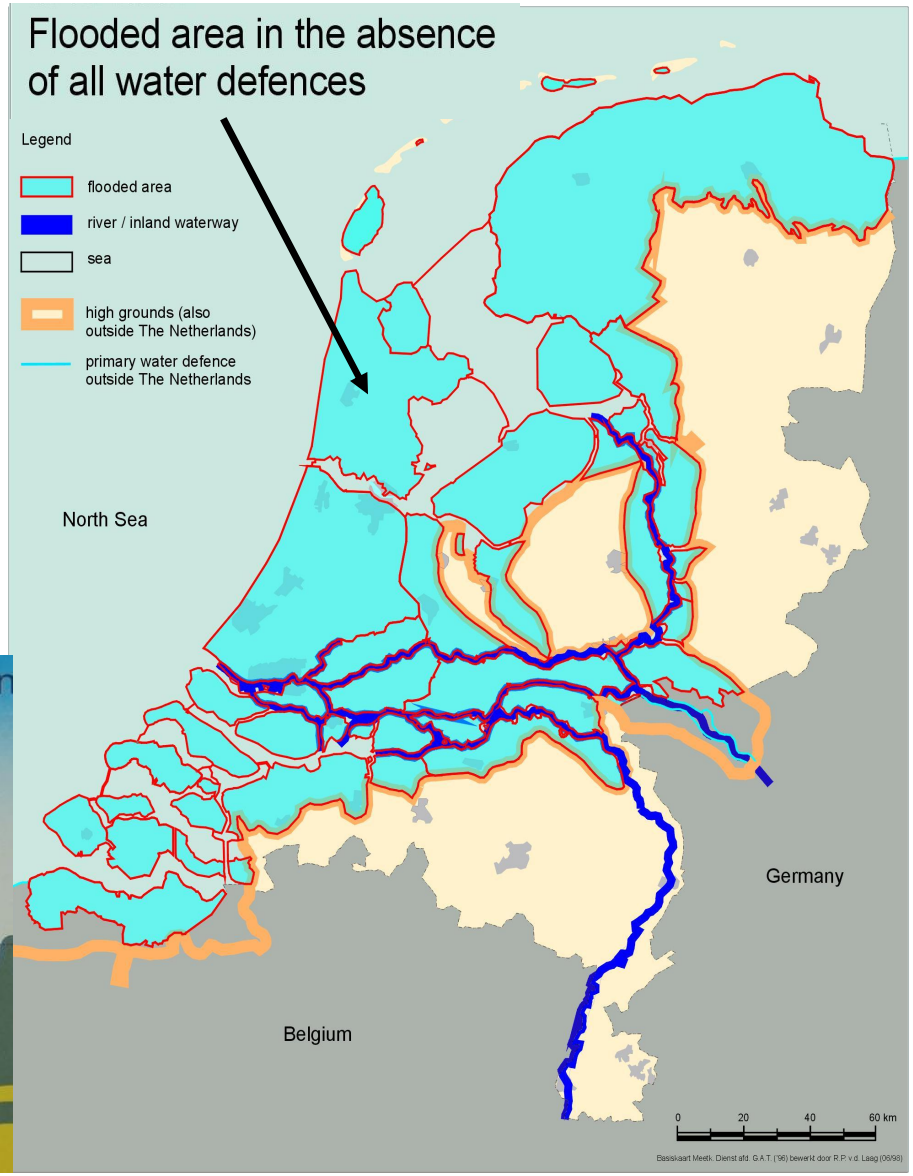
- First studies in the 1980's
- 2008: second Delta Committee comprising a.o.:
  - an international review on anticipated sea level rise and changes in river discharges
  - focussing at "tipping points" for present Dutch water management policies



