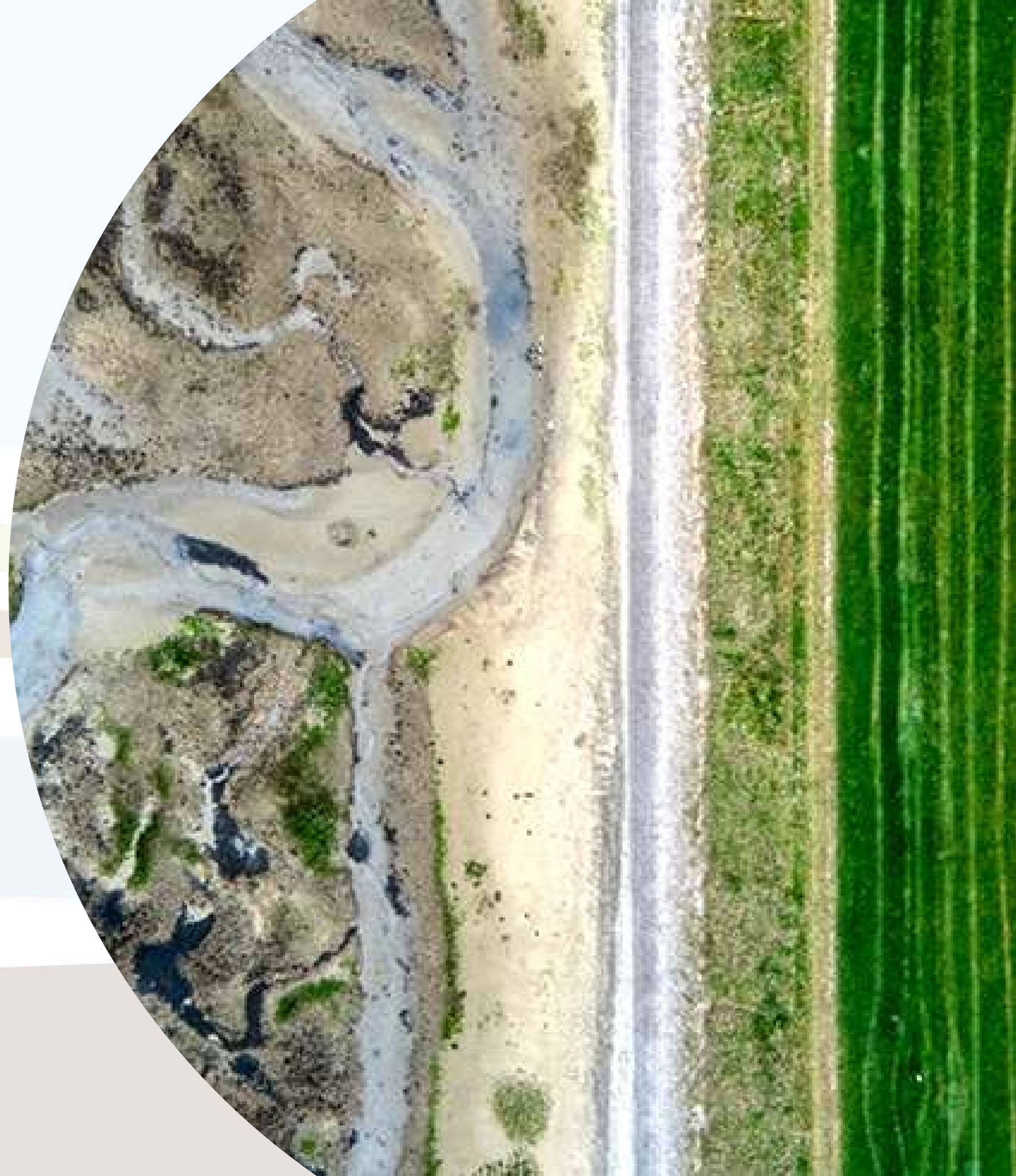




PHISHES

PHysically-based Integrated
Soil HHealth Simulation platform

PREDICTING SOIL HEALTH TO PROTECT ECOSYSTEMS



*How do **soil use and soil contamination** influence **soil functions and associated ecosystem services**, in the presence of major drivers such as **climate change**, and how can we predict the impacts of **mitigation and adaptation measures**?*

A KEY SCIENTIFIC QUESTION



PHISHES – Physically-Based Integrated Soil Health Simulation Platform

is a four-year EU Research and Innovation Action project that aims to:

- bridge the **missing link between data** on soil health and actions for the safeguard of soils
- provide an **integrated simulation environment to quantitatively assess** the influence of land-use change and soil pollution on soil functions and ecosystem services

7 key activities, structured within 7 work packages and 5 test cases, ensuring a comprehensive approach.

