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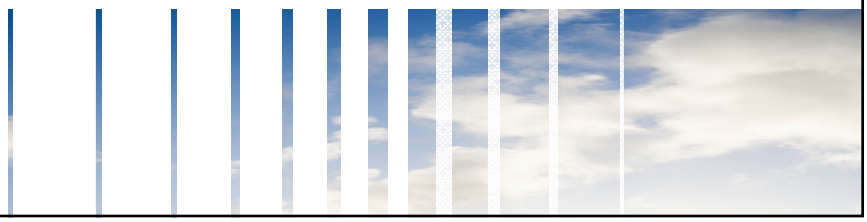
Flood risk in spatial planning

Nico Pieterse, PBL Netherlands
Environmental Assessment Agency



Nico Pieterse

- Physical Geograpy (Utrecht University) 1994
- Ph.D. on modelling land- and ecosystems. Utrecht University in 2003. Thesis: "patching up the landscape"
- Wrote several books:
  - The green heart 2003 (about spatial planning versus developments in reality)
  - Co-author of the scenario study “Welfare, Prosperity and Quality of the living environment” (WLO) in 2006
  - Risk zoning 2009
  - A changing delta (climate adaption strategies) 2011

Organisation

- PBL (Netherlands Environmental Assessment Agency)
- Director: Prof. dr. Maarten Hajer
- 2 locations: The Hague and Bilthoven (RIVM)
- 260 employees

Main tasks of the PBL

- Assessing and evaluating the actual quality of the environment, nature and spatial developments.
  Biologists, physical geographers, policy scientists, mathematicians, engineers…
- Exploring challenges for current and future generations

That is quite something….

- We are independent (but reside under the flag of the ministry of infrastructure and environment)
- Broad coverage of all departments
- Strong relations to the EU
- Analysis from the perspective of the national interest

Independent … but dealing with short term political agenda's

Pieterse, 3-10-2008

We are used to be living on the edge: The Netherlands as Rhine-delta

- About 400 km of Rhine river
- International catchment
- About 350 km coastline
- About 9 million inhabitants below flood level
- Invested value 1800 10^9 euro, 65% of GNP
- Safety level: 1:10.000 – 1:1250
- $Q_{design:}$16.000 m^3/s
- 3500 km of flood defences, hundreds of locks, sluices, pumping stations

