



## An introduction to TOPSOIL

TOPSOIL is a EU cooperation supported by the Interreg VB North Sea Region programme in line with priority 3 of the programme: 'Sustainable North Sea Region, protecting against climate change and preserving the environment'.

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## A pilot in the picture: Sunds (Denmark)

The town of Sunds, located in Herning municipality, is being confronted with a groundwater table that is very close to the surface and subsequently reacts rapidly in response to increasing rainfall. Due to increasing precipitation as a result of climate change in the near future the town and adjacent fields are very likely to be flooded in winter

periods.

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## TOPSOIL on tour!

Last august an international delegation of water management experts visited Drenthe as part of a TOPSOIL tour to exchange knowledge and ideas.

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## 5 questions to project manager: Rolf Johnsen

As a conclusion to this first TOPSOIL newsletter we asked project manager Rolf Johnsen from Central Denmark Region what his experiences have been in this first phase of the project.

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**Total Project Budget: € 7.34 million**

**Total ERDF: € 3.67 million**

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## An introduction to TOPSOIL

TOPSOIL is a EU cooperation supported by the Interreg VB North Sea Region programme ([www.northsearegion.eu](http://www.northsearegion.eu)), more specifically priority 3 of the programme: '*Sustainable North Sea Region, protecting against climate change and preserving the environment*'.

When facing the consequences of climate change, everybody is watching the sky, expecting monster rain and storm surges. However, also the ground beneath our feet plays an important role with regard to water related outcomes of climate change. This project looks beneath the surface of the ground, predicts and finds solutions to climate change related flooding in wet periods and droughts during summer seasons. In addition, the project will also analyze and manage the impact of climate change on water quality.

The values of society are tied up to the uppermost 20-30m of the subsurface. This is where crops are cultivated and infrastructure is built. In addition, the main hydrological and chemical dynamics are represented in this uppermost part of the subsurface. New knowledge has to be obtained on this matter in order to create sustainable solutions for towns, farmers, waterworks and the environmental remediation of polluted sites. The project will explore the possibilities for using the uppermost soil layers to solve present and future water challenges.

Through the WaterCAP projects, an Interreg IVB North Sea Region programme supported cluster project on water management in a changing climate, the partnership has been involved in extensive consultation with stakeholders, including the EU commission, waterworks, farmers, agricultural bodies, city planners and public bodies. This work provided important input to the following 5 challenges that will be explored in the TOPSOIL project.

1. Flooding in towns and agricultural areas due to rising groundwater table caused by changing precipitation patterns.
2. Saltwater intrusion into freshwater reserves due to rising sea levels and changed irrigation, drainage and drinking water demands.
3. The need for a groundwater buffer to store water in periods of excess rainfall. The buffer of fresh water can be used for irrigation in dry periods.
4. Better knowledge and management of soil conditions, which will provide better resilience to extreme rain events and improve water quality and improve crop yields.
5. The capacity to break down nutrients and other environmentally hazardous pollutants in the uppermost layers is yet unexplored. By improving our understanding, better land management can be implemented.

These challenges will be addressed in 16 pilot areas, to develop and test solutions that eventually will improve the climate resilience across the North Sea Region.



## A pilot in the picture: Sunds (Denmark)

### Introduction

The town of Sunds, located in Herning municipality, is being confronted with a groundwater table that is very close to the surface and subsequently reacts rapidly in response to increasing rainfall. Due to increasing precipitation as a result of climate change in the near future the town and adjacent fields are very likely to be flooded in winter periods.

Taking responsibility for the disadvantages which are connected to rising groundwater tables is a rather new challenge in Denmark. The responsibility to take action is primarily situated at household level. Municipalities and water companies have the responsibility to secure clean drinking water and to transport rain and sewage water, but local groundwater tables aren't within the range of core tasks of local authorities.

In the Topsoil project the partnership will search to understand the challenges the North Sea Region face and find relevant measures and solutions to the problems confronted with.

### Aim of the Sunds pilot

The aim of this project is to better understand the challenges connected to a strong control of the groundwater table. It is expected that the quality of excess water differs from region to region. In some areas the quality is of high standards, while in other areas the quality of the water is poor due to pollutants. Handling climate adaptation due to groundwater flooding will be investigated by new methods and by introducing knowledge from other partner countries with expertise within this field.

### Objectives of the Sunds pilot

- 1) Map the uppermost 60m of the subsurface using different geological and geophysical methods, partly developed within the project.
- 2) Establish a detailed hydrological model with special focus on management of groundwater levels and sensitivity of streamflow to changes in the groundwater head.
- 3) Identify an alternative use for the excess water in the area (irrigation, cooling,...)
- 4) Collect and imply transnational knowledge about near surface groundwater management from the Netherlands, Belgium, the UK and Germany.
- 5) Propose and implement alternative management interventions in the area.

