

Lessons learned on Groundwater Flooding in TOPSOIL



midt
Central Denmark Region

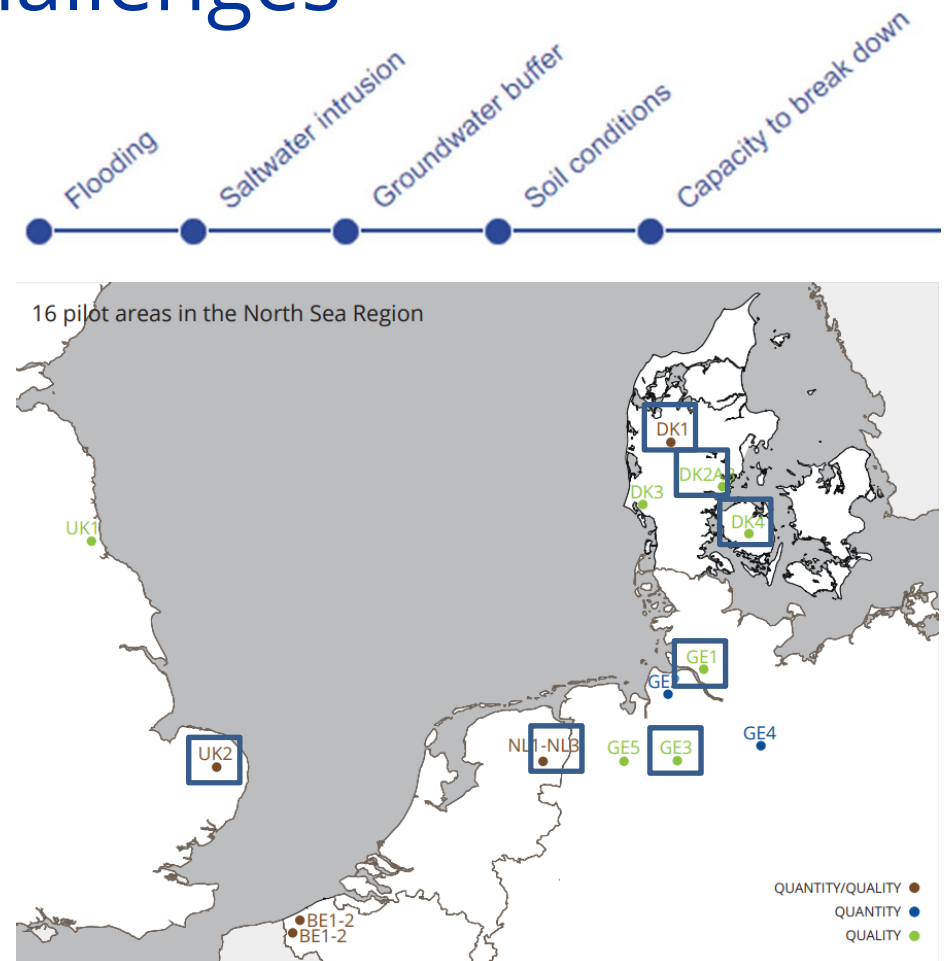


National Conference on Climate Adaption 2019
23rd of October 2019
Anders Juhl Kallesøe, GEUS



TOPSOIL pilots and challenges

- Groundwater flooding 1 of 5 challenges
- Groundwater flooding is investigated in 7 of the 16 pilots: [DK-1](#), [DK-2](#), [DK-4](#), [GE-1](#), [GE-3](#), [NL-3](#), [UK-2](#) (more or less intensively)



