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**Creating a water-robust urban environment**  
An approach for the Netherlands

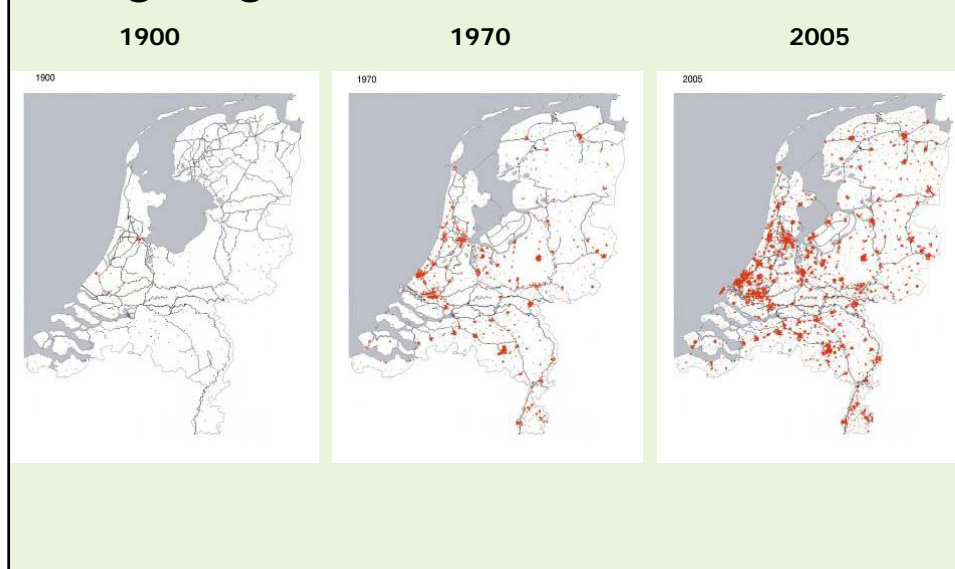
 COP15 - Cities and Climate Change  
8 December 2009 

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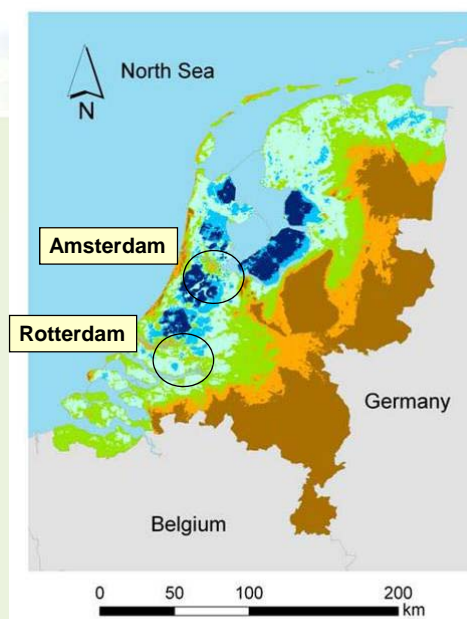
- “We do have a problem...”
  - no need to tell you
  - however, ...
- Response options
- Three-steps approach
- **What** to do
- **Who** is to take action
- **When** to select measures
- **How** to make businesscase
- Conclusions



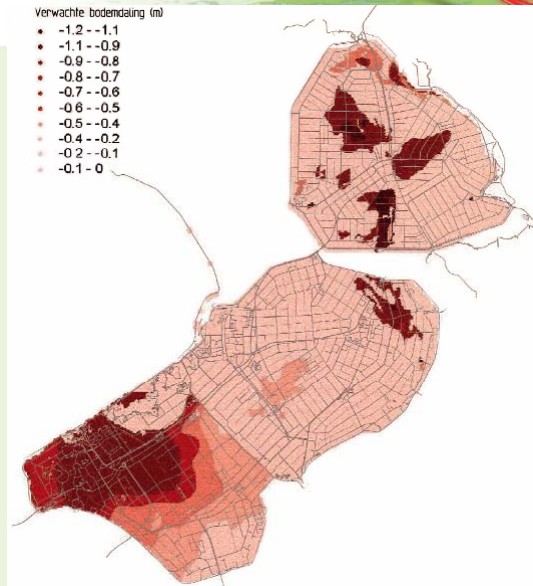
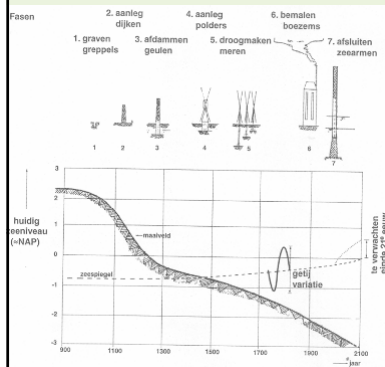
## Our delta shows ongoing urbanization



in particular in the lowest parts...

