



**ROYAL HASKONING**
consultants architecten ingenieurs

The challenge to adapt to dryer and more saline conditions in the Groene Hart

Robert Speets, Delta Conference
29 september 2010

Content of the presentation

ROYAL HASKONING

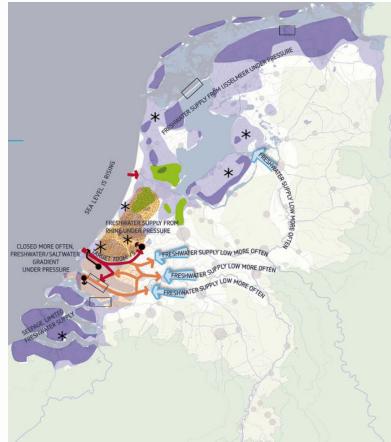
- Introduction
- Goals of the study
- Preliminary results
- Conclusions



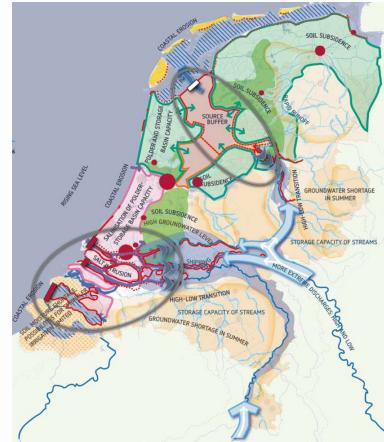
Climate change: dryer and warmer



River discharge low more often
Water quality under pressure



Salinisation (internal/external)
Soil subsidence



The study area



- Densely populated delta
- Major part below sea level
- Complicated water management system

Two main issues

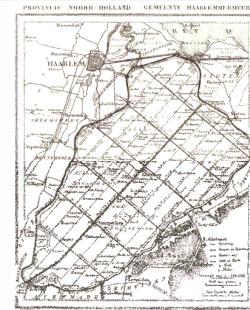
1. Safety against flooding from rivers and sea
2. Safeguarding fresh water supply



The Groene Hart, characteristics



Typical landscape of peaty meadow areas



Droogmakerijen (deep laying polders)



Greenports: bulbs, tree and shrub nurseries, glasshouses



Urbanisation

PROVINCIE: NOORD-HOLLAND GEMEENTE: HAARLEMMERMEER

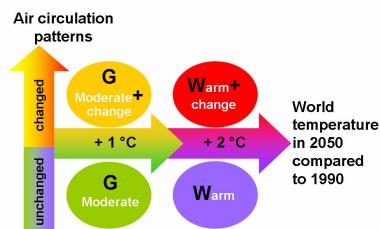
Goals of the study



Search for a climate proof regional freshwater supply

Specific goals of the study:

- Long term water demand development (2050) for W and W+ climate scenario's
- Exploration of measures to increase regional freshwater self reliance
- Adaptation strategies for the period 2020-2050



KNMI'06 climate scenarios for the Netherlands.

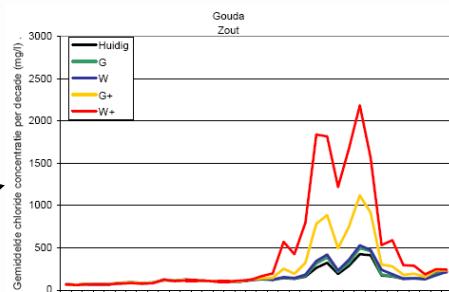
External salinisation



River intake at Gouda:

chlorine concentrations:

- W 500 mg/l
- W+ 2000 mg/l



Chloride concentration at the intake Gouda in a dry year in 2050 (Rijkswaterstaat)