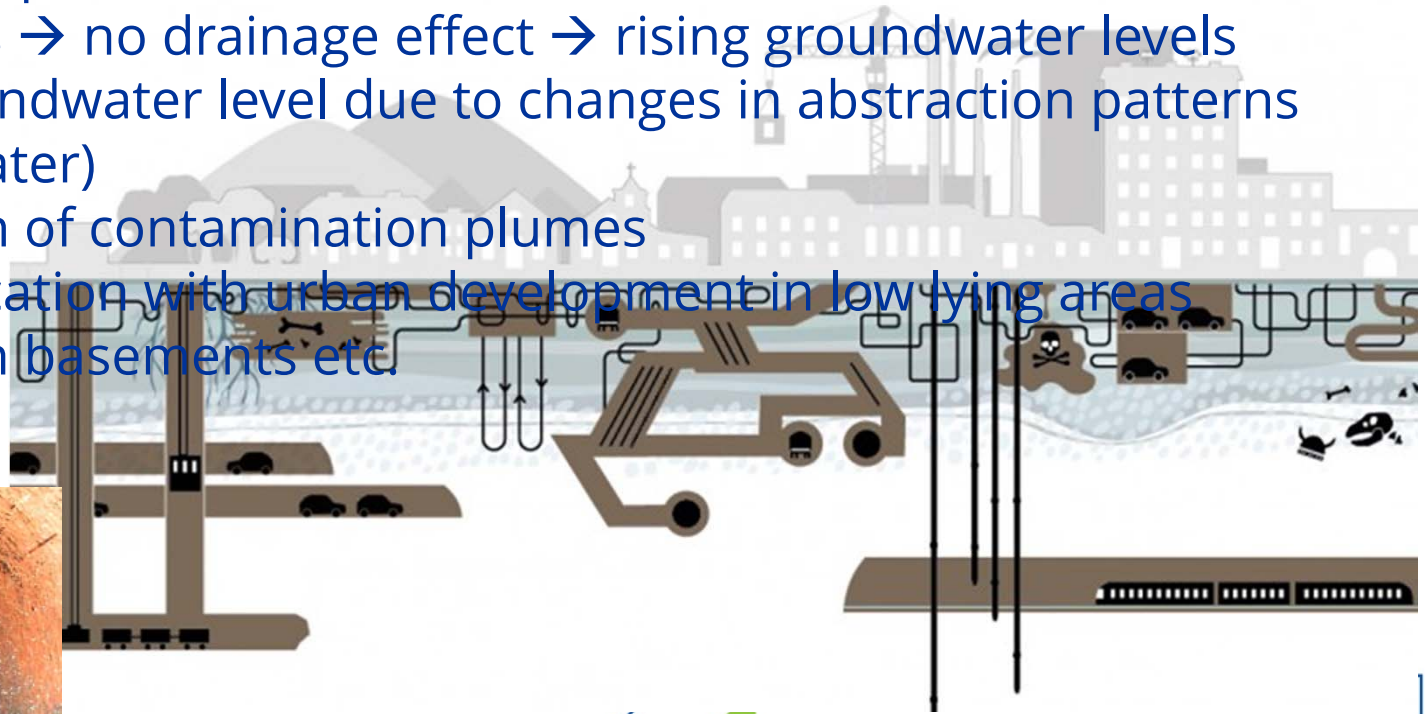
The challenges of groundwater flooding



The direct consequences - experienced in TOPSOIL

The urban environment

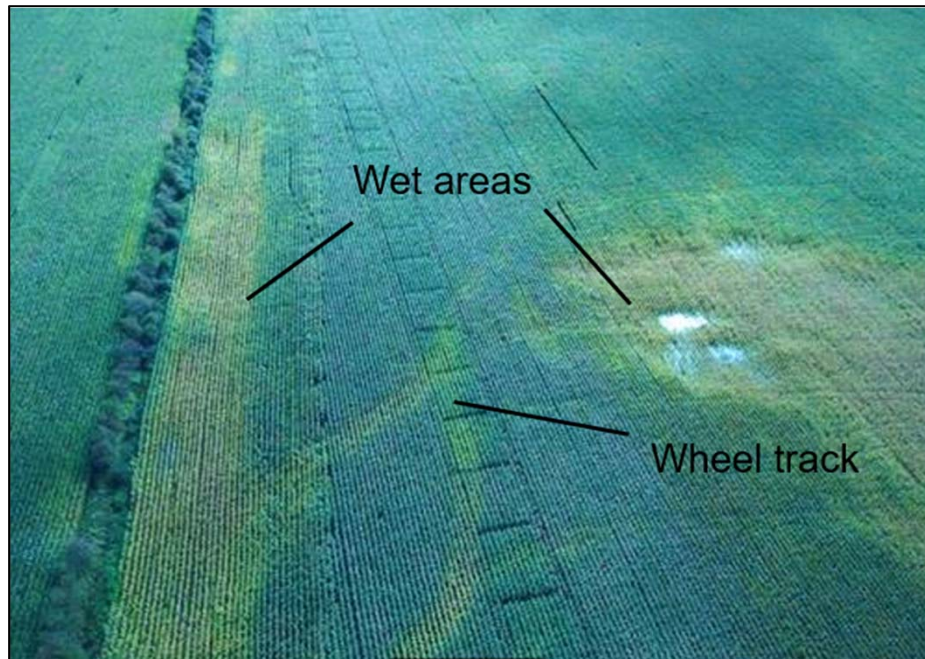
- Old sewers act as drainage (unintentional large water volumes at waste water plant)
- New sewers → no drainage effect → rising groundwater levels
- Rise in groundwater level due to changes in abstraction patterns (drinking water)
- Mobilization of contamination plumes
- City densification with urban development in low lying areas
 - Water in basements etc.