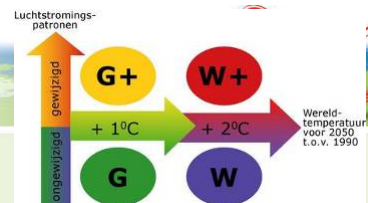


while the land  
subsides,  
the sea level rises...



and climate is  
changing.

*Climate scenario's (KNMI, 2006)*



2050		G	G+	W	W+
Changing West circulation		No	Yes	Yes	No
Winter	average precipitation	+4%	+7%	+7%	+14%
Summer	average precipitation	+3%	-10%	+6%	-19%
	evapotranspiration	+3%	+8%	+7%	+15%
	<b>daily rainfall (T=10 yr)</b>	+13%	+5%	+27%	+10%

## We do have a problem...

However,

the planner, the project developer, the  
house owner, the bank, ....

has NOT!

- No (real) awareness – no receptivity
- No business case

## Our response options

- Mitigate, to reduce CC
- Adapt our living environment  
= develop water robust cities!

But **what** can we do?

## Water robust cities

### Water robust cities (WRC):

Urban areas

(re)developed in such a way,  
that they are able to cope with  
a more extreme

- water surplus or
- shortage of water and
- heat



## Scope of WRC

- All water stresses: Flooding, drought & heat
- New developments *and* existing urban areas
- Buildings *and* public space
- Technology, process, legislation and practice

To identify appropriate measures, taking into account

- Types of water stress ...
- Types of vulnerability ...

## Measures we could take

### > 180 measures identified.....

- Collective 'soft' measures  
*e.g. contingency plans, building legislation*
- Collective 'hard' measures  
*e.g. dikes, drainage systems*
- Individual 'soft' measures  
*e.g. increasing water risk consciousness, insurances*
- Individual 'hard' measures  
*e.g. building without crawl space, wet or dry proofing*



... and counting

## Measures we could take

We have

a **selection** problem

Buildings	Construction measures	
		Drijvende woningen
		Amfibische woning
		Bouwen op palen
		Niet woonwoneerbare grond
		Wet proofing
		Wet proofing
		Bouwen met waterbestendige keerschotten
		Kruipruimteless bouwen
		Verhoogd vloerpeil ten opzichte van straatpeil
		Gebouw als helling
		Low impact development
		Wateroverlast
		Wateroverlast
		Warmte-koude opslag
		Bescherming gevaarlijke stoffen
		Bescherming life support voorzieningen
		Ondergrondse infiltratie
		Meer zwarte grond in tuin
		Opvoeren tuin en dak
		Regenton/regentank
Infrastructure	Dams and dikes	Dijken
		Dammen
		Natuurlijke waterkering
		Onbezwaakte dijken
		Overstroombare dijken
		Multifunctionele dijk
		Keermuur/keewand
		Kade

## Measures we could take

What type of **selection** problem?

	Problems &Objectives		
Available means and measures		Known and agreement about	Unknown and/or no agreement about
	Known	<i>structured problem</i>	<i>political problem</i>
	Not known	<i>scientific problem</i>	<i>unstructured or wicked problem</i>

## Measures we could take

How to solve this?

	Problems &Objectives		
Available means and measures		Known and agreement about	Unknown and/or no agreement about
	Known	optimization	??
	Not known	Innovation	??



## Measures we could take

How to solve this?

