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# Towards a climate proof fresh water supply and demand for the Netherlands

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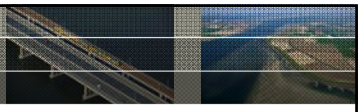
**COP15 Copenhagen 11-12-2009**

## contents



1. fresh water supply and demand in the Netherlands
2. Trends and effects
3. Do we have to act?
4. Adaptation strategies
5. Overall conclusions

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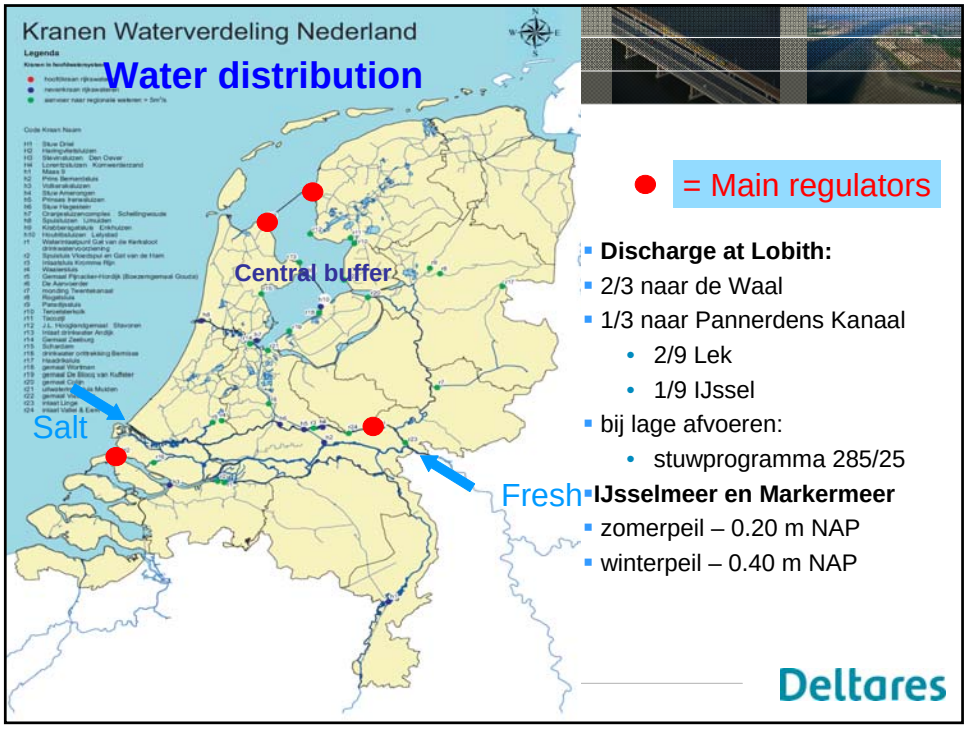


= Main regulators

- **Discharge at Lobith:**
- 2/3 naar de Waal
- 1/3 naar Pannerdens Kanaal
  - 2/9 Lek
  - 1/9 IJssel
- bij lage afvoeren:
  - stuwprogramma 285/25
- **IJsselmeer en Markermeer**
- zomerpeil – 0.20 m NAP
- winterpeil – 0.40 m NAP

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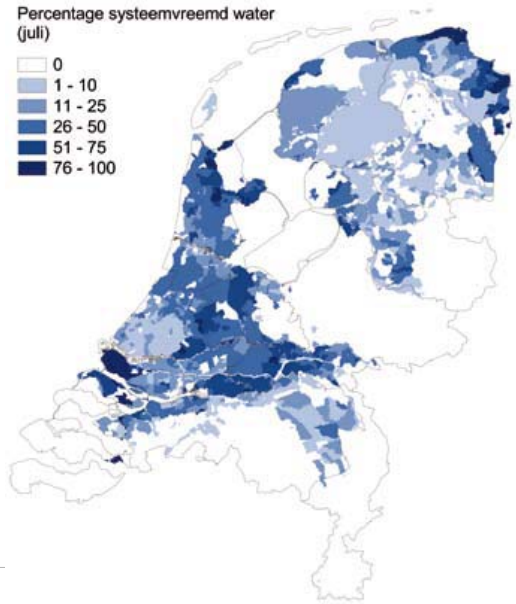
## Percentage water externally supplied (dry summer)