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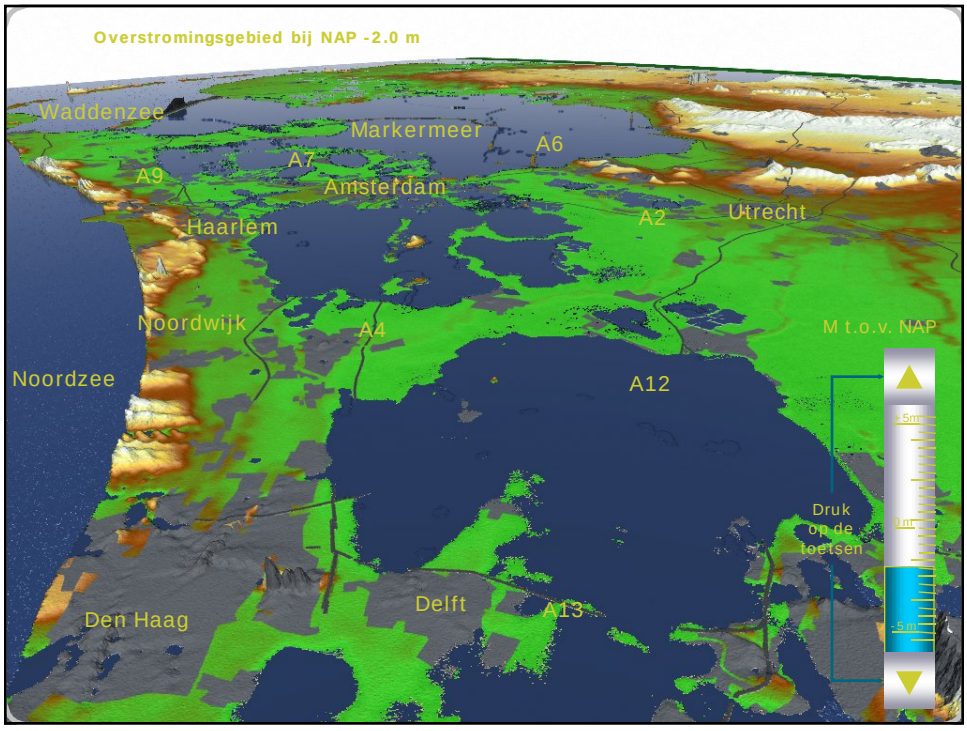
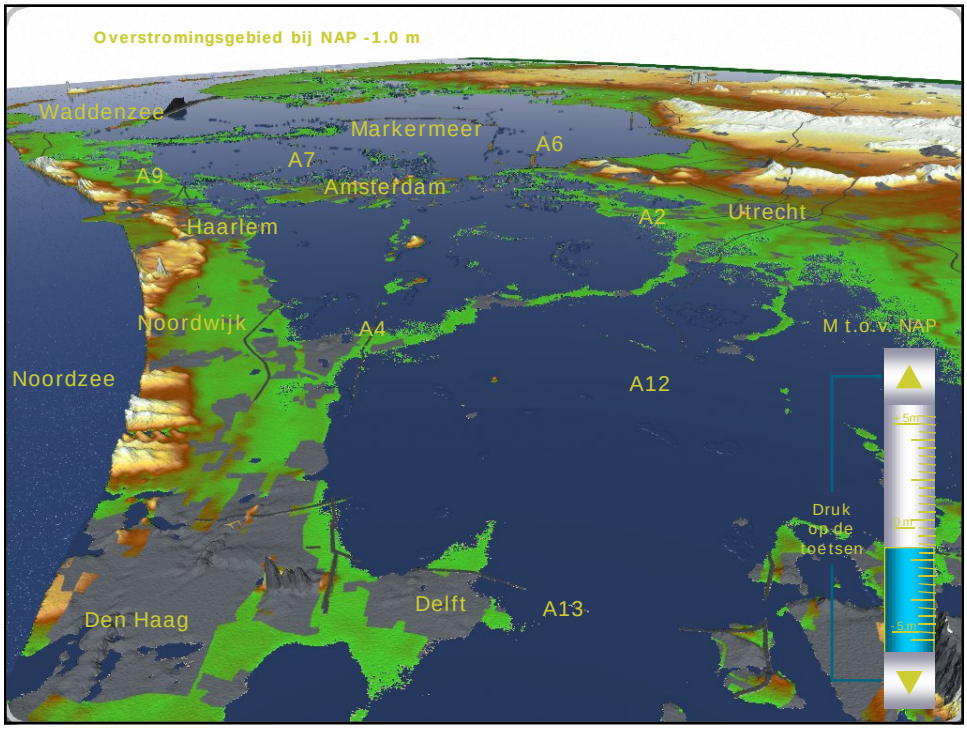
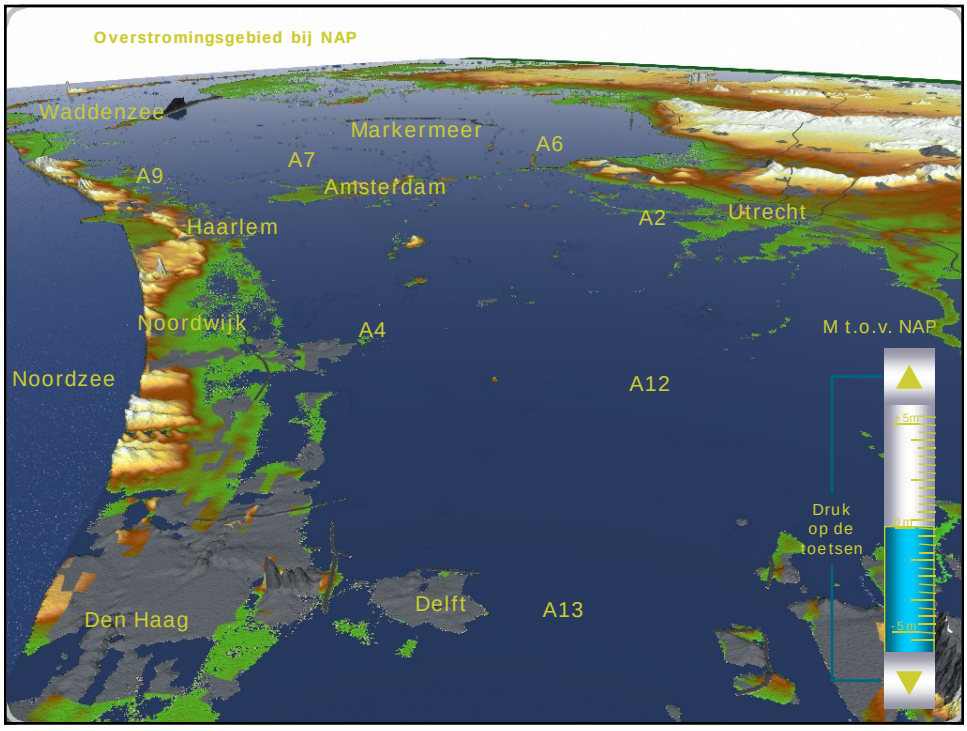



Overstromingsgebied bij NAP -1.0 m
Waddenzee
Markermeer
A6
A7
A9
Amsterdam
A2
Utrecht
Haarlem
Noordwijk
A4
M t.o.v. NAP
Noordzee
A12
+5m
0m
-5m
Druk
op de
toetsen
Delft
A13
Den Haag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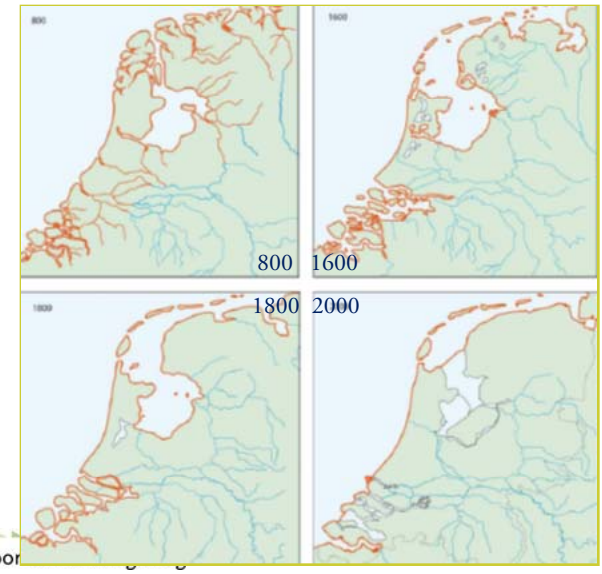
Den Haag