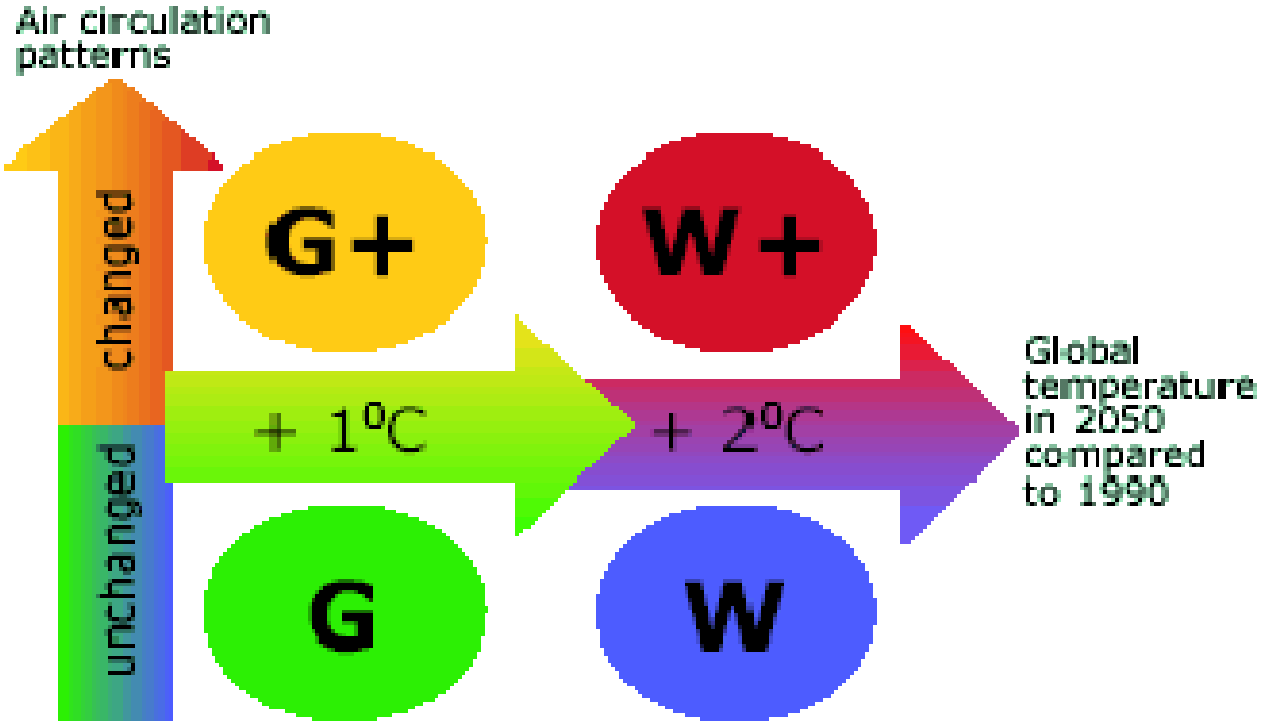
Flood protection is crucial for the Netherlands:

- 60% of the country is potentially threatened by floods
- 10 Mln people live in these areas, and 65% of the GNP (600 billion US$) is generated here
- Large cities like Amsterdam and Rotterdam are well below sea level