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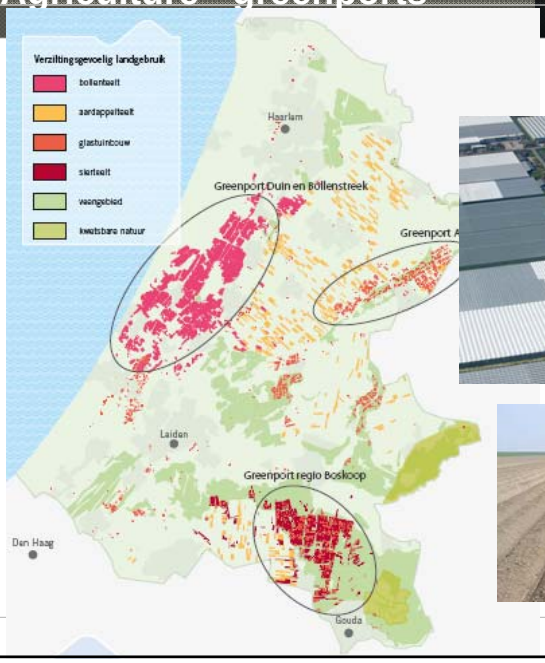
## Agriculture - greenports

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## managing waterlevels to prevent drying out of dikes

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## shipping and industry

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## Nature and drinkingwatersupply

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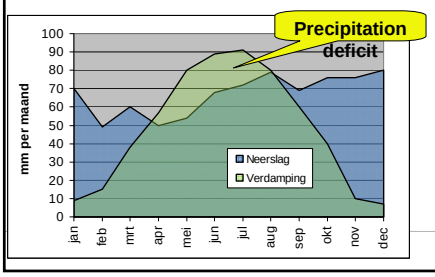
## Trends and effects

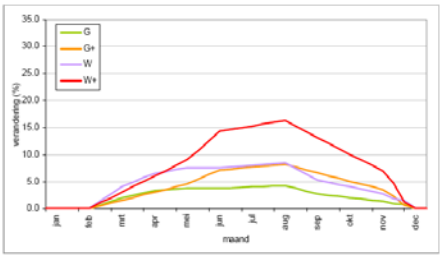
## Expected climate trends up to 2100 (1)

- It will be warmer
- It will be dryer
- Precipitation deficits will increase

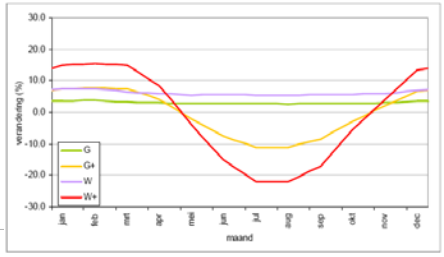
| | 1906-2000 | G | G+ | W | W+ |
|---|---|---|---|---|---|
| Gemiddelde maximale neerslagtekort (mm) | 144 | 151 | 179 | 158 | 220 |
| Herhalingstijd voor een maximaal neerslagtekort zoals in 2003 (jaren) | 9,7 | 7,9 | 4,1 | 6,5 | 2,0 |