(former) strategy: shortening the coastal line



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Defences of the North Sea coast

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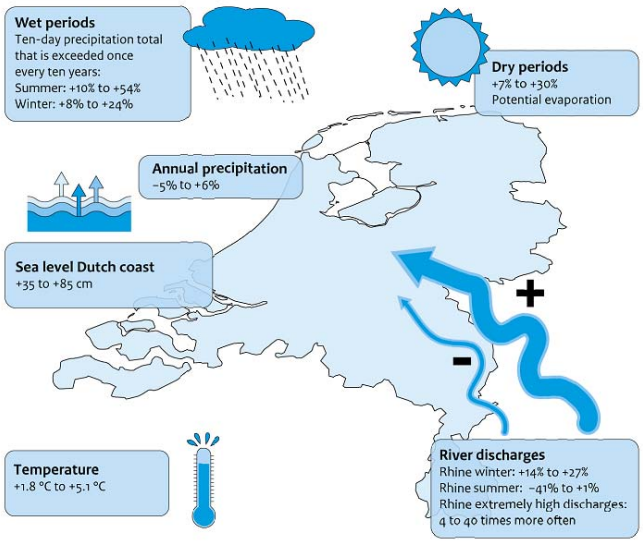
The climate may be changing

Possible climate change 1990–2100, according to KNMI's 2006 scenarios



Pieterse, 3-10-2008

The population is increasing

Population growth is often on risky locations

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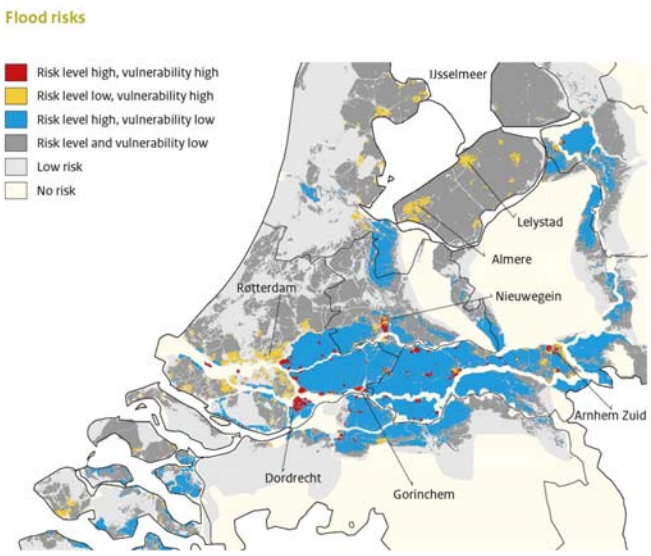
Pieterse, 3-10-2008

Hotspots current flood risks



Dutch National Water Plan

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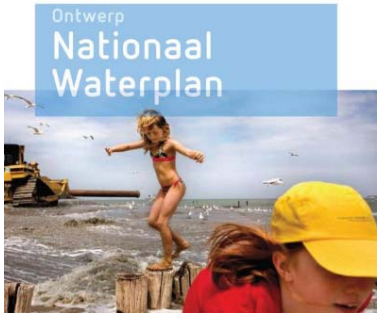
We can's always change spatial planning. So we should not only focus on prevention, we also focus on a reduction of negative effects



→ Spatial planning

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Risk zoning studies (2007; 2009; 2011): Identify a starting point for spatial planning

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- Can we show **the risks** of the current situation
- Can we implement **extra safety** for existing situations
- A starting point to formulate alternatives **for plans**

→Can we construct maps that shows us which places we should not build / build differently?

→First two studies were PBL only, the latest study in collaboration with Deltares

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Risk = chance x impact

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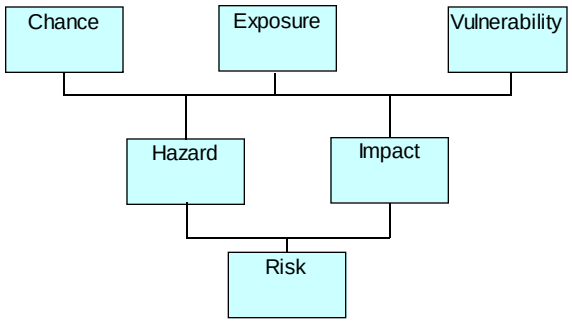

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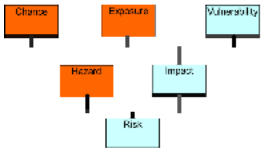
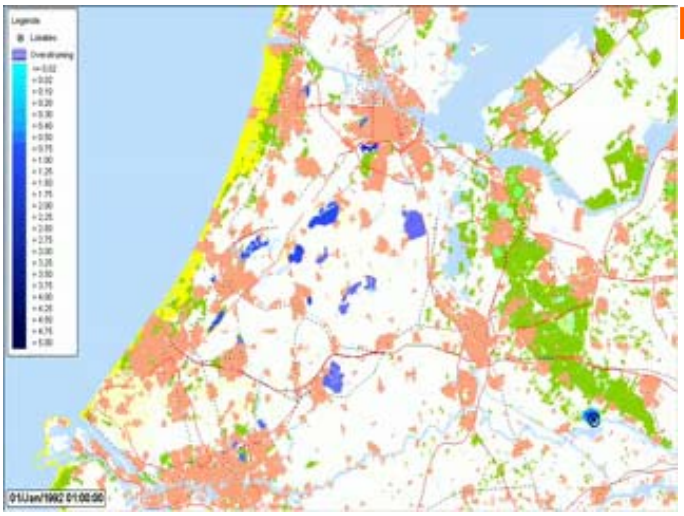
Hazard