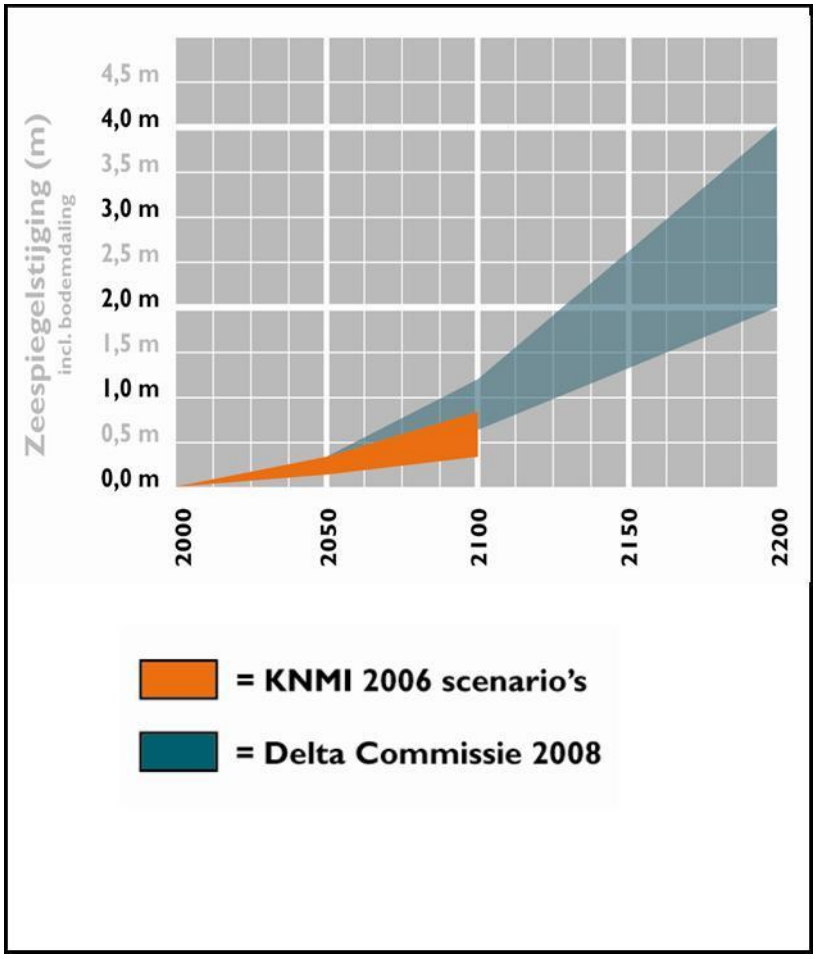




Climate Change scenario's used include anticipated changes in temperature, air circulation and rainfall patterns

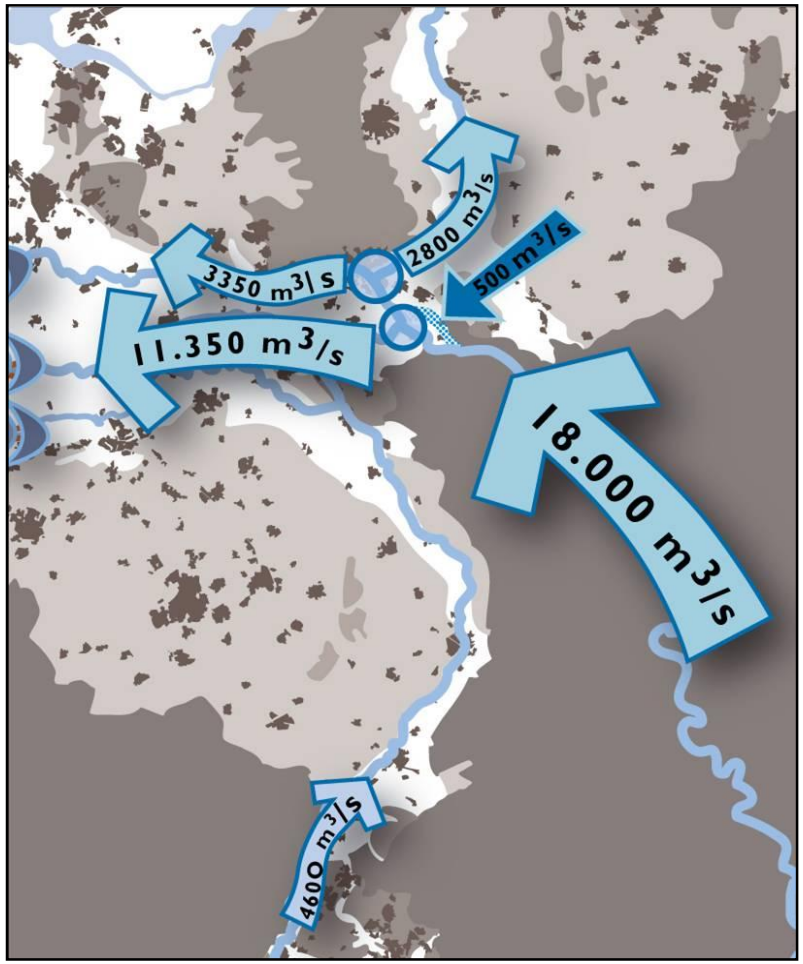


Anticipated maximum Sea level rise



- 2050: + 0.4 m
- 2100: + 0.65 to +1.30 m
- 2200: + 2 to +4 m

Anticipated changes in river discharges



River Rhine:

Summer:

1700 m^3/s →

700 m^3/s in 2100

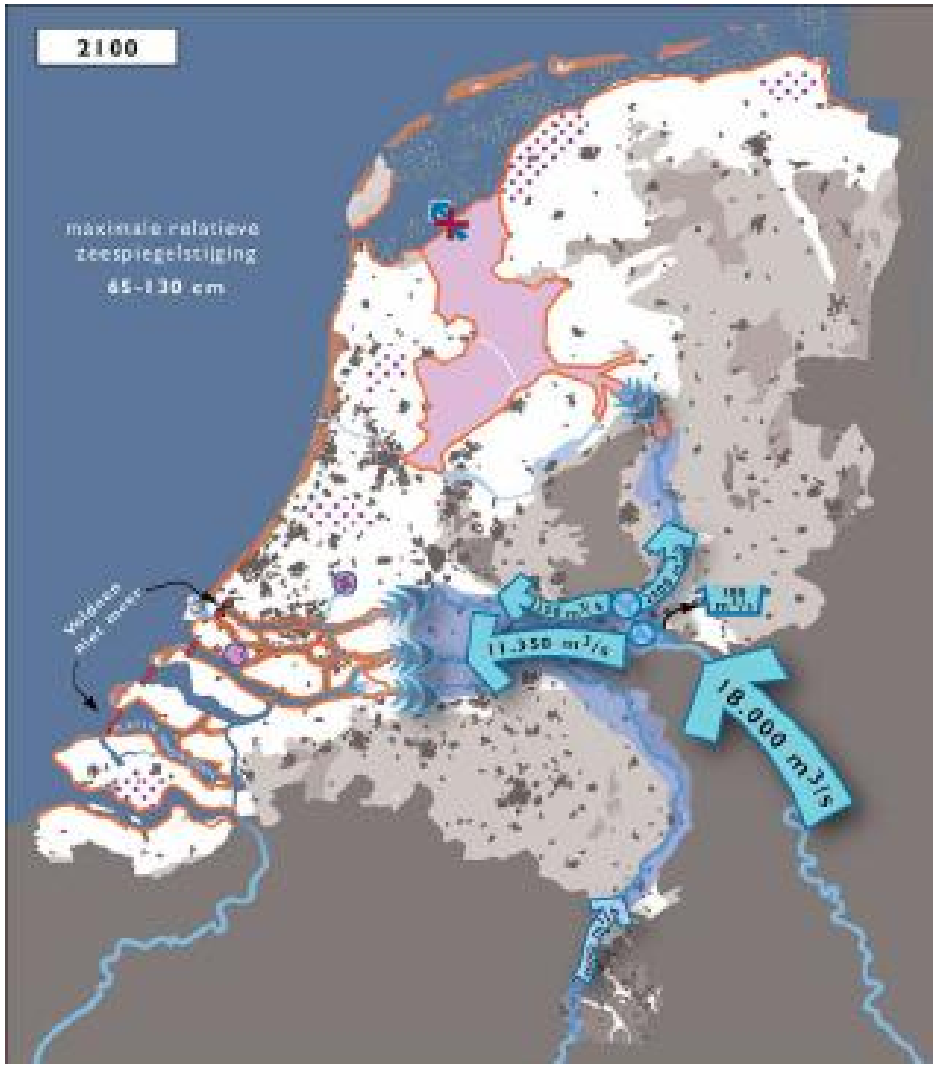
Winter:

16.000 m^3/s →

18.000 m^3/s in 2100

Consequences for:

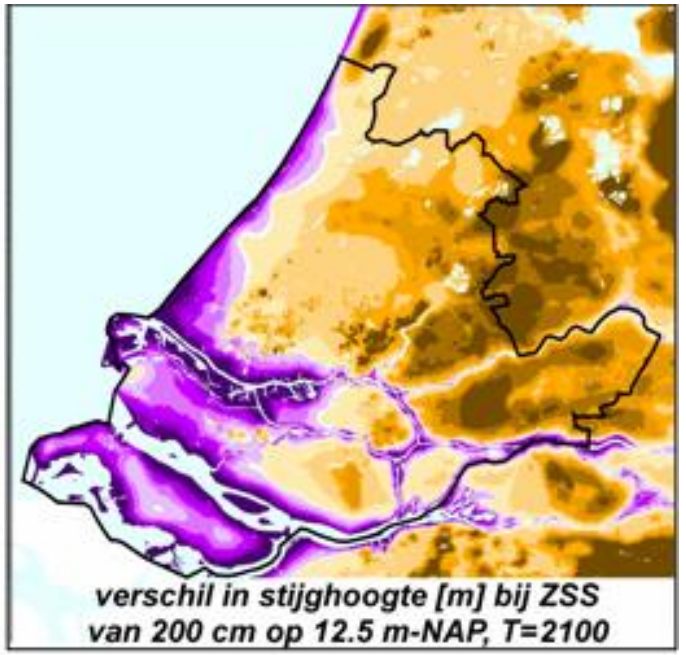
- Fresh water supply
- Flood safety along rivers and the coast
- Ecosystems & biodiversity
- Inland shipping