The direct consequences - experienced in TOPSOIL

The open land

- Groundwater flooding of fields/crops
- Many derived effects on agriculture (limited root zone, lower soil temp



Reference: SEGES, R. K. Laursen

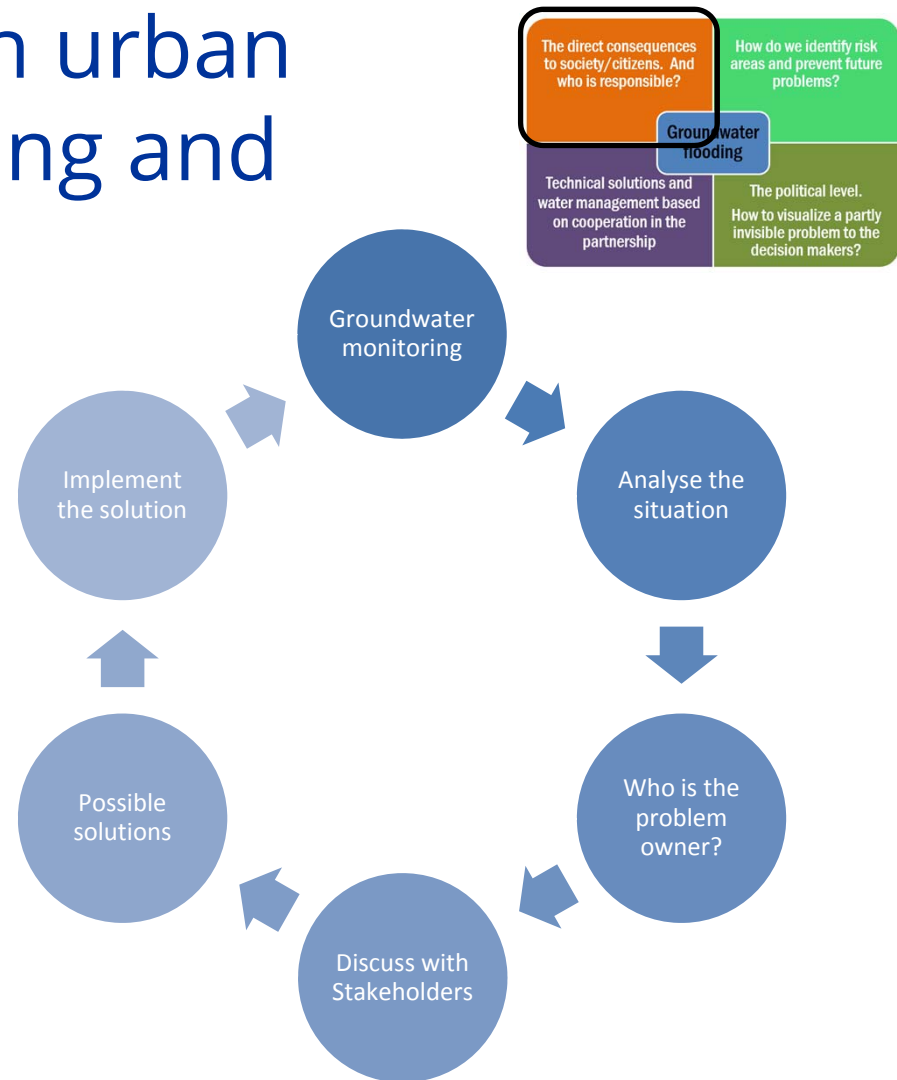
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Shared experiences on urban groundwater monitoring and legislation

Lessons learned

- Urban groundwater monitoring network important
 - Predict and prevent problems
 - Identify problem owner
- The management of surface water is also of influence on the groundwater level in urban areas
- Effective to regulate groundwater by a third drainage pipe in the sewer systems
- The importance of proper stakeholder involvement (clear communication plan)



Reference: Helbig A., Gemeente Gr



Legislation – barrier or opportunity?