Focus on pilot areas



Focus on pilot areas

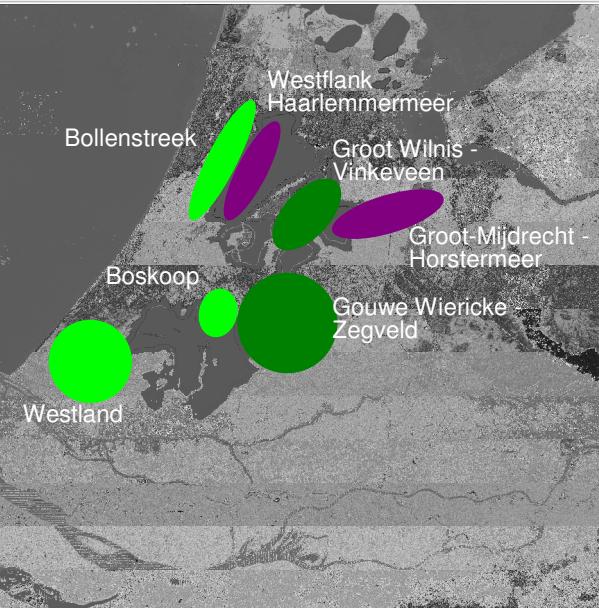
- Already some awareness of effects of climate change
- Specific goals, for example:
 - reduction of soil subsidence
 - establishment of a sustainable network of nature reserves
 - transformation of landuse

Water balances for present situation, W and W+
Possible measures to reduce water demand
Discussions with the stakeholders in the pilots

Study area and pilots



- greenports
- droogmakerijen
- peaty meadow areas



Preliminary results



Example for the Groot Wilnis Vinkeveen peaty meadow area

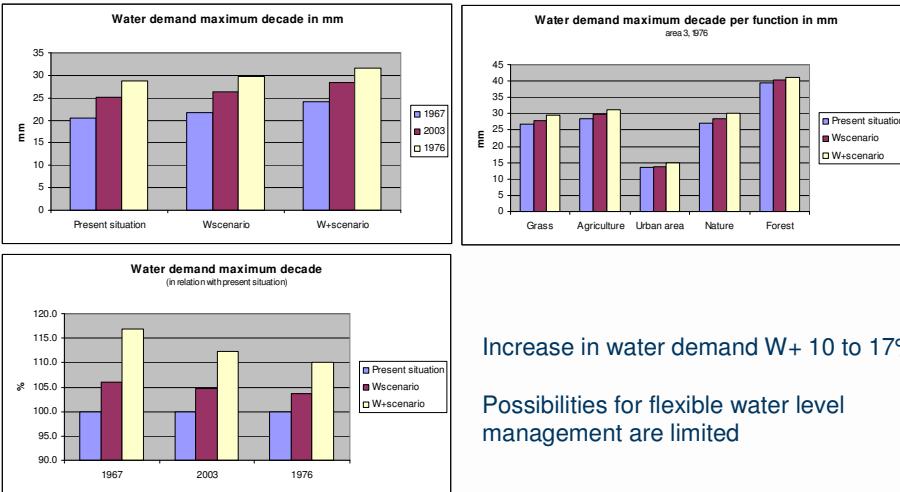
Infiltration area next to the deep laying droogmakerij Groot Mijdrecht