Fresh water availability

Expected “tipping points” for salinity in the Dutch river estuary:

- In 2050 high exceedence of critical salt concentrations for water supply and irrigation
- Influence of sea level rise still limited
- High saline intrusion in the province of Zuid-Holland, comparable with that in the provence of Zeeland now



Safety against flooding along the sandy coast

Expected “tipping points” for beach nourishment of the Dutch coast:

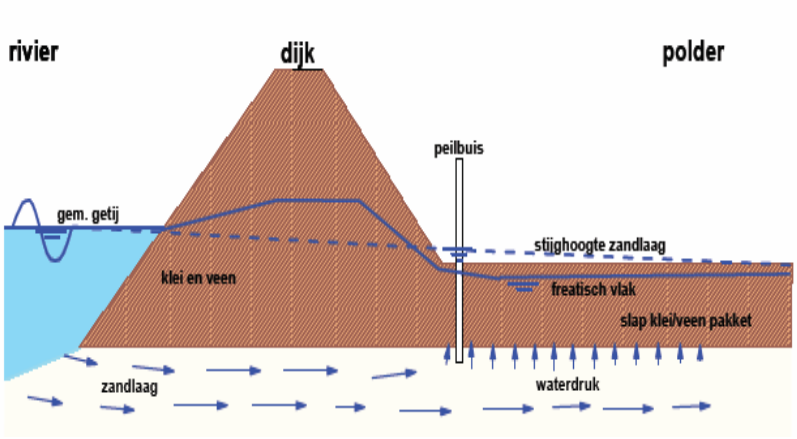
- beyond 2100,
  present practices may need to be intensified
  - Enormous stock of sand, enough to cope with a sea level rise of +5 m (350 Million m3/y)
  - Current amount: 12 million m3/year
  - Current costs: 40 million €/year
  - Increase annual costs << increase GNP/year
  - Sand stocks should be claimed in time in the context of North Sea spatial planning

Storm surge barriers: with a sea level rise between 50 and 100 cm these huge structures do not meet Dutch flood risk safety standards

Safety against flooding along the major rivers (constructions)

Expected “tipping points” for levees / dikes along the major rivers

- In 2050: variable



Technical aspects:

- No limitations until 3 m.
- In some areas (weak soils, high groundwater pressure) extra wide dikes are neccessary

Spatial impacts:

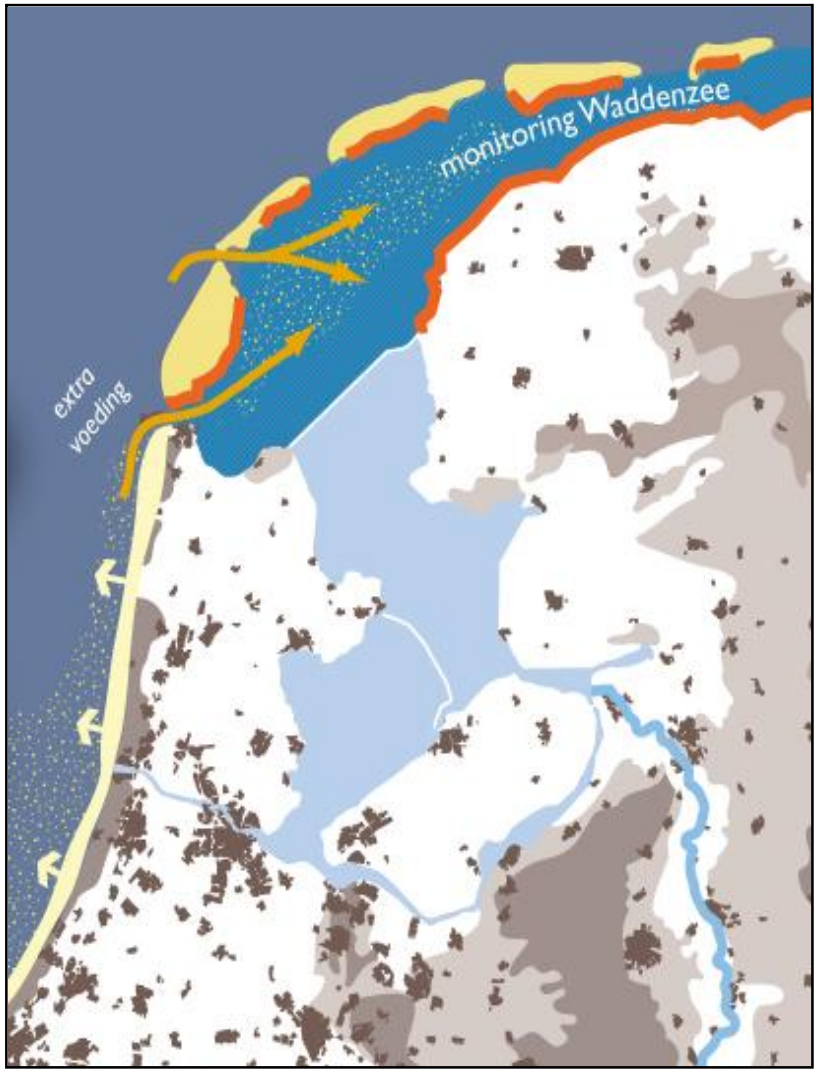
- due to limited space ‘hard’ constructions needed in some areas

Costs:

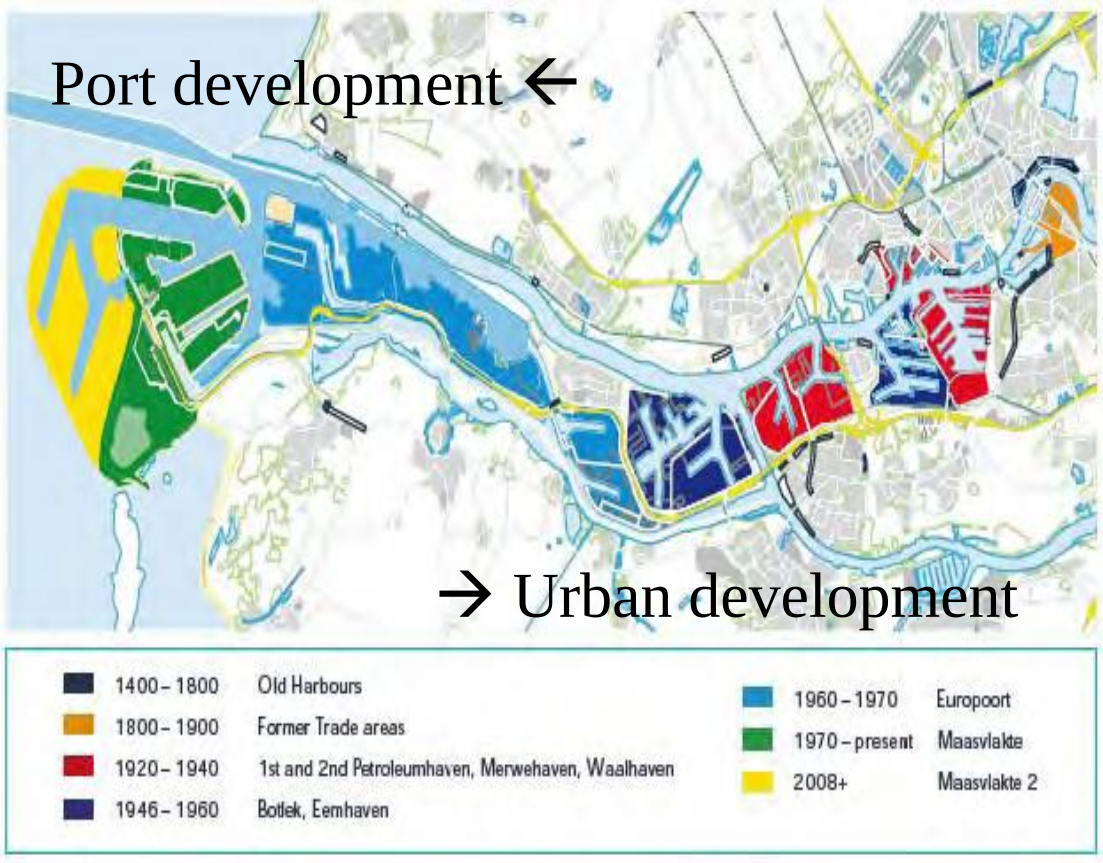
- Factor 2 to 10 more expensive

Nature development in the Dutch Wadden Sea

- UNESCO world heritage
- Unique landscape of intertidal areas (plates)
- Is expected to be able to grow with a sea level rise of 30 cm/century
- Is expected to be inundated permanently when sea level rises over 60 cm/century



Urban development in Rotterdam City & Harbour area



Old view:

- Water is a threat

New view:

- Water is an opportunity

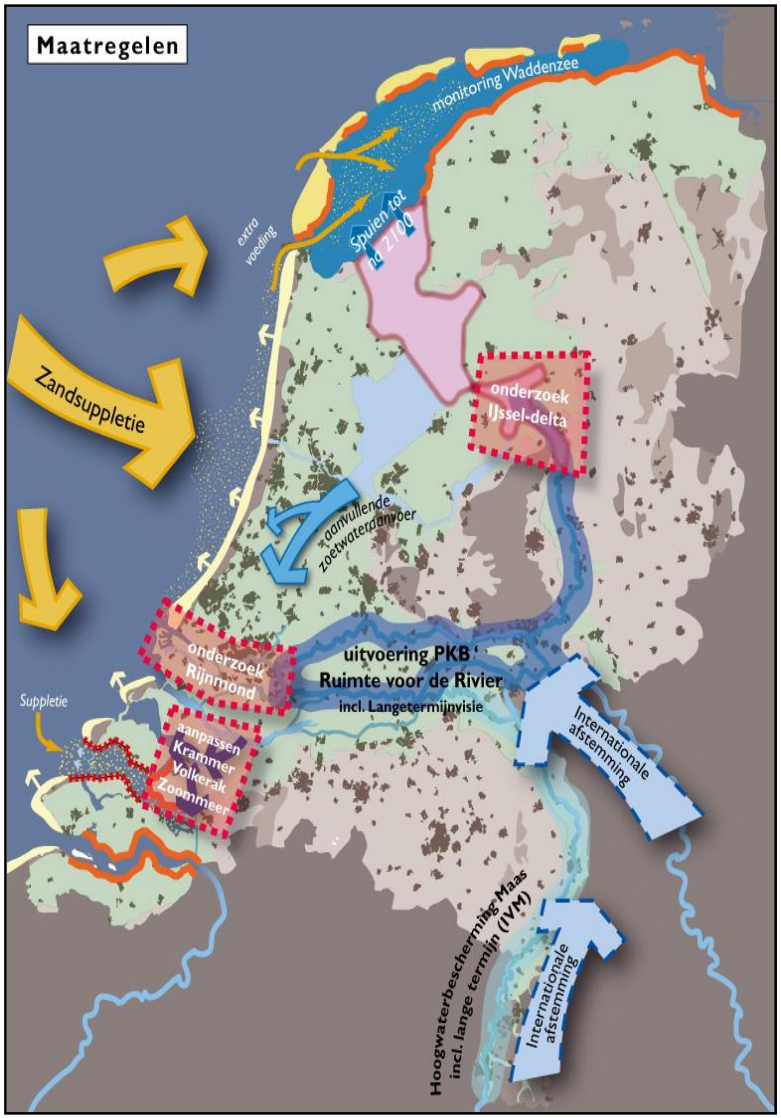
Issues:

→ Safety against flooding
→ Accessability
→ Urban renewal
→ Urban water management
→ Spatial planning
→ Integrated approach

Proposed measures by 2nd Delta Committee

- Beach nourishments
- Room for rivers
- Levee/dike reinforcements
- Restore estuarine dynamics
- Lake IJssel as a strategic fresh water basin
- Special solutions for areas around Rotterdam, e.g. additional storm surge barriers