The cross border partnership valuable in the process for adapting national legislation on groundwater flooding/rising groundwater

Example:

Clear Dutch legislation on shallow groundwater partly as an driver/input to push for changes in regulation in Denmark

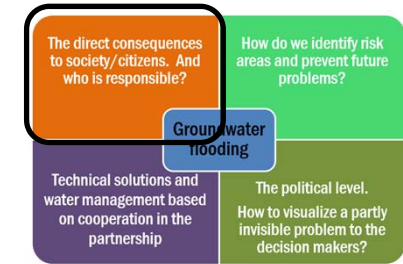
Dutch regulations on this topic since 2008



Figure to right: Danish scientific newspaper article describing challenges in the present Danish legislation

Reference: Helbig, A., Gemeente Groningen

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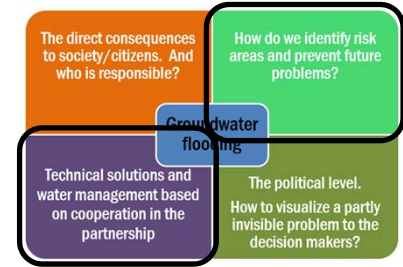
Lovgivning bremser effektiv indsats mod stigende grundvand



Reference: Ingeniøren, August



Added benefit in TOPSOIL pilots – new technical solutions



- Thorough subsurface mapping and modelling approach
- New geophysical investigation methods → Tow-TEM and FloaTEM
- Detailed geological and hydrological models → effective preventive measures

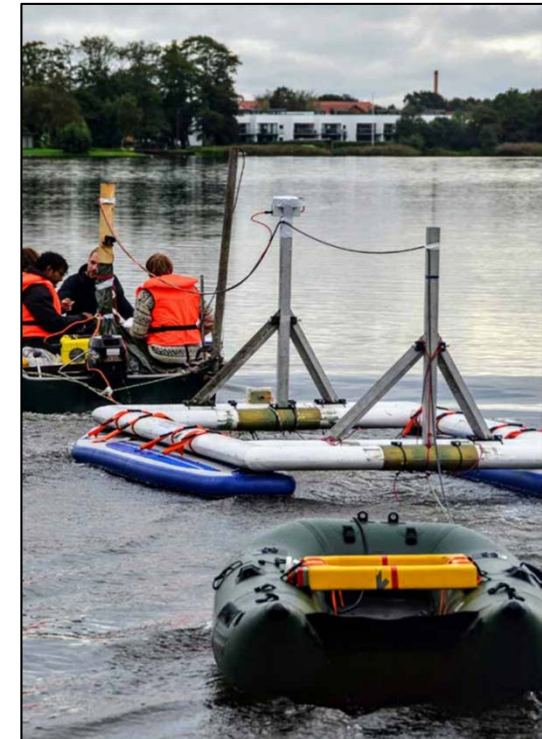
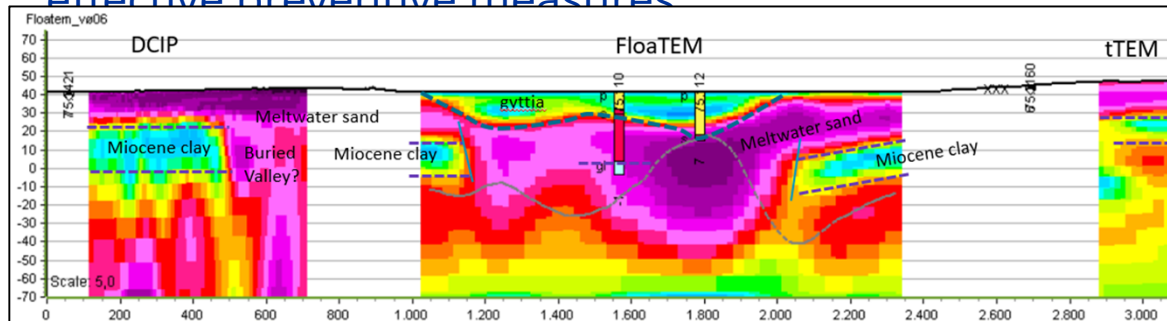