evaporation

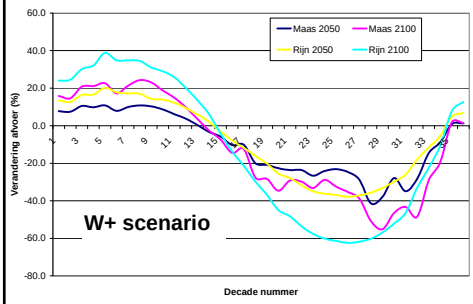


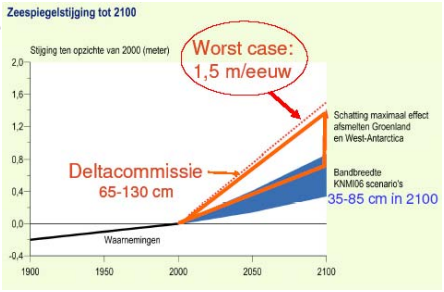

precipitation



## Expected trends (2)

- Sea level is rising
- Summer river discharges decre

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## characteristic years

| Kind of year | precipitation deficit (mm) | return period (year) | exceedence frequency (1 / year) |
|---|---|---|---|
| average(1967) | 151 | 2.5 | 0.400 |
| fairly dry (1996) | 199 | 6.7 | 0.149 |
| dry (1949) | 226 | 11.7 | 0.083 |
| very dry (1959) | 352 | 70.9 | 0.014 |
| extremely dry (1976) | 361 | 89.4 | 0.011 |
| average (1906-2000) | 144 | | |

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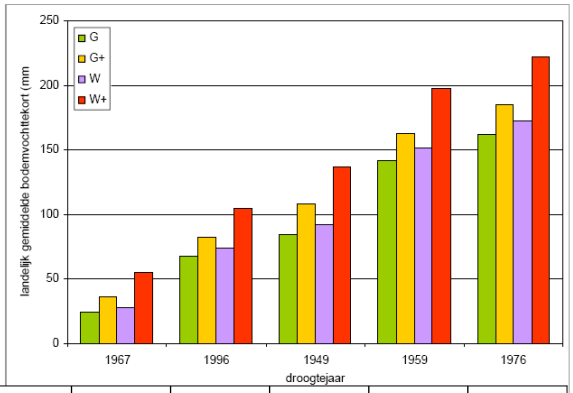
## Expected trends (3)

- Soil moisture deficit increases

**Bodemvocht tekort = verschil tussen potentiële en actuele verdamping veroorzaakt door vochttekort**




| Karakteri-sering | gemiddeld | matig droog | droog | zeer droog | extreem droog |
|---|---|---|---|---|---|
| Herhalings -tijd (jaar) | 2.5 | 6.7 | 12 | 70 | 90 |

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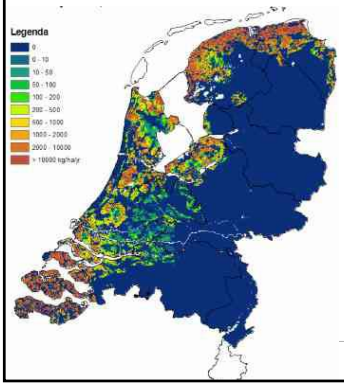
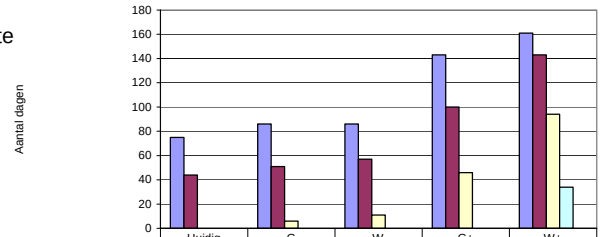
## expected trends (4)

- External salinization increases (salt intrusion via rivers and sluices)
- Internal salinization increases
  - mainly autonomous
  - partly because of climate




Gouda
Totale overschrijdingsduur (>250mg/l; >48 uur)




| | Huidig | G | W | G+ | W+ |
|---|---|---|---|---|---|
| 1976 Extreem zout | 75 | 86 | 86 | 143 | 161 |
| 2003 Zout | 44 | 51 | 57 | 100 | 143 |
| 1996 Gemiddeld zout | 0 | 6 | 11 | 46 | 94 |
| 1994 Brak | 0 | 0 | 0 | 0 | 34 |
| 2002 Matig brak | 0 | 0 | 0 | 0 | 0 |

