Ministerie van Verkeer en Waterstaat

Flood risk management in the Netherlands

present approach and future developments

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1 The Netherlands as river-delta

About 600 km of rivers

International catchments

About 350 km coastline

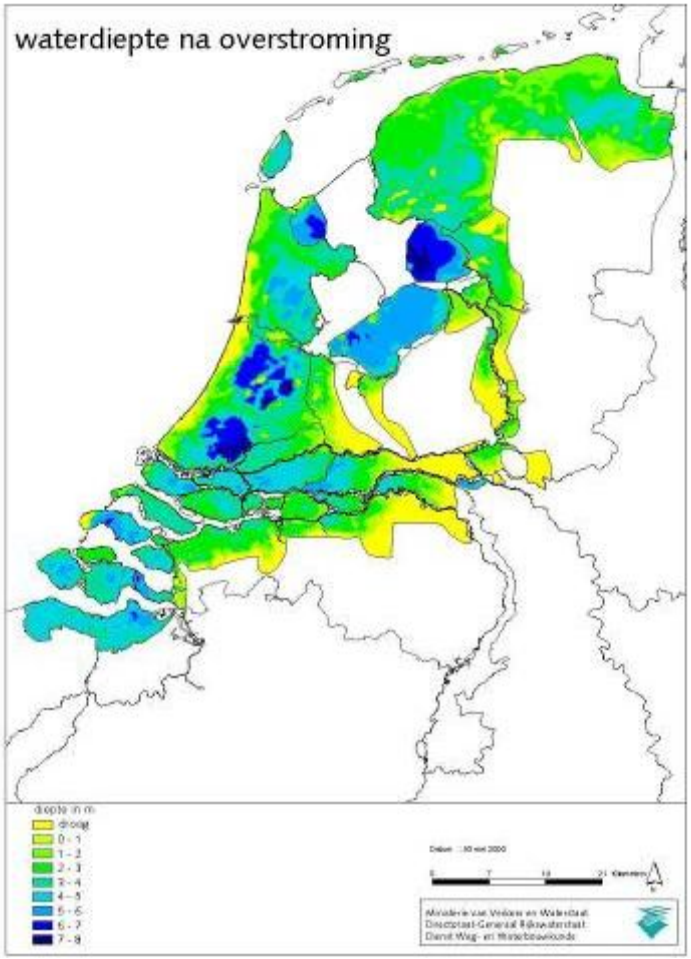
About 9 million inhabitants below flood level

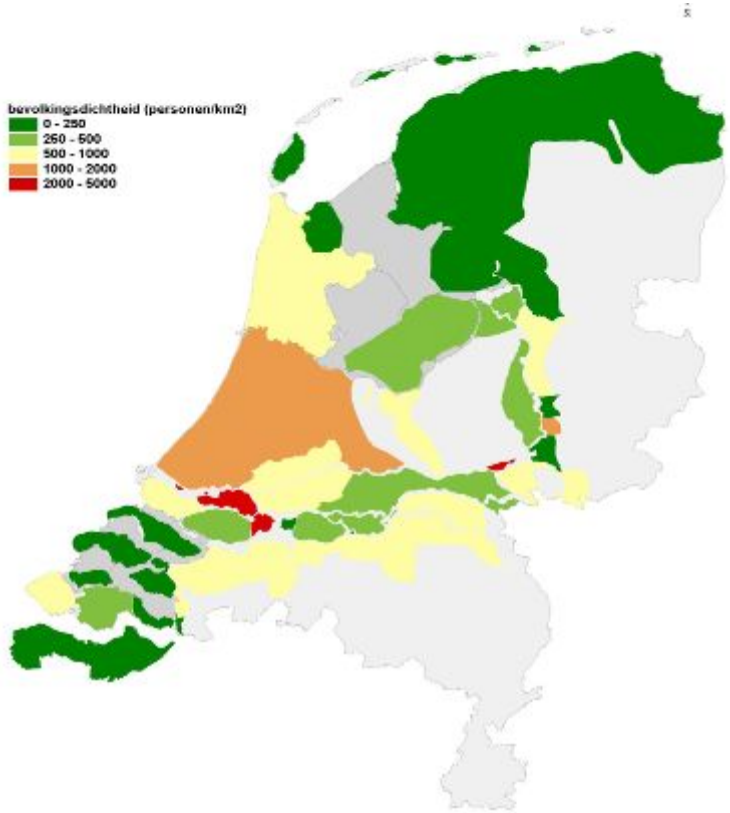
Invested value 1800 10^9 euro, 65% of GNP