	Problems & Objectives		
		Known and agreement about	Unknown and/or no agreement about
	Available means and measures		
	Known	<b>optimization</b>	<b>negotiation</b>
	Not known	<b>innovation</b>	<b>design</b>

## Our proposal:

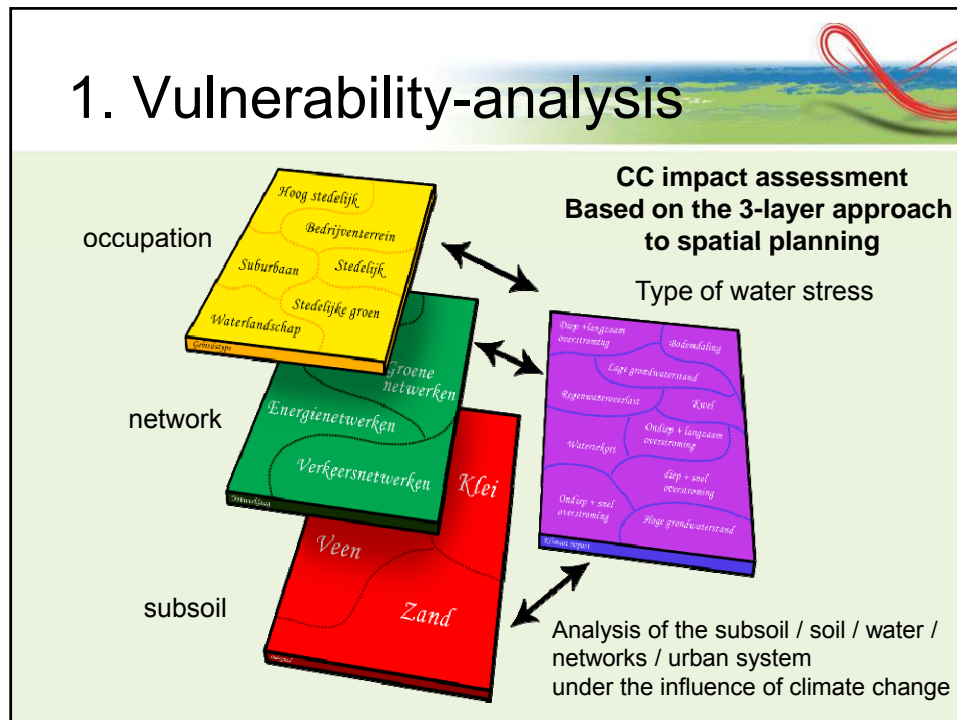
Three-step approach

- Step 1: Completing a vulnerability-analysis
- Step 2: Strategy to reduce vulnerability
- Step 3: Select appropriate set of measures



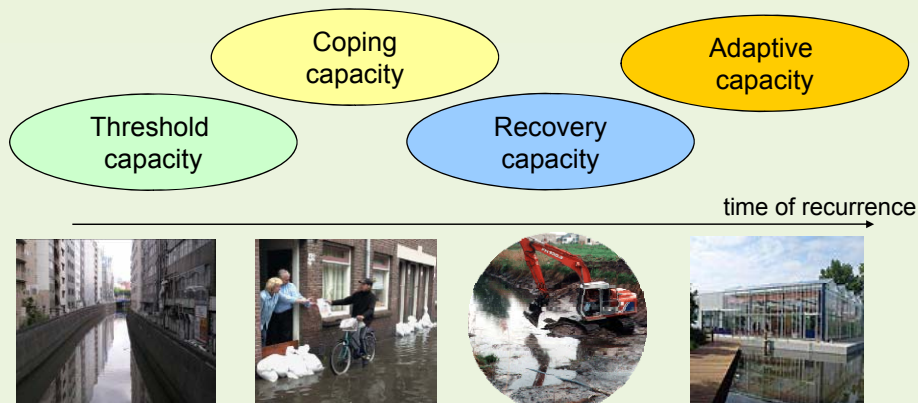


# 1. Vulnerability-analysis



## 2. Strategy to reduce vulnerability

Four **capacities** to reduce vulnerability:



\* Graaf, R. de, N. van de Giesen and F. van de Ven, 2007, Alternative water management options to reduce vulnerability for climate change in the Netherlands, Natural Hazards nov.

### 3. Selecting measures

Selection depends on:

- Results vulnerability analysis
- Strategy to reduce this vulnerability
- Long-list of available 'hard' and 'soft' measures

### 3. WRB measures selection

Measures to strengthen ...