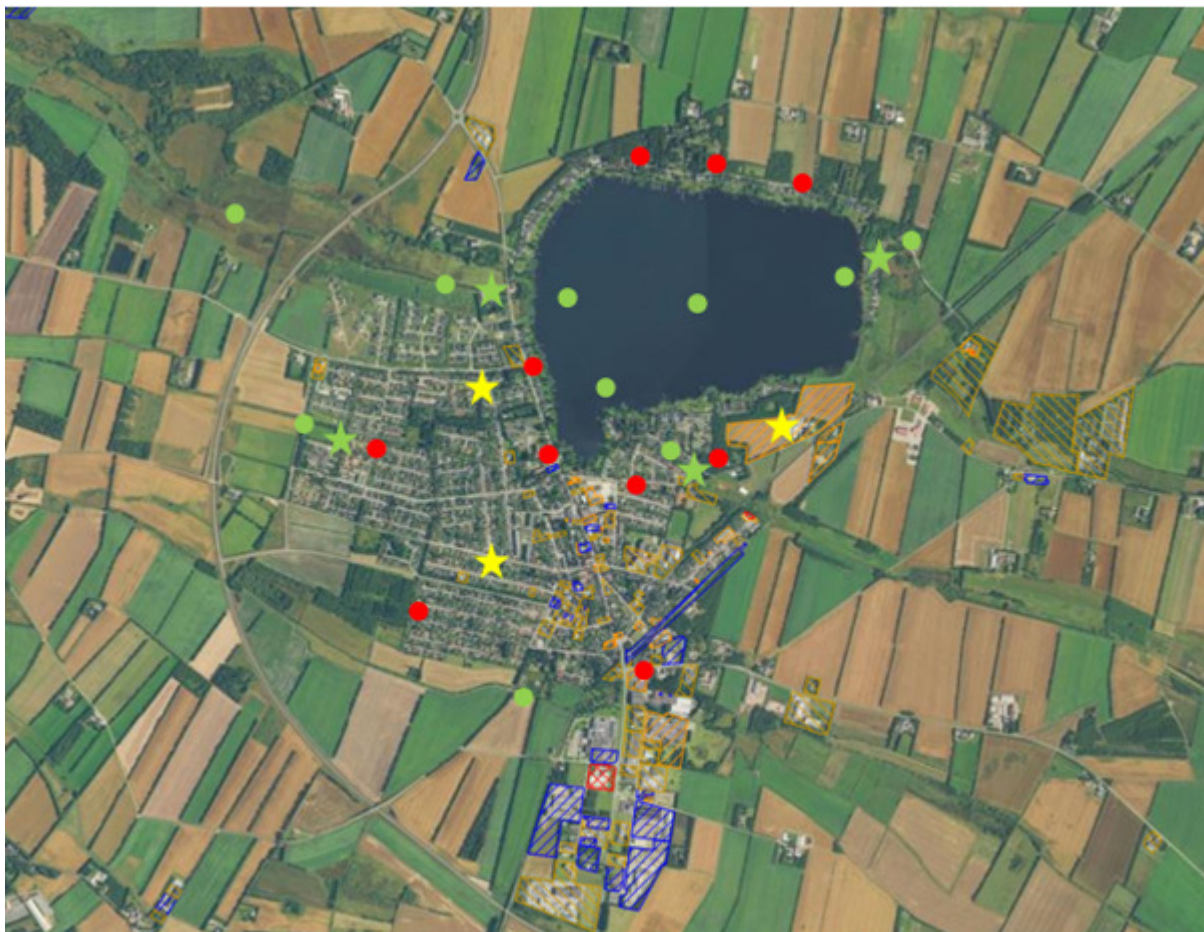
### Planned field work

At the early stages of the project an investigation of the surface- and subsurface groundwater quality is planned. The investigations should contribute to the assessment of different applicable solutions to the challenges in the area. The quality of the water indicates whether the excess water can be recycled, with multiple benefits, or that it needs to be disposed of.

The quality of groundwater close to the surface will be determined through a number of samples taken from boreholes (**red dots on figure 1**) placed throughout the town. The locations of the boreholes are decided based on cognition of areas with high groundwater levels.

In addition to groundwater sampling, surface water will also be collected on 10 different points throughout the town (**green dots on figure 1**). Samples will be collected in 3-4 campaigns to cover seasonal differences.

As a number of point sources within the town are known to be contaminated, the water samples of both ground- and surface water will be analyzed for a number of compounds; i.a. chlorinated solvents, hydrocarbons, water soluble solvents, new and old pesticides and caffeine, which serves as an indicator of wastewater. Furthermore the quality of the natural background will be described through controls of PH, ammonium, arsenic, phenol, ion, potassium, NVOC BOD and COD.



**Figure 1: The pilot with Sunds town and lake. Red dots: boreholes for groundwater sampling. Green dots: points for surface water sampling. Green stars: water level measurement. Yellow stars: groundwater level measurement. Blue marking: potential contaminated. Red marking: contaminated.**

Additionally it is planned to make a geophysical survey using the newly developed TowTEM method (**figure 2**) which can map the soil from 0-60+ mbs. The TowTEM system consists of a non-metallic frame which is towed behind an ATV. The high spatial density one can acquire with the TowTEM

system would be key in order to map the location and orientation of the buried valleys Sunds is located on.