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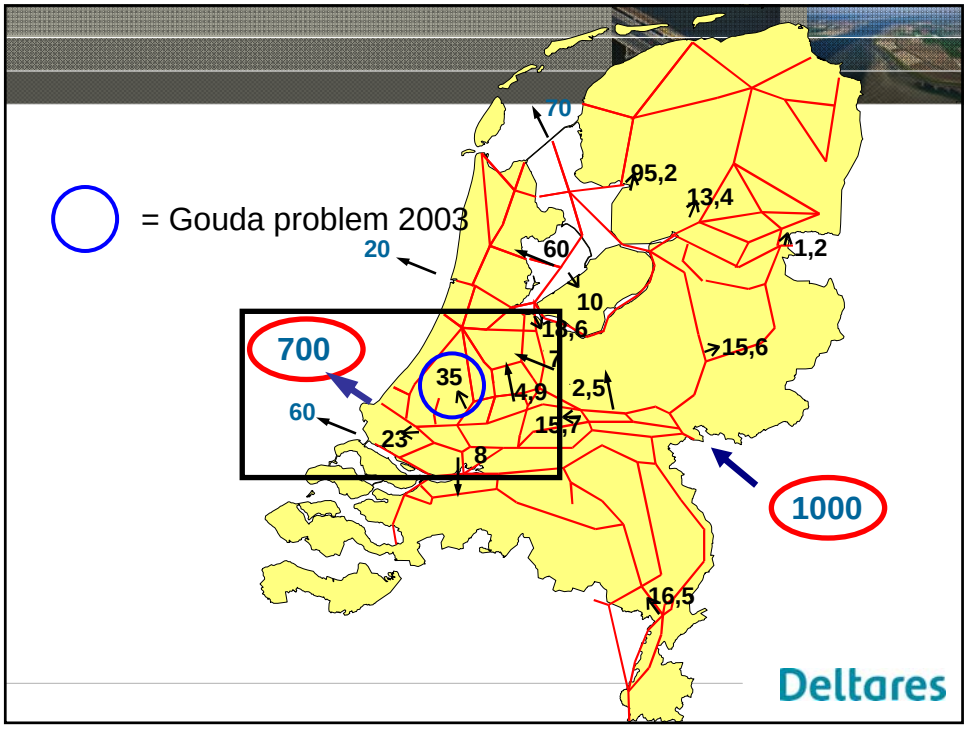
= Gouda problem 2003
70
95,2
13,4
20
60
1,2
10
18,6
700
15,6
7
35
4,9
2,5
60
15,7
23
8
1000
16,5
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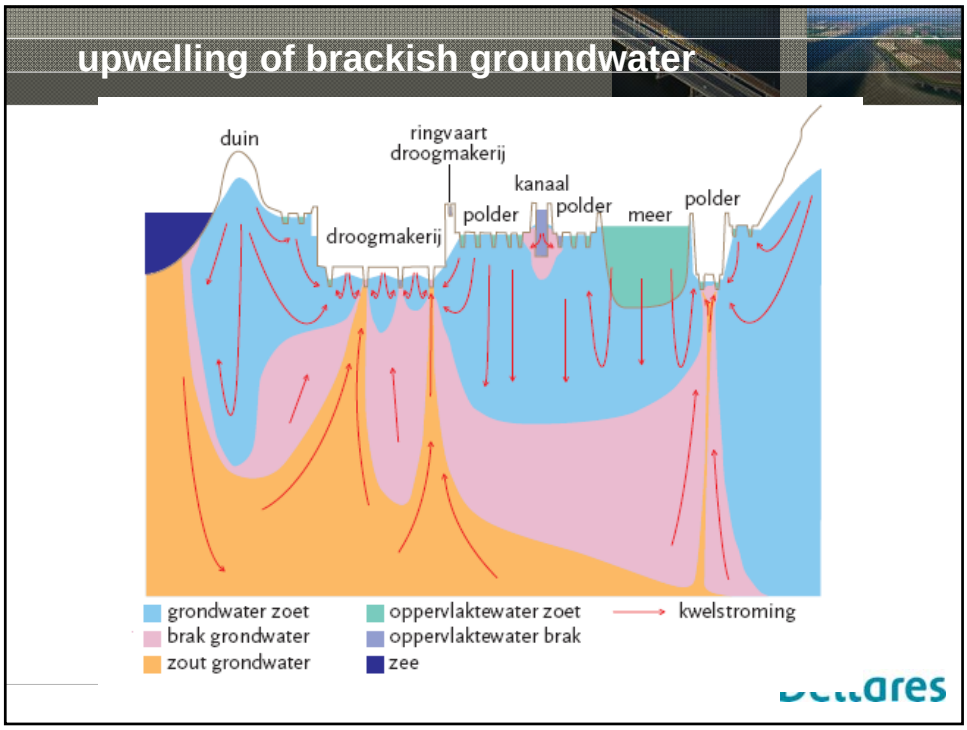
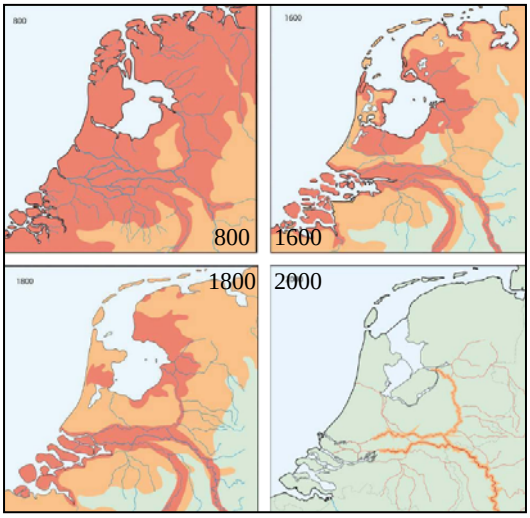