- Project number: **101157438**
- Duration: **48 months**
(from 1st September 2024)
- EU Contribution: **HORIZON-RIA**
- Coordinator: **DHI A/S**
- Consortium: **9 organizations from 8 countries**



- While many efforts to assess soil health rely on qualitative approaches, **PHISHES is developing quantitative predictive soil health modelling capability**: at the core of the project is the **development of the PHISHES Digital Platform to promote soil health on European territory**.
- The platform provides a **generally applicable yet transparent methodology** that eases the use of advanced numerical modelling tools for such purposes at any location in Europe, and that allows decision-makers to assess the impact of various management choices and environmental conditions on soil functions and ecosystem services.
- PHISHES will translate scientific insights into evidence that can **inform policy recommendations**, ensuring that decision-makers have the necessary data-driven insights to protect and restore soils.

TECHNOLOGIES USED

- PHISHES builds on **existing and well-recognised modeling tools** to analyse and predict interactions between water, soil, and contaminants in complex ecosystems.
- By leveraging these technologies, the project aims to **enhance the accuracy and applicability of its simulations and support scenario modeling** for environmental assessment and decision-making.
- The use of specialised software enables the integration of **geospatial data, simulation of surface and groundwater flows, environmental impact assessments, optimisation of water resource management strategies.**

FIELD SCALE

DAISY

HYDRUS - PHREEQC

WATERSHED SCALE

MODFLOW 6

MODFLOW 2005

MIKE SHE

ADDITIONAL TOOLS

MIKE ECOLAB

TOXICOKINETIC-TOXICODYNAMIC (TKTD)

THE PHISHES MODELLING RESULTS WILL BE APPLIED AND TESTED AT FIVE SITES ACROSS EUROPE



**Airport in
Örnsköldsvik**
Sweden



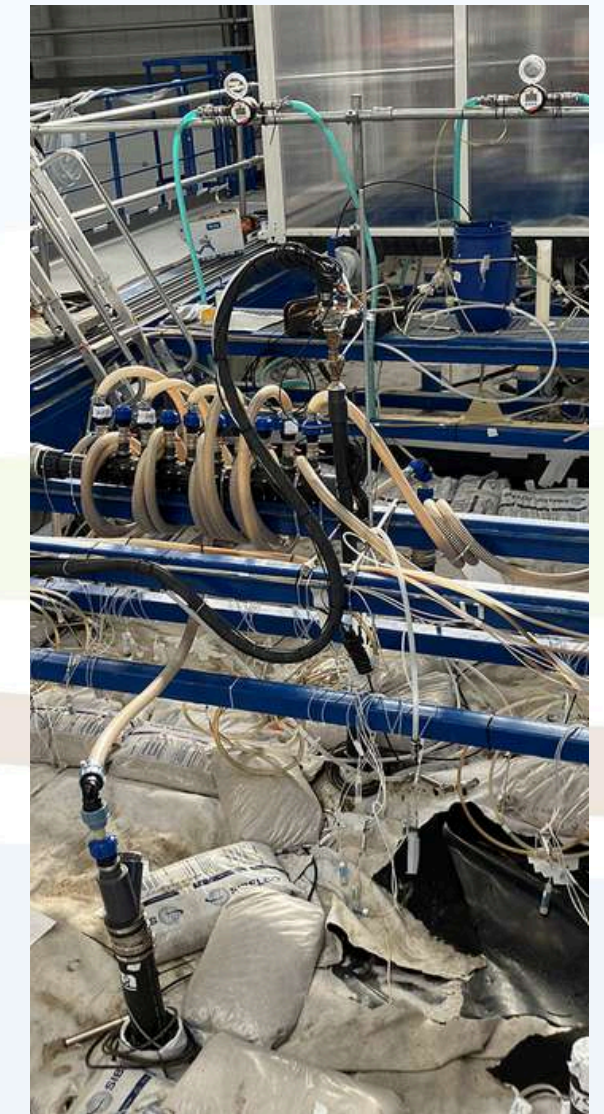
**Koprzywianka
River**
Poland



**Rotterdam
Urban Area**
The Netherlands



**Zelivka River
Basin**
Czech Republic



**PFAS fate and
transport**
France



AIRPORT IN ORNSKOLDSVIK, SWEDEN

Swedish Geotechnical Institute

- Örnköldsvik Airport is located approximately 450 km north of Stockholm, Sweden and 13km from the coast of the Baltic Sea. Adjacent to the airport is an active fire-fighting training area where **aqueous film-forming foam (AFFF)-impacted soils** can be found due to historical use of PFAS.
- This site provides a **real-world test case to study PFAS impacts on soil health, assess remediation strategies, and explore land-use changes**. It also supports testing modelling approaches and identifying the data needed to inform policy decisions.