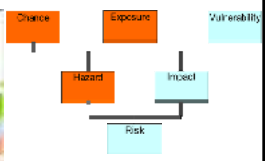


1. Chance

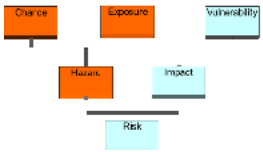
- Outside the levees: high chance
- Within the levees: a very small, monitored chance
- Extreme low chance (too high, too far, extra levees, etc)

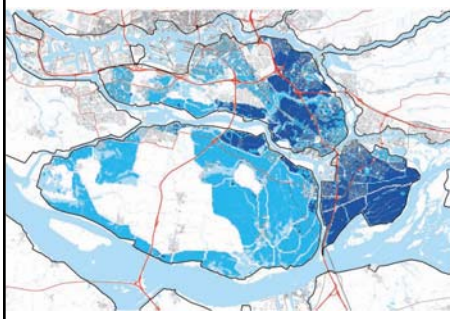
Exposure from “Events”





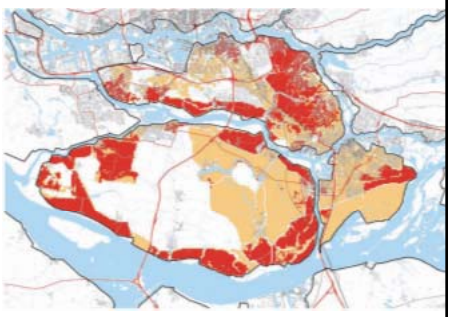
Hazard: using time and depth





Depth

- 0 – 0,5 m (ondiep)
- 0,5 – 2 m (middeldiep)
- > 2 m (diep)
- Extreem kleine kans op overstromen



Time to impact

- < 9 uur (snel)
- > 9 uur (langzaam)
- Extreem kleine kans op overstromen

Harzard map of the Randstad region

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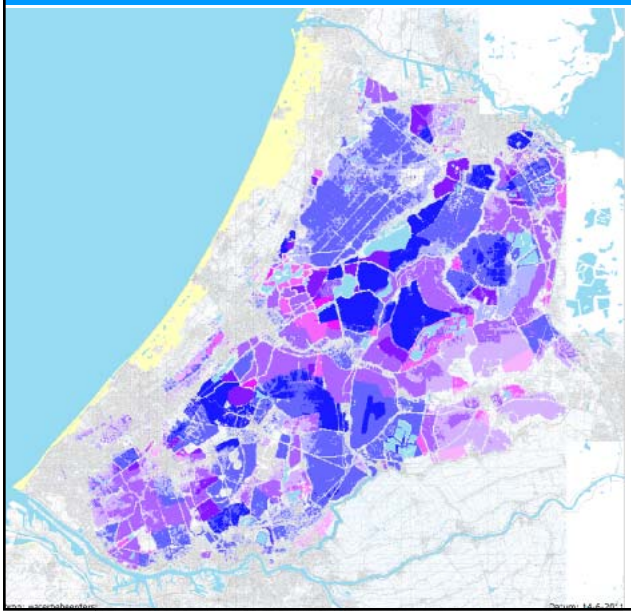
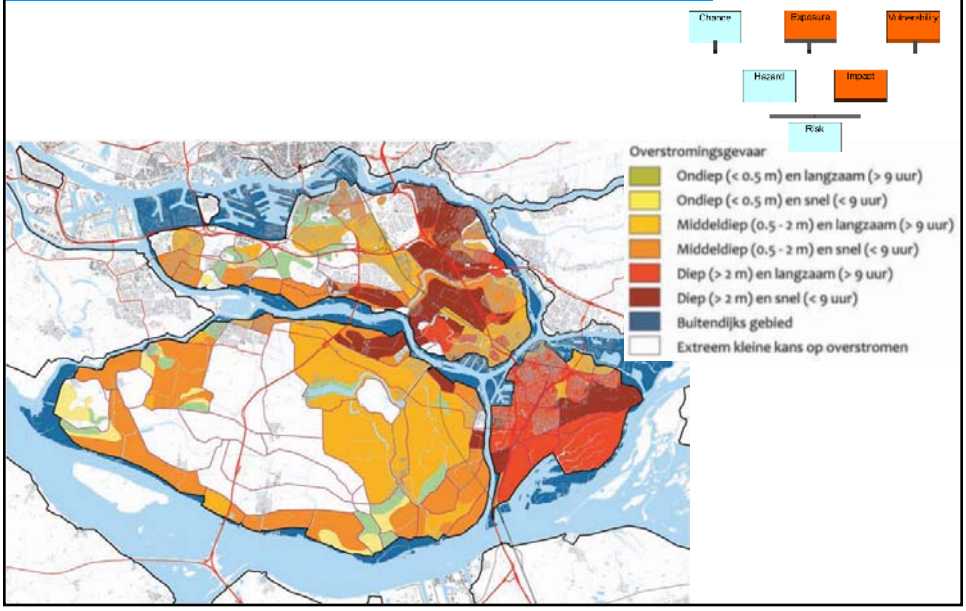
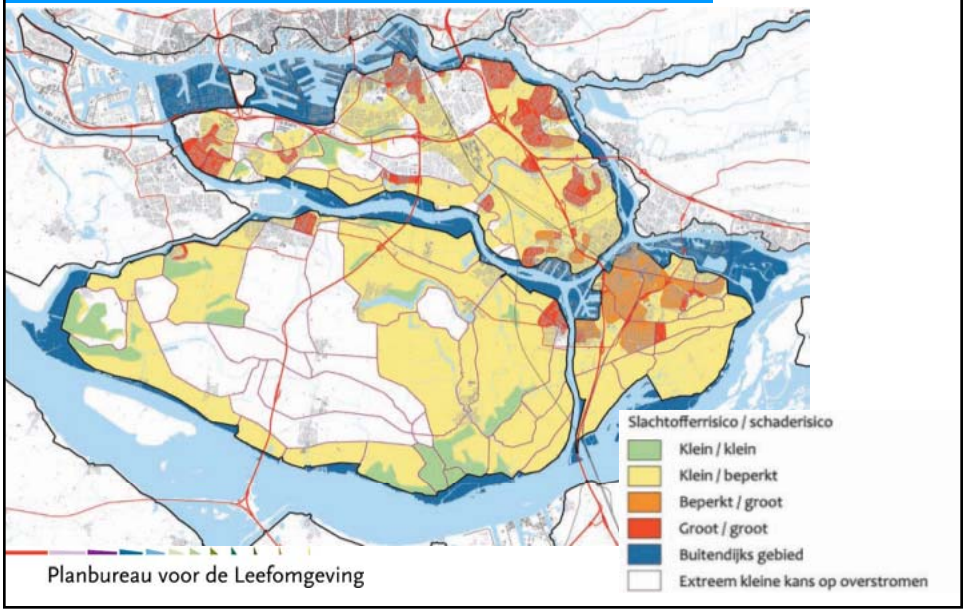