upwelling of brackish groundwater
duin
ringvaart
droogmakerij
kanaal
polder
polder
meer
polder
droogmakerij
grondwater zoet
brak grondwater
zout grondwater
oppervlaktewater zoet
oppervlaktewater brak
zee
kwelstroming

## Long tradition of reclaiming land and managing waterlevels




Degree of control of waterlevels:
red=uncontrolled
green= well controlled

**Will it be managable in the future under a changing climate?**

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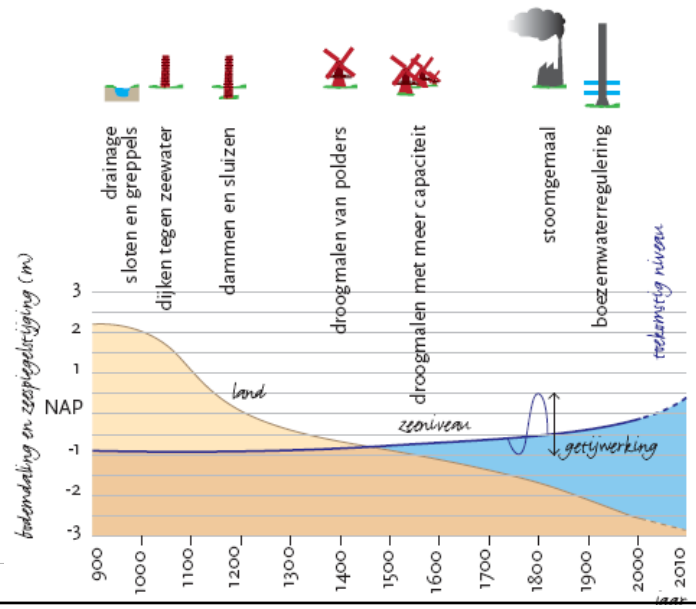
17