Safety level: 1:10.000 – 1:1250

3500 km of flood defences, hundreds of locks, sluices, pumping stations

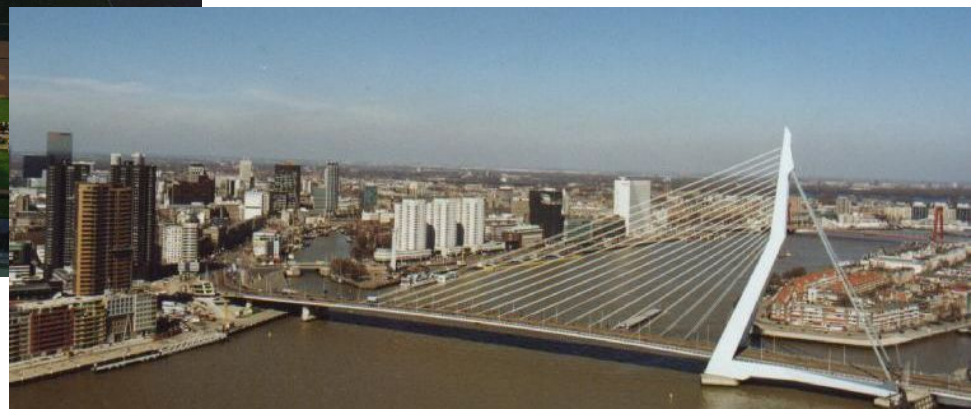
Flood prone and densely populated



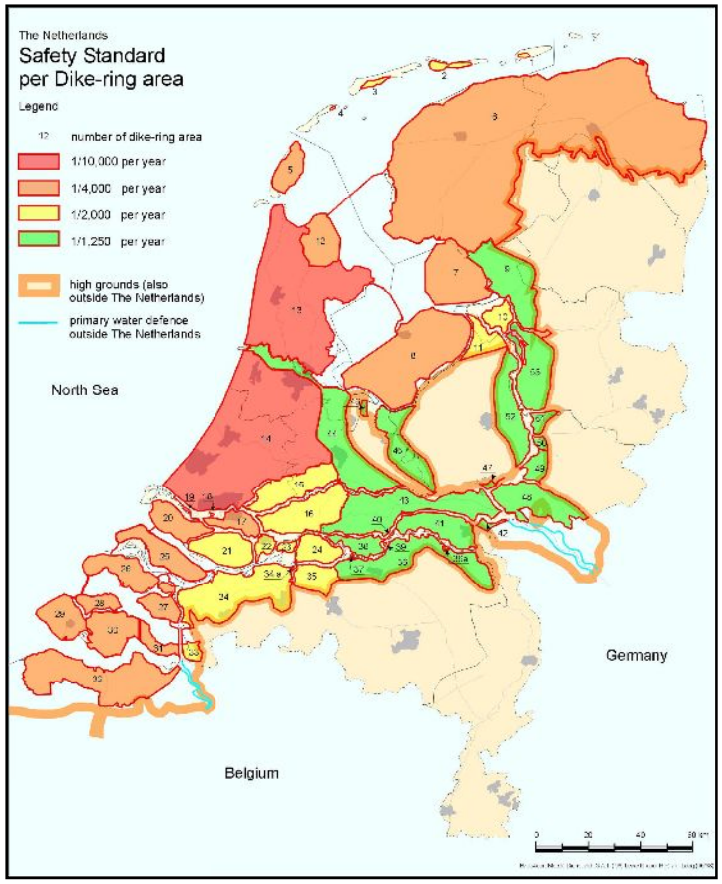


Amsterdam, Schiphol, Rotterdam:

9 million people below flood level



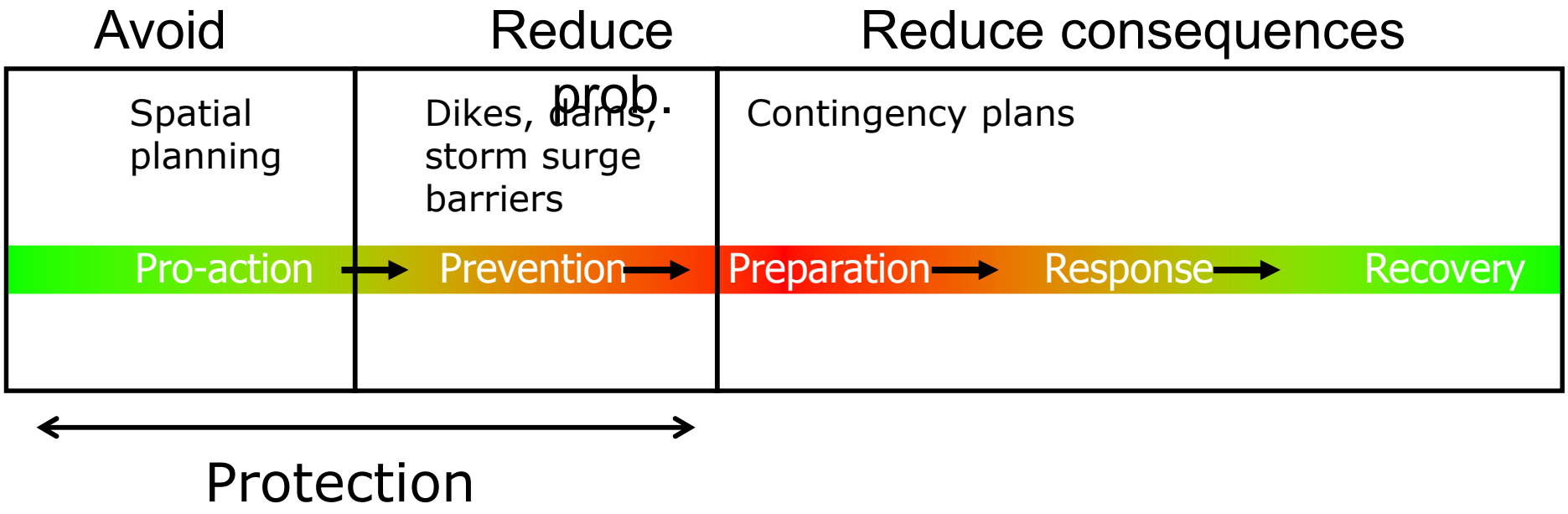
Flood risk standards



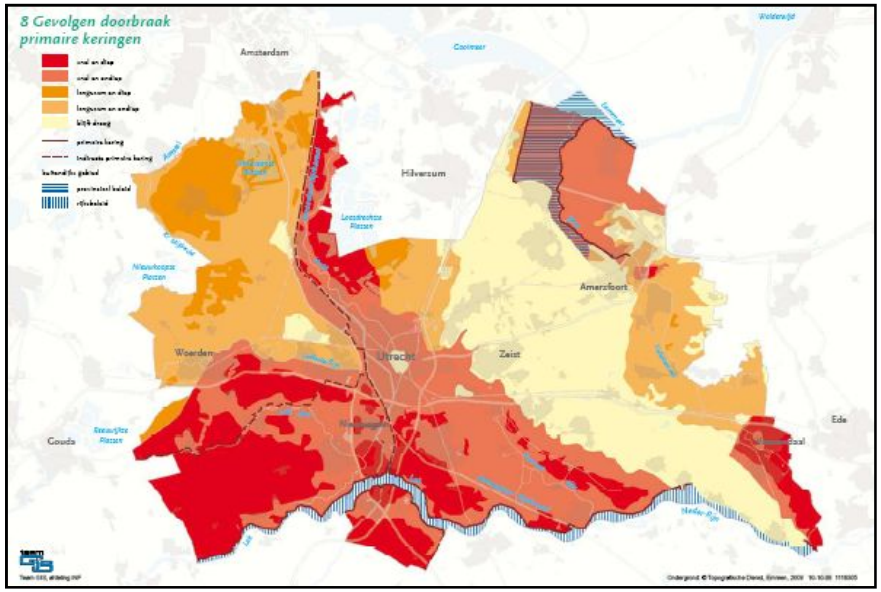
- Based on cost-benefit analysis ‘60s
- Overtopping is dominant failure mechanism
- 1/10.000 – 1/1250, legal
- 5 year assessment/evaluation
- Robust design: anticipated discharge/sealevel 50 – 100 yr

- → protection dominated approach

Risk based approach 1: Safety Chain (European Union)! Hazard life cycle



Pro-action (= avoid)



Spatial Planning:

Hazard zones

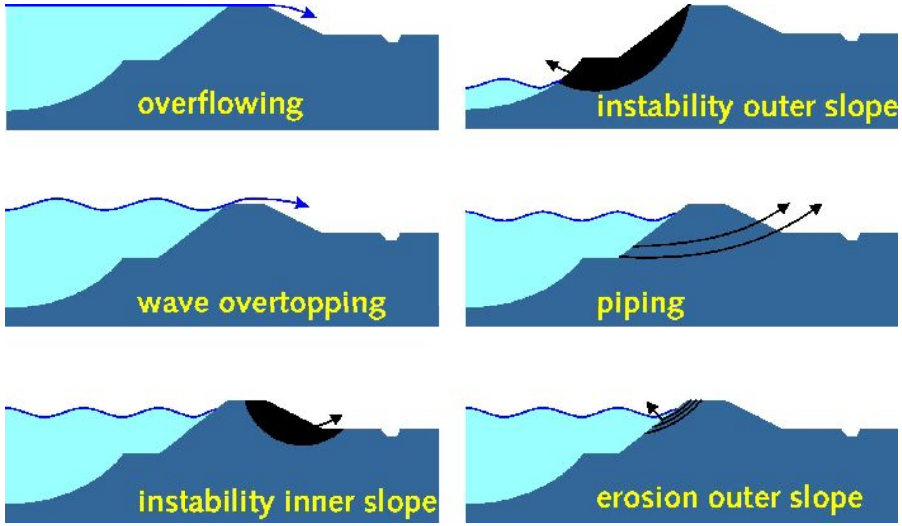
Building codes

Prevention (= probability reduction)

- Build and maintain flood defences:
  - dune and beach nourishments,
  - sea walls
  - storm surge barriers)
  - Dikes and retention basins