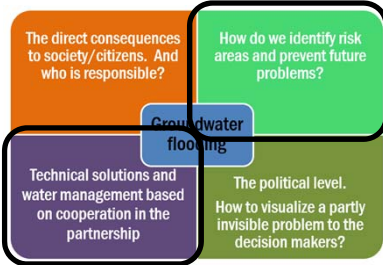
Photo from: Hydro Geophysics Group, Geoscience, Aarhus University



Reference GEUS, 2019

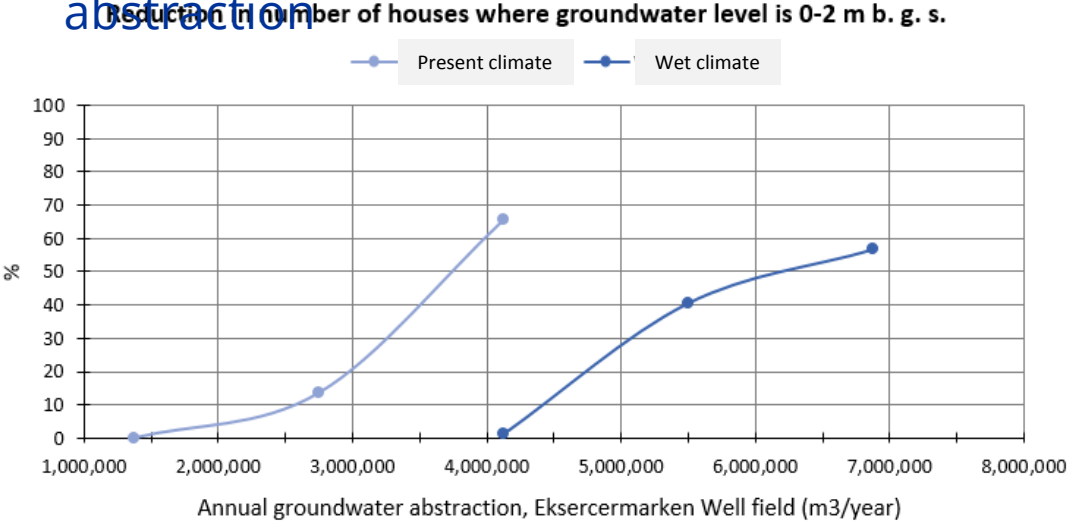
Modelling of rising groundwater levels and preventive measures

- Example from Odense (pilot DK4)
- Challenge
 - Climate induced increase in precipitation and extreme rain
 - Reduced groundwater abstraction in urban areas



Reference: GEUS (Ane LaBianca)

Tested measure: Increase in groundwater abstraction



TOPSOIL as a platform for communication on groundwater flooding to the political level



- TOPSOIL cases adds value on how to face/prevent groundwater flooding
- TOPSOIL acts as channel of communication to politicians in the North Sea region on groundwater-surface water project
- Lessons learned gives perspectives on future focus in groundwater – surface water management

References

Aarhus University, 2019; tTEM Mapping Sunds, Report number 05-03-2018, HydroGeophysics Group, March 2018

Auken E., Foged N., Larsen J. J., Lassen K. V. T., Maurya P. K., Dath S.M., Eiskjær T. T., 2019; tTEM — A towed transient electromagnetic system for detailed 3D imaging of the top 70 m of the subsurface; GEOPHYSICS, VOL. 84, NO. 1 (JANUARY-FEBRUARY 2019); P. E13–E22, 10.1190/GEO2018-0355.1

GEUS, Geological and Hydrological model for Sunds - Preventive measures for lowering the groundwater table now and in a future climate, September 2019 (final draft)

GEUS, Ane LaBianca , Model simulations , Odense, 2019

Ingeniøren, 2019; “Lovgivning bremser effektiv indsats mod stigende grundvand”, Andersen U., August 2019

Helbig A. , Gemeente Groningen, Netherlands; presentation from seminar on groundwater flooding, Vejle, November 2017

Laursen, R. K., SEGES; presentation from seminar on groundwater flooding, Vejle, November 2017