## decreasing landsurface while sealevel rises

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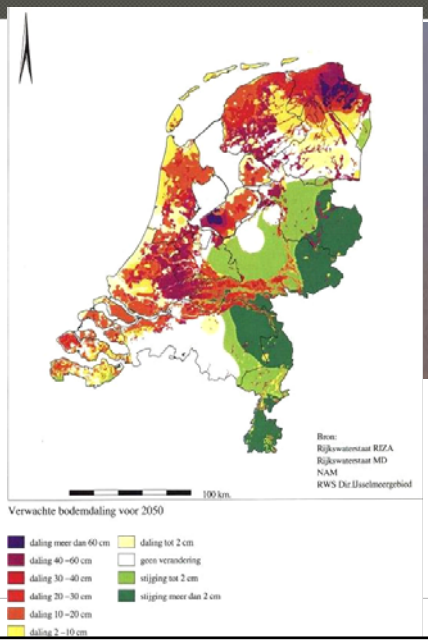
## The subsurface is sinking (5)

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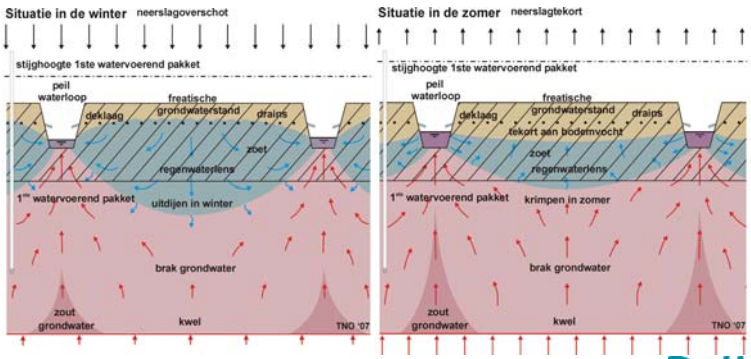
## Expected trends (6)

- shallow fresh groundwater lenses may disappear in 2050 (W+, few dry summers in a row)

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## Trends and effects summarized

- Less water available from rivers and from local soil moisture content
- Increasing external salinization due to SLR and lower river discharges
- Increasing internal salinization due to subsidence and upwelling

- To counteract salinization effect ( in some parts of the Netherlands up to 90% of surfacewater is used for flushing) and for irrigation extra fresh water is needed

- **WATERDEMAND INCREASES AND AVAILABILITY DECREASES**

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## Do we have to act?

## Do we have to act?

- Expected average damage under W+ 2050:
  - Agriculture: 624 M€/year (current: 351 M€/year)
  - Shipping: 280 M€/year (current: 90 M€/year)
- Do we want 2003 to become an average year before 2050?
- Large potential relative changes. And what will Germany do?
- May be the most urgent climate problem in the Netherlands. To act in time we should start now

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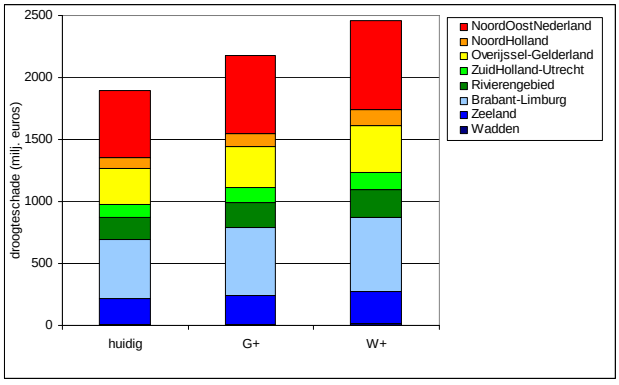
## agricultural damage 2050 extreme dry year

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## We're allready acting

- Delta Committee
- Delta programme 2 has just started
- Aim: climate proof water safety and fresh water supply up tp 2100
- Integrate approach
- Delta fund: 1 billion euro/year

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## Regions within the Deltaprogramme