Pieterse, 3-10-2008

Impact



Risk = (Hazard x Impact)

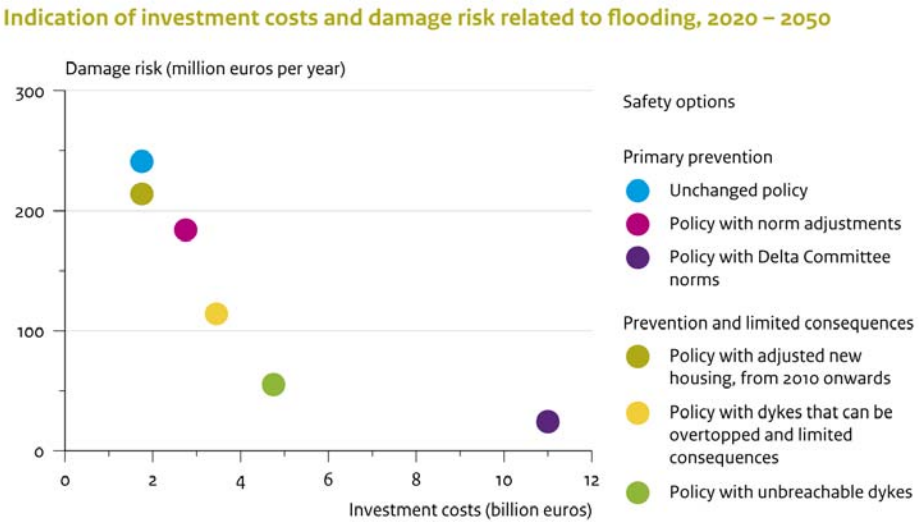


Alternatives?

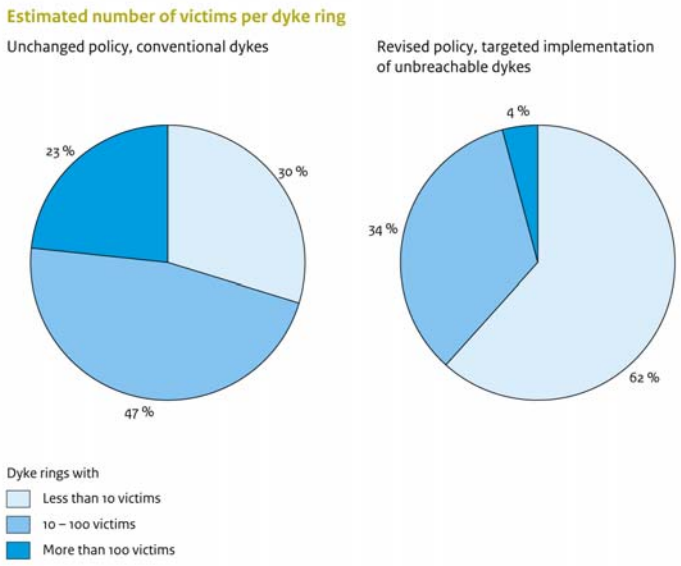
- Risk map is not suitable for planning
- impact map can be used to pinpoint less "potential dangerous" areas.