A transmitter loop is mounted on the frame and is used to emit a current which in return creates electrical eddy currents in the soil. When the current is shut off in the loop, a secondary magnetic field is generated. The decay of the secondary field is subsequently measured in a receiver coil which is situated on the frame. The decay and strength of the secondary field is dependent on the resistivity of the soil, which can be related to the geological layers in the soil.



Figure 2: TowTEM system

In urban areas the Electrical Resistivity Tomography (ERT) is to be used (**figure 3**). This method works well in urban areas, since it is not that sensitive to man-made installations, such as telephone cables and powerlines. ERT measures are carried out by injecting electrical current into the ground by means of steel electrodes, subsequently measuring the resulting potential differences at the surface.



Figure 3: Electrical Resistivity Tomography

## Topsoil on tour!

On the 23rd and 24th of August an international delegation of water management experts visited Drenthe as part of a Topsoil tour to exchange knowledge and ideas. Following a short stop in Bremen, representatives from Danish, German and English municipalities, water authorities and knowledge institutes joined their Dutch colleagues to visit various locations and see how Drenthe is approaching issues related to climate change.

The programme included:

- Water management and soil remediation technologies in the urban environment of Hogeveen
- Water quality measures in the Drentsche Aa (a National Park and Natura 2000 area)
- A farm visit with an emphasis on the relationship between agriculture, water and soil
- Adaptation of the sewage system in the City of Groningen

The Topsoil tour was an inspiring experience for all participants!





## 5 Questions to project manager Rolf Johnsen

### What is the main goal of the project?

The main goal of the project is to bring skilled professionals, working on groundwater and geology, together across the North Sea Region. During the course of the project the organizations in this large consortium should find solutions for water management which enables society to tackle climate change and environmental goals at the same time.

The roadmap to the changed management includes traditional ways of evaluating a pilot project, like field surveys, analysis and modeling. However, the new thing in this project is the way we incorporate learning processes. The exchange of knowledge is increased by transnational workshops where we travel- ask questions and debate management of different parts of the water cycle. These learning cycles are expected to provide ideas on how to change administration and legislation around the North Sea.

### What is the role of the Central Denmark Region in this project?

The Central Denmark Region has a large interest in pilot areas in the region. These pilot areas are dealing with three main elements:

- 1) High levels of groundwater flooding (cellars and other areas)
- 2) Soil and crop management at farm level
- 3) Developing new methods for mapping contaminated sites

On top of these academical agendas the Central Denmark Region is the lead partner of the project. Primarily being concerned with project management the role of CDR includes responsibility of securing the direction and progress of the project.

We are a large team of skilled geologists, engineers, hydrologists and administrative employees, working hard to secure a good corporation and spirit within the partnership.

### What is the added value of this Interreg VB North Sea Region?

The fact that 24 organizations across the North Sea Region work closely together on shared challenges like water management and creating resilience against climate change provides us with a regional platform for developing new methods and new administrative solutions, in corporation with engaged stakeholders.

Besides the rather theoretical angle of the project, the 16 pilot areas all deal with one or more concrete challenge. Another advantage of the project is that it will bring the local beneficiaries closer to a solution on their challenges via the project.

### What are the biggest challenges you encountered until now?

The project consortium is being characterized by a very strong partnership. The beneficiaries are all very eager to do their best and work together. However, there are some challenging difficulties to overcome.

The partnership includes 24 partners from five different countries. Within the project we deal with five main challenges. Combining the interests of the different partners and their professional skills is quite a challenge. Working with such a large amount of partners is also quite time consuming. For example: when we want to present the ideas and results in all 16 pilot areas, at least four and a half hours would be required, which isn't that evident.

### **Do you have any experience with other Interreg projects?**

During the last ten years of my career I have been working daily with Interreg projects. An important parts of the Topsoil consortium network was initiated in 2004 during a project called BurVal, in the Interreg IIIB programme. The project's focus was on geological structures and groundwater resources.

In 2008 a lot of awareness was raised in Europe about the need for climate adaptation. As a result of that trend a project focusing on groundwater and climate change was initiated. This project was named CLIWAT. In 2012 the lead partners of all projects in the Interreg IVB programme concerning climate change and water initiated a corporation project called WaterCAP. The project brought results from the 'mother projects' to the EU Commission in Brussels to ensure the results were incorporated in the 2020 strategies.

This was a very interesting journey and increased the EU network in many dimensions. Also, for this project specifically, the partnership is the result of an extensive collaboration between water managers, farmers, public bodies and other important stakeholders, providing valuable input for the challenges explored in the TOPSOIL project.

To conclude I would definitely like to stress that working in Interreg projects has broadened my horizon and perspective in a very important way. You are given the valuable opportunity of comparing own practices with other facing similar challenges.