- North Sea coast
- Wadden region
- SW Delta
- River regions
- Rijnmond
- IJssel Lake area

3 nation wide programms:
- Fresh water supply
- Water safety
- spatial (re)investments

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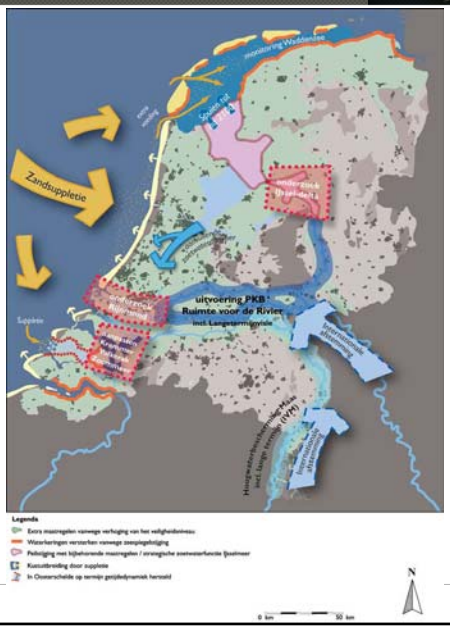
## Advise Delta committee

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## Adaptation strategies

## what are the main options?

- Accept and leave it to economic sectors to act
- Continue the Dutch tradition: why not there's plenty of water, Government just distribute it better and prevent external salinization
- Improve and expand local sources of fresh water (e.g. water technology)
- Adapt water demand by:
  - land use changes: crops
  - reallocation of functions (e.g. green ports)
  - increase waterefficiency

regional self sustainability and/or national organized fresh water supply

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## Does it work?

## Some examples

- Research and Delta programme is just starting
- Large scale measures (water allocation)
- Canalization of rivers (shipping)
- Local allocation and buffering
- Regional self-sustainability

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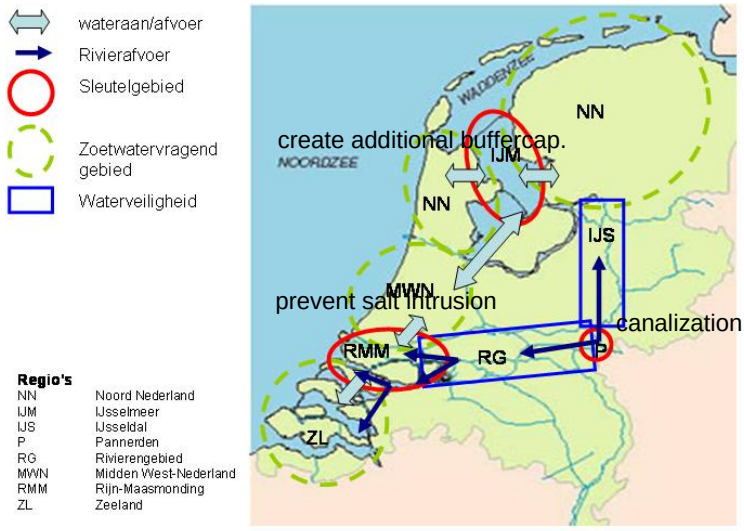
## Large scale measures




**Regio's**

| | |
|---|---|
| NN | Noord Nederland |
| IJM | IJsselmeer |
| IJS | IJsseldal |
| P | Pannerden |
| RG | Rivierengebied |
| MWN | Midden West-Nederland |
| RMM | Rijn-Maasmonding |
| ZL | Zeeland |