- But.. What if the chosen site is dangerous, and there is no alternative location?

Options safety against floods: a cost-benefit analysis



Fail safe enbankments: more safety



Multifunctional use of fail safe enbankments

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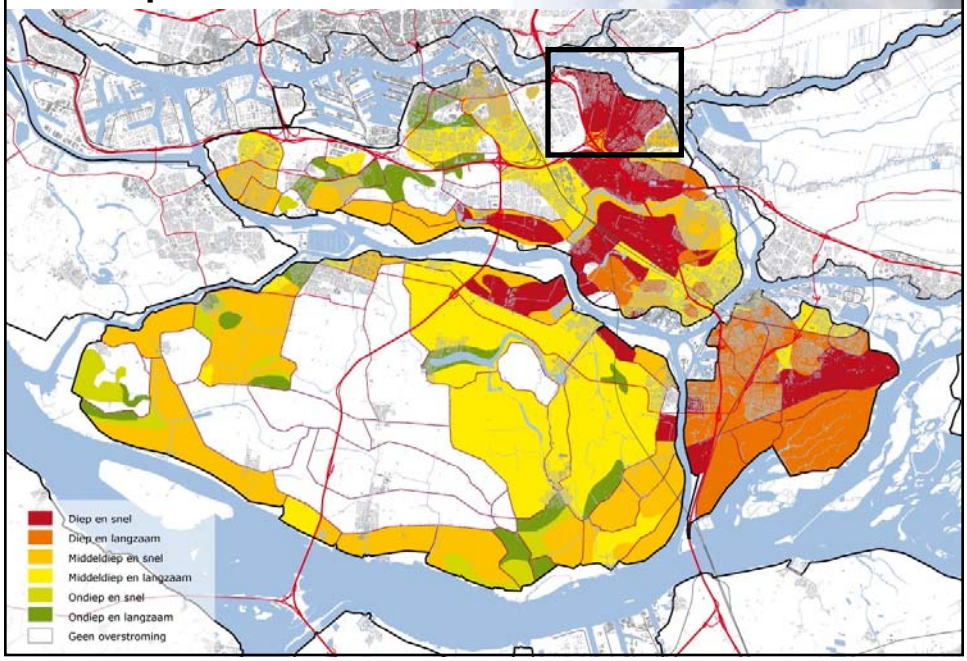
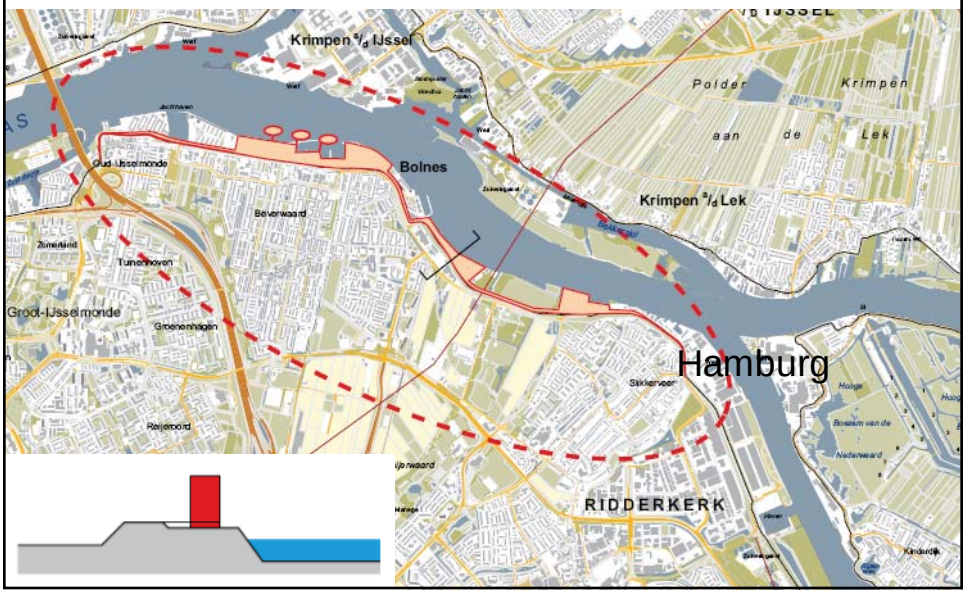
Example: area around Dordrecht