<b>1. Threshold capacity</b> Waterrobust infrastructure Enlarged seasonal storage capacity High floor level vs street level Floating housing  Et cetera	<b>2. Coping capacity</b> Major drainage sytem; adapted street profile Wet proofing Warm grass instead cold grasses  Et cetera
<b>4. Adaptive capacity</b> Temporary houses & buildings Adaptive management Water-based spatial planning Regular updates water & space policies	<b>3. Recovery capacity</b> Extra pumping capacity Cleaning & drying capacity Water supplying capacity in extremely dry periods  Et cetera

### 3. Selecting measures

Selection depends on:

- Results vulnerability analysis
- Strategy to reduce this vulnerability
- List of available 'hard' and 'soft' measures
- **The stakeholders (!!)**

### Who are the stakeholders?

#### **Public**

- State
- Province
- Municipality
- Water board

#### **Private**

- Owner-occupier
- Real estate developers
- Housing associations
- Waterworks
- Electricity companies
- Telecom companies
- Insurance companies
- Mortgage banks

**Note:** Different parties involved in each phase of a (re)development process !

## When to select?

Depends on the phase of development:

- Planning
- Design
- Building
- Maintenance

## When to select ?

= when to apply this three-step approach

1. **Spatial planning phase:** **Select spatial plans**
2. **Spatial development**
  - a. Initiative: **embracing the**
  - b. Draft designs: **select water robust measures (spatial water strategy)**
3. **Feasibility study:** market analysis
4. **Design, planning, preparation, construction**
  - a. Developing the plan
    1. Contracts
    2. Commitment
  - b. Urban design: **final selection of measures**
5. **Building process**
  - a. Engineering/preparation
  - b. Building site preparation: **technical design of selected measures**
  - c. Construction
  - d. Completion
6. **Maintenance**
  - a. Property-, asset- en portfolio management
  - b. **Keep up operational rescue capacity, ...**

**Spatial planning phase**

**Planning & design phase**

**- At transfer  
- Corrective measures**

## How to create a business case?

So far: Defensive!

Aiming at **CONTROL** of effects

Go to: Positive!

Aiming at **UTILIZING** adaptation measures!

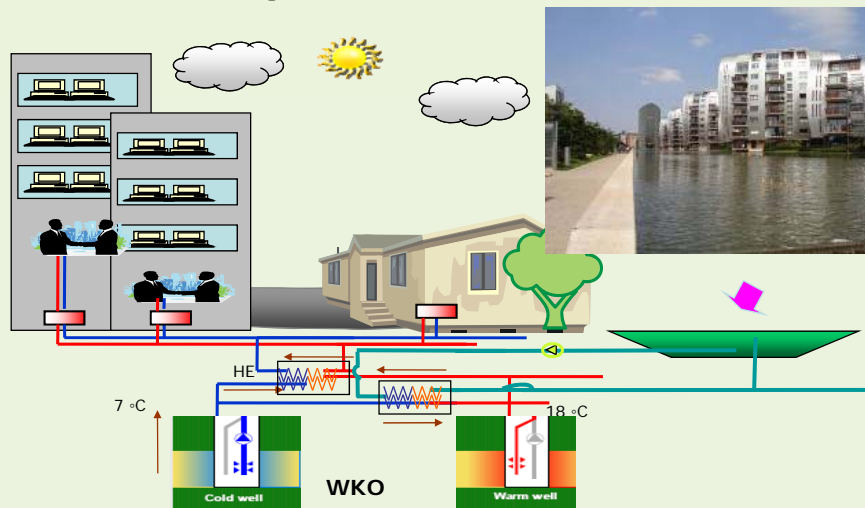
e.g.

e.g. More water storage  
= more water for supply



R.E.de Graaf, 2007, personal communication, TU Delft

e.g. More water storage  
= larger solar collector



E. Aparicio (2008) Using surface water for energy supply and cooling,  
Delft University of Technology

## In conclusion

- Plenty of measures! Often low-cost!
- Selection of appropriate measures needs a **negotiation & design process**
- WRB requires coherent actions  
in the phase of spatial planning,  
in the phase of design and  
in exploitation and maintenance!  
of multiple stakeholders.
- WRB requires a business case!

 **-consortium thanks**

BETER BOUW- EN WOONRIJP MAKEN

**Steering committee:**

**+ Advisory board WRC:**

## More information

More information:

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[www.bouwrijp.nl](http://www.bouwrijp.nl)

[www.wrm.tudelft.nl](http://www.wrm.tudelft.nl)

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