Problems/tasks

- > Desiccation
- > Soil subsidence
- > Realisation of a Green spine



Results Wilnis Vinkeveen



Increase in water demand W+ 10 to 17%

Possibilities for flexible water level management are limited

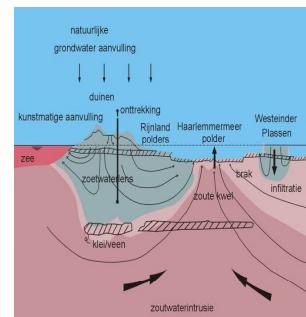
Droogmakerijen



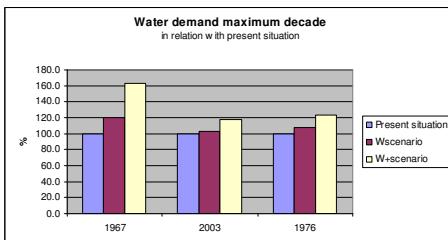
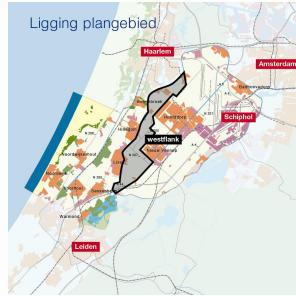
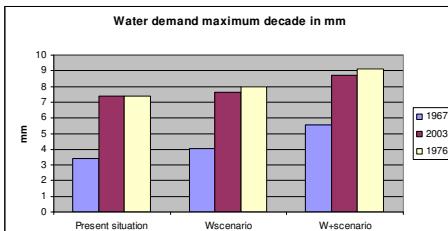
- Deepest parts of the Netherlands
- Upward seepage saline groundwater
- Flushing for reducing chlorine and nutrient concentrations
- System is very sensitive for collapsing of the soil due to high groundwater pressures
- More possibilities for flexible water level management

Results for Haarlemmermeer (Westflank)

- Reclaimed area 150 years ago
- Agriculture, urbanisation, transport (Schiphol airport)



Results water balance Westflank Haarlemmermeer



Increase in water demand 20 – 60 %
(in absolute figures increase is moderate)

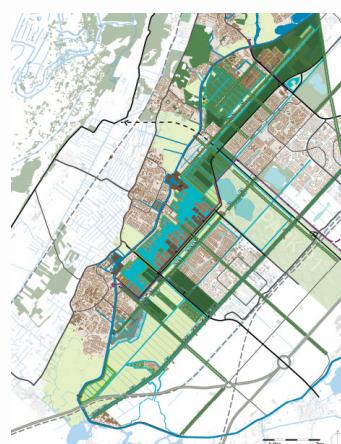
Results: effect of measures Westflank Haarlemmermeer



Conservation and storage of freshwater

Westflank Haarlemmermeer
Transition of 3000 ha agriculture
 ➔ urbanisation in a blue-green setting
 ➔ ambition: watersystem fully self sufficient

- More possibilities for flexible waterlevel management (up to 65 cm) and more surface water (15 %)
- Reduction of seepage by introducing significant higher surface water levels

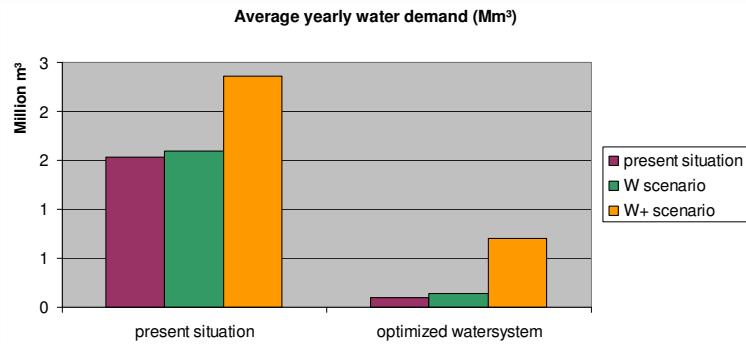


Westflank Haarlemmermeer: effect of measures



The effect of a new innovative watersystem

- > Percentage surface water 4 → 15%
- > Flexible waterlevel management



Waterquality aspects



Main aspects of climate change that affect waterquality

- > Rise of temperature
- > Changes in precipitation patterns
- > Rise of sea level

Main consequences (roughly)

Peaty meadow areas

- Significant increase in nutrient concentrations by accelerated mineralisation and internal eutrophication
- Deterioration of biological waterquality by lower oxygen concentrations and higher nutrient concentrations

Droogmakerijen

- Slight increase in nutrient concentrations by accelerated mineralisation and internal eutrophication
- Deterioration of biological waterquality by lower oxygen concentrations

Preliminary conclusions



- Significant increase in water demand for the maximum decade in 2050 varies due to land use and hydrological characteristics (10 -60% for W+ climate scenario)
- Possibilities for enlargement of regional self reliance are limited; best possibilities in droogmakerijen in combination with changes in land use and have to be tailor made
- Freshwater demand in dry periods will become more dependant from supply from the main watersystem
- A knowledge gap with respect to changes in water quality due to climate change
- Increase in water demand at a W scenario towards 2020 can be accommodated by actual watermanagement policies
- For the W+ scenario a pro-active policy development is propagated for 2050