Costs: ±1.5 billion euro/year



Proposed organisation and financing structures

Installation of a National Committee, AND both programme and funding adopted by the national government, through:

- Ministerial steering committee, chaired by Prime Minister
- Delta Director, supervising adequate execution
- Delta fund for secured availability of required finances

  (at least 1 billion euro/year)
- Delta Act, anchoring Delta director, Delta programme and Delta fund

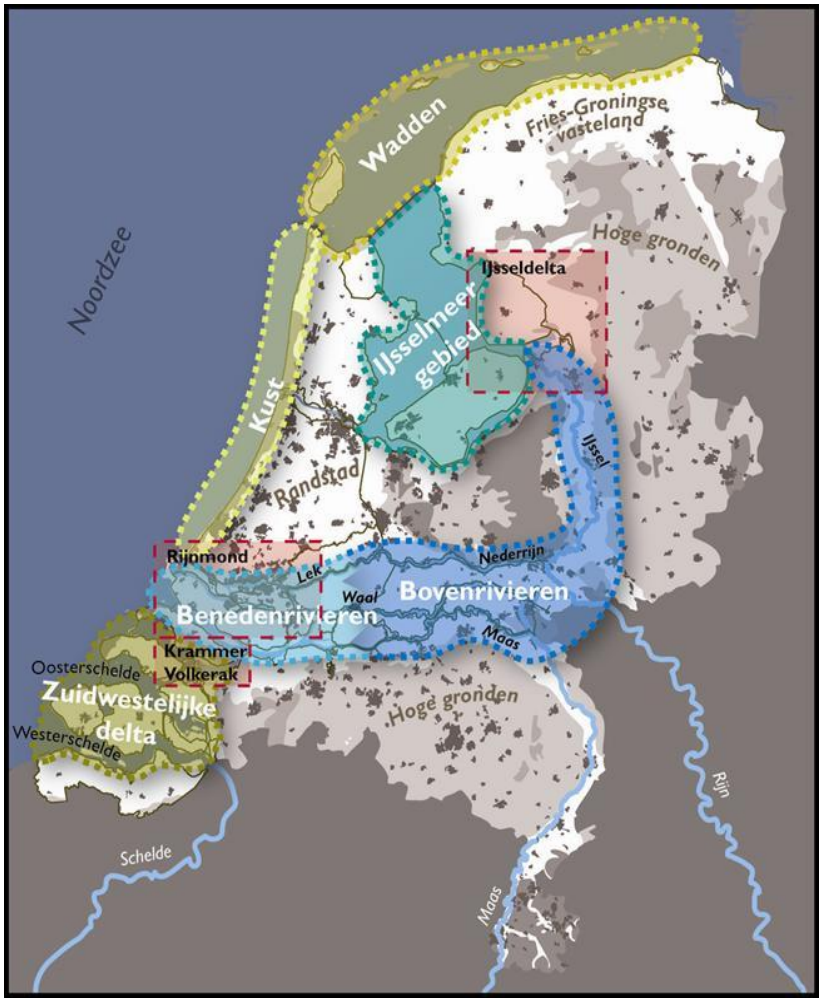
The Netherlands climate change adaptation strategy

The Delta Programme:

- Coherent and comprehensive package of investments to ensure that the Netherlands can absorb the effects of climate change and will remain a safe an attractive country in the long term

- **General themes**:
  - Safety standards and measures
  - Resources for freshwater supply
  - Inland shipping
  - Building in deep lying polders and Urban renewal
  - Ecosystem restoration and development

- **Territorial approach**



The Netherlands adaptation strategy

- Time scale 2020 → 2025 → 2100
- Adapt now!
  - integrated approach
  - area oriented (coastal zone, river basin, delta, rotterdam, ijssel lake)
  - political, administrative, legal and financial measures
- Flexibility
- Transboundary cooperation

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The Dutch Deltaprogramme

from Knowledgebase to Advice and Programme

The Netherlands stands ready to share it's knowledge and experiences in developing Climate Change adapation strategies for integrated water management in other countries and delta areas of the world

www.deltacommissie.com
www.delta-alliance.org
www.knowledgeforclimate.org
www.climatedeltaconference.org
www.deltares.nl

The Dutch Deltaprogramme thanks you for your attention !