Tools: the primary model train to be employed is **MODFLOW/MT3D** and **Hydrus 1D/PHREEQC** to capture the transport of PFAS within the unsaturated (HYRDRUS/PHREEQC) and saturated (MODFLOW/MT3D) zones.



KOPRZYWIANKA RIVER, POLAND

Warsaw University of Life Sciences

- The Koprzywianka River is situated in the south-eastern part of Poland, within the Świętokrzyskie Voivodship. Modelling here focuses on **hydrologic responses to varying soil retention and hydraulic properties**, along with the impacts of irrigation practices, and the transport of chemical compounds resulting from agricultural management.
- The site provides a framework for **assessing pollution impacts, evaluating agricultural adaptation measures and soil management practices**, and developing **mitigation strategies for heavy metal contamination**.

Tools: MIKE SHE was selected for the development of the Koprzywianka catchment model, to simulate heavy metals leaching from soils.



ROTTERDAM URBAN AREA, THE NETHERLANDS

Deltares

- Rotterdam consists of a large **harbor area and urban area**, located in the Rhine-Meuse River delta region in the southwest of the Netherlands, , a **low-lying region characterized by soft, water-saturated sediments**.
- The site provides a real-life test case to **evaluate how NbS influence soil health in urban areas**, reducing peak discharge during heavy rainfall and increasing urban greening to mitigate rising temperatures caused by climate change.

Tools: A model workflow for the quantitative evaluation of the effect of various nature-based solutions. This workflow is based on the **MODFLOW 6 (MF6) framework**.



ZELIVKA RIVER BASIN, CZECH REPUBLIC

CzechGlobe

- The River Želivka basin is situated in Central Bohemia and Highlands Region in the Czech Republic, and it has an hilly landscape with three major land use types: arable land (51%), forests (30%) and green areas (16%). **The basin is primarily used for agriculture.**
- The site has been selected due to the **extensive monitoring data available for soil, groundwater, and surface water** that can support modelling of fertilizer and pesticide transport and help identify best practices and adaptation measures to improve water quality under changing climate conditions.

Tools: Healthy soil and its properties affect water quality parameters, both surface and groundwater. The modelling tools were selected carefully and consist of: **MIKE SHE + ECOLAB and DAISY.**



SOIL LABORATORY OF FATE AND TRANSPORT OF PFAS

BRGM

- The Soil Laboratory of fate and transport is an **innovative testing laboratory for soil and water remediation**: PRIME is a facility classified for environmental protection and gives the opportunity to develop and test remediation solutions for potentially hazardous substances.
- The facility is primarily used **to address challenges associated with soils contaminated by emerging pollutants such as PFAS, and their impacts on soil functions that support ecosystem services**.

Tools: A modelling framework has been developed that couples a one-dimensional (1D) model - used to describe water flow and reactive solute transport in the soil and subsoil - with three-dimensional (3D) groundwater flow and transport models: **HYDRUS, MODLFOW, MT3D and PHREEQC**.

PHISHES IS PART OF THE EU MISSION “A SOIL DEAL FOR EUROPE”

To exchange on specific topics and develop concrete actions for cooperation within the EU Mission Soil Community:

Data and knowledge management cluster

To organise, structure, store, share, and access the diverse data and knowledge outputs generated across the soil health community.

Communication and stakeholder engagement cluster

To strengthen communication, dissemination, and stakeholder engagement across the soil health community.

Soil pollution and remediation cluster

To address the urgent and complex challenge of soil contamination, as pollution is a major threat to soil health, with diverse sources and highly localised impacts.

CONSORTIUM

The PHISHES consortium brings together **diverse and complementary expertise**

- **DHI, Denmark (Coordinator)**
- **BRGM - French Geological Survey, France**
- **University of Copenhagen, Denmark**
- **DELTA RES, Netherlands**
- **Swedish Geotechnical Institute, Sweden**
- **German Environment Agency, Germany**
- **CzechGlobe, Czech Republic**
- **Warsaw University of Life Sciences, Poland**
- **T6 Ecosystems Srl, Italy**



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Soil HEalth Simulation platform

Predicting soil health to protect ecosystems