Ridderkerk / Bolnes

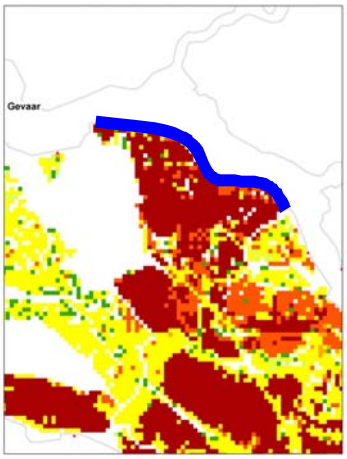
Fail safe embankment

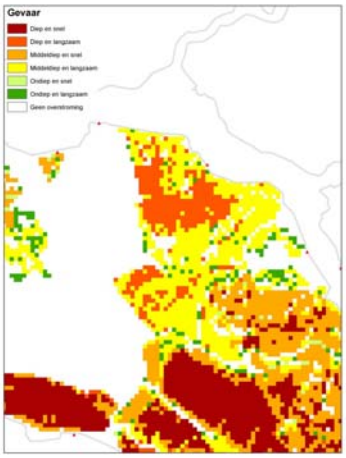


Fail safe embankment

Before

After





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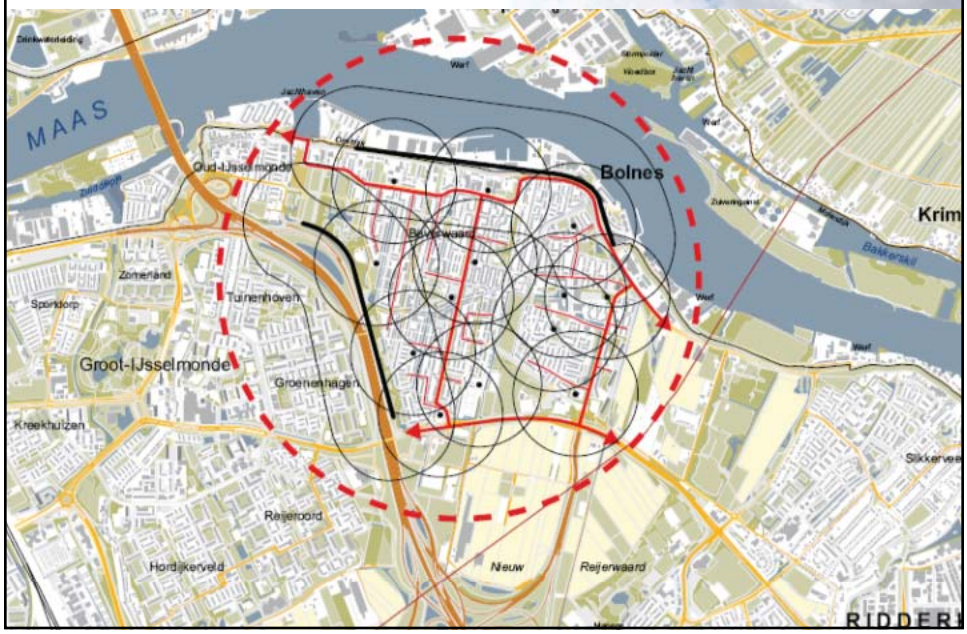
Alternative: escape routes, safe places



Levels of obligation

- information
- political agreement
- financial instruments
- obligatory procedures
- obligatory measures

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Use in the planning process

- monitoring
- reducing risk
- gradually reducing vulnerability

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Use in the planning process

- monitoring

  map: risk map

  instruments: information (obligatory procedures)
- reducing risk

  map: risk map, opportunities map

  instruments: political agreement, obligatory measures
- gradually reducing vulnerability

  map: impact map

  instruments: obligatory procedures, financial instruments

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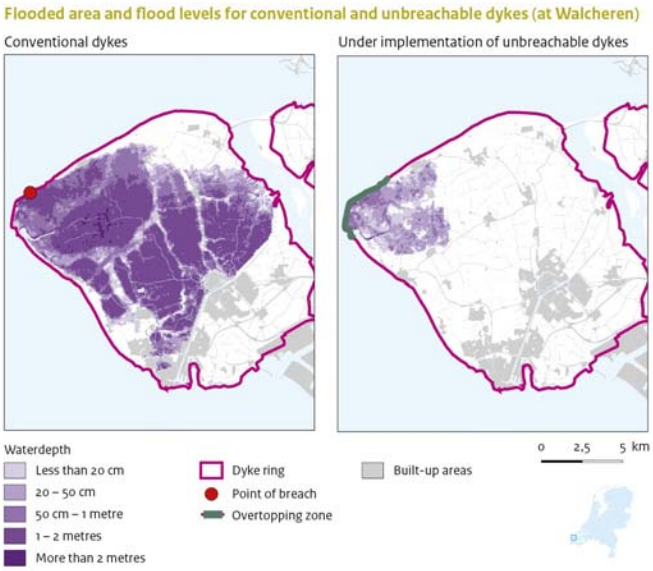
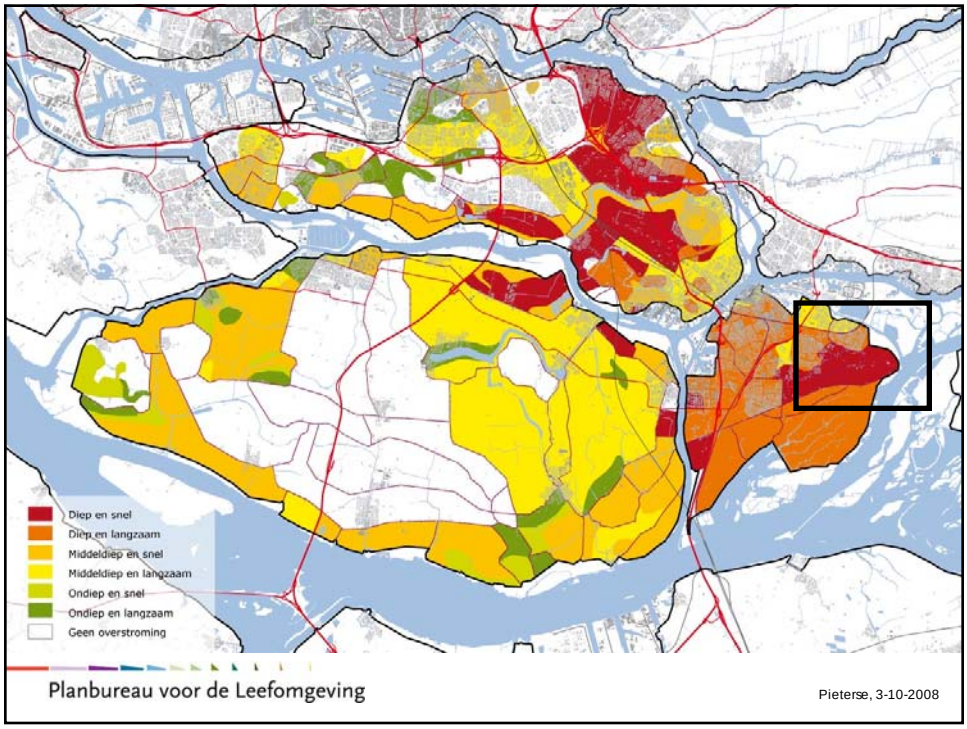
How would a flood look like?