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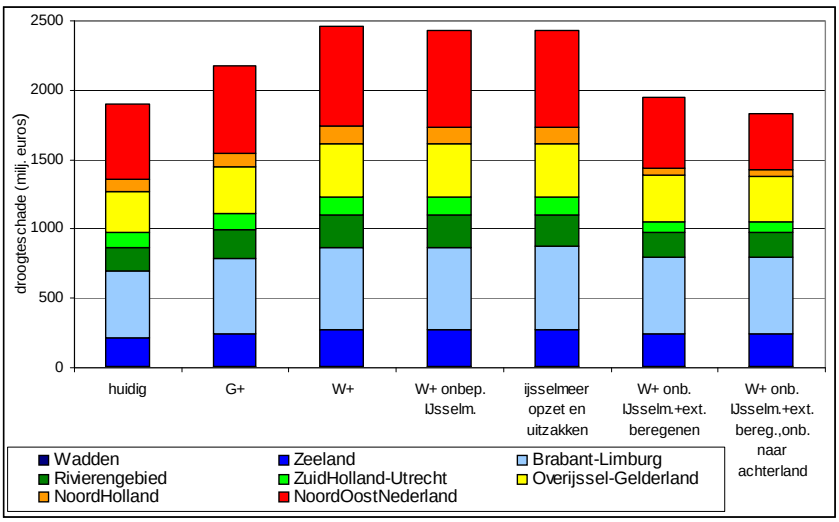
## By increasing IJssellake buffer , agricultural damage can be reduced to current levels (in theory)

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## IJssellake (2)

- Extra buffer of more than 1 meter might be needed
  - raising
  - lowering

  Both options have many consequences

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## Canalization of Waal and IJssel

- Infrastructural measures to prevent damage to shipping are very expensive duur and have a limited effect because of extra waiting times at sluices
  - solutions can also be sought within the shipping sector itsself.

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## Closing off rivers by sluices

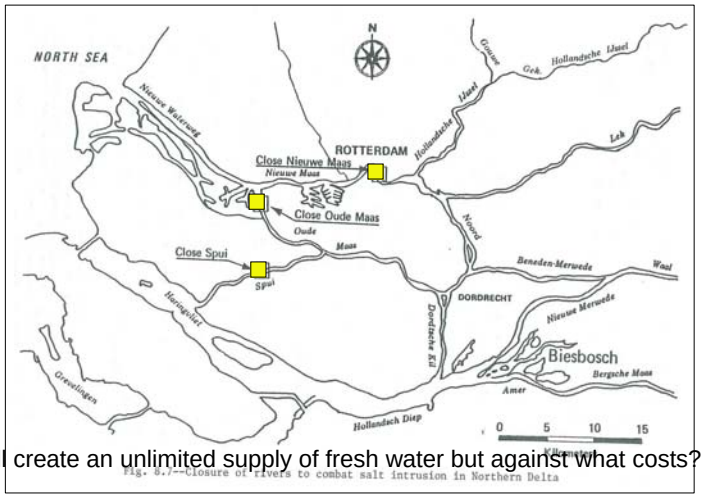

Fig. 8.7--Closure of rivers to combat salt intrusion in Northern Delta

Will create an unlimited supply of fresh water but against what costs?

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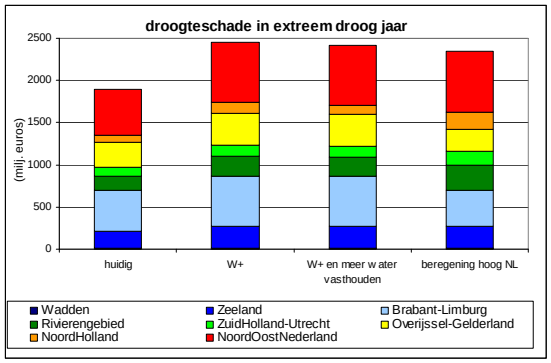
## Local waterbuffering on a national scale not effective

reason in a dry year not enough water to preserve in area.

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salt resistant crops

## In some area's greenhouse sector allready 90% selfsufficient

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## Some mild conclusions

- It's all starting now
- Coming years more research on effectiveness of solutions that promote regional independance
- Better describe water demand
- In the deltaprogramme there might be opportunities to combine large scale measures with water safety measures:
  - Rotterdam area
  - IJssellake

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