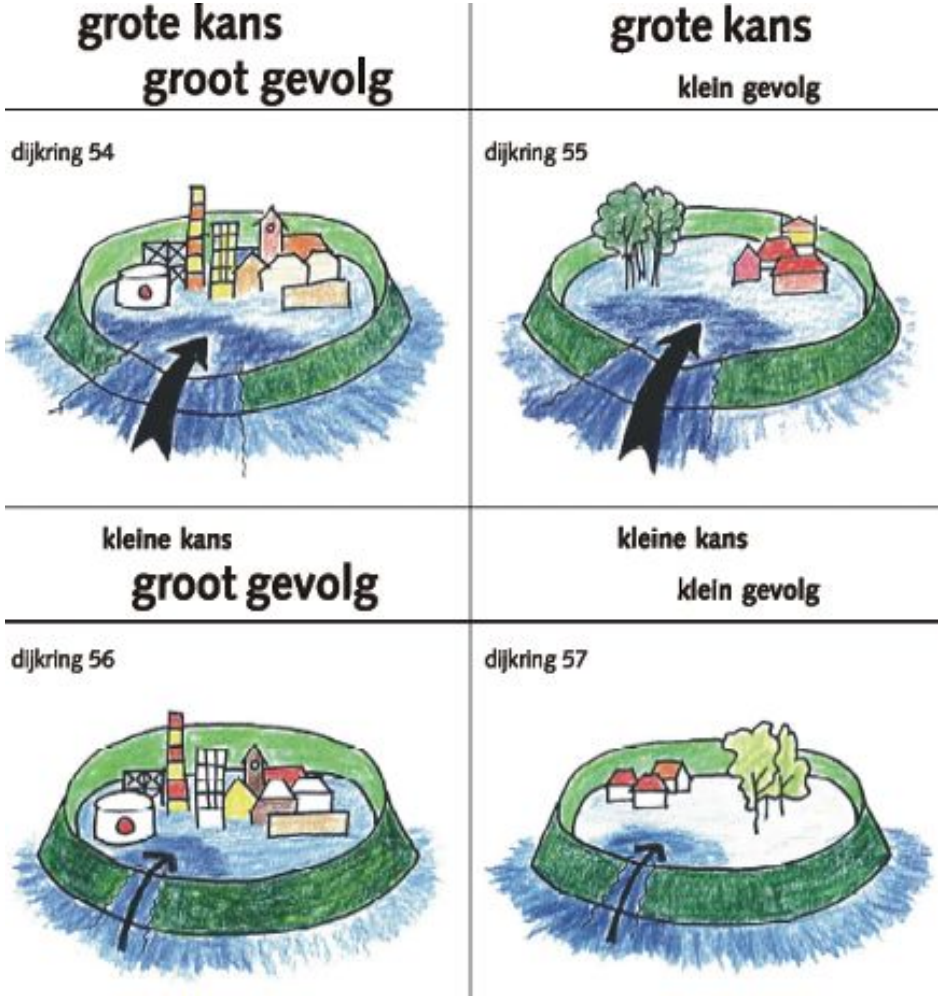
Response, disaster management

New developments: risk based approach 2



1. Calculation of the **probability** of dike ring flooding, including all mechanisms of failure

2. Estimation of potential (economic) **damage** (as function of flood depth)

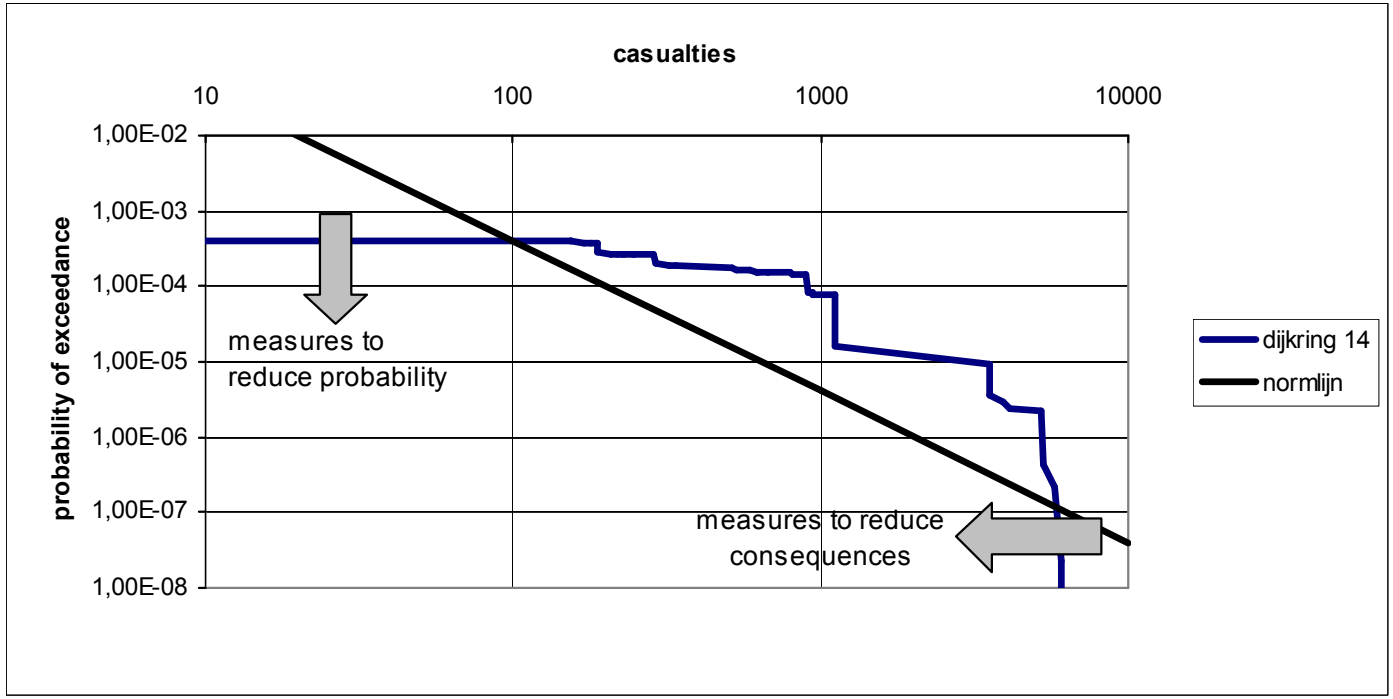


3. Calculation of **flood risk** (p x d) per dike ring

New developments: include non-monetary values

- Casualties
- Natural and cultural heritage
- Disruption
- Loss of reputation

Casualties



- Individual risk (specific location), 10^{-6}? → basic level of protection
- Group risk (group of casualties due to disaster) → avoid uncontrollable failure and flooding

Conclusions

- Risk based approach like “hazard cycle”: Yes (EU Directive)
- Risk based approach like Prob.x consequences: Maybe
- Include casualties etc. Yes, but how?