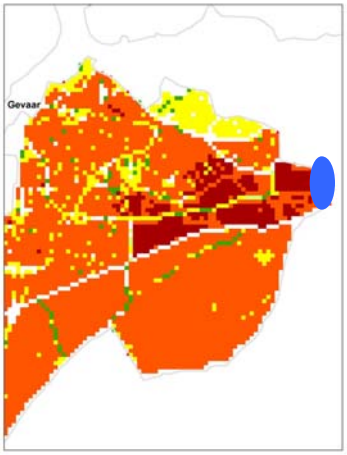


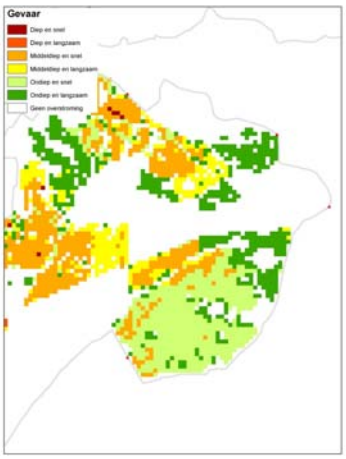


Fail safe embankment

Before

After





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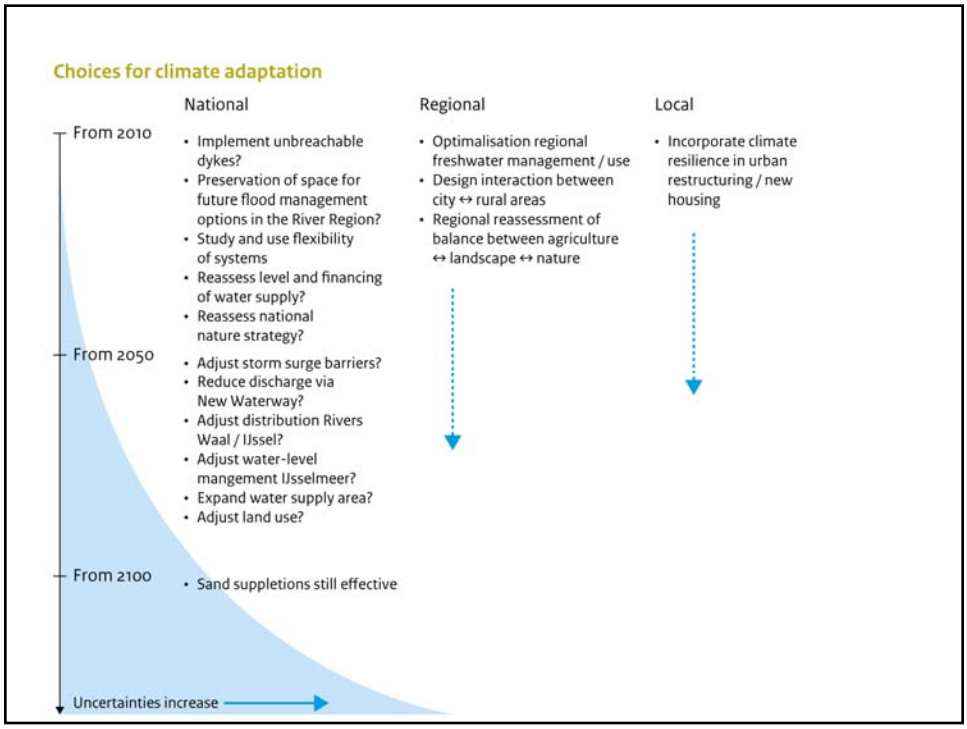
Choices for climate adaptation
National
Regional
Local
From 2010
• Implement unbreachable dykes?
• Preservation of space for future flood management options in the River Region?
• Study and use flexibility of systems
• Reassess level and financing of water supply?
• Reassess national nature strategy?
• Optimalisation regional freshwater management / use
• Design interaction between city ↔ rural areas
• Regional reassessment of balance between agriculture ↔ landscape ↔ nature
• Incorporate climate resilience in urban restructuring / new housing
From 2050
• Adjust storm surge barriers?
• Reduce discharge via New Waterway?
• Adjust distribution Rivers Waal / IJssel?
• Adjust water-level mangement IJsselmeer?
• Expand water supply area?
• Adjust land use?
From 2100
• Sand suppletions still effective
Uncertainties increase