Integrating Geophysical Methods for Monitoring and Evaluating Infiltration Processes in an Artificial Recharge Pond

Prayag, Ankita; Dahlin, Torleif; Martin, Tina; Hägg, Kristofer; Rossi, Matteo; Hedblom, Per; Abu Jaish, Yaman

2025

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

Integrating Geophysical Methods for Monitoring and Evaluating Infiltration Processes in an Artificial Recharge Pond

Ankita Prayag[1], Torleif Dahlin[1], Tina Martin[1], Kristofer Hägg[2], Matteo Rossi[1], Per Hedblom[1], Yaman Abu Jaish[1]

[1]Engineering Geology, Lund University, Sweden, ankita.prayag@tg.lth.se

[2]Sydvatten AB, Sweden

The Vombverket water supply facility utilises 54 infiltration ponds as part of its Managed Aquifer Recharge (MAR) system, a key part of the water supply system in southwestern Scania, Sweden. Due to population growth, increasing industrial and agricultural demands, and the impacts of climate change, the production of the MAR plant needs to increase. In this study, one pilot pond is studied in detail using geophysical methods to provide a basis for optimising the use of the infiltration ponds.

To monitor the infiltration, a Direct Current Induced Polarization (DCIP) system, along with sensors measuring water conductivity, soil moisture, and temperature, was installed to gather data on water saturation and groundwater flow paths (see Dahlin et al., this workshop). The sandy sediments above the groundwater table exhibit high resistivity values (above 1 kΩm), while in the saturated zone, resistivity decreases to just a few hundred Ωm (Figure 1a). In the southern area near another infiltration pond filled with water, we observe a significant decrease in resistivity. This drop indicates higher groundwater levels and a transition to lower resistivity (refer to the pond location in Dahlin et al., this workshop). After 49 days of data collection, the pond begins to receive water, which is evident from the changes in water content.

The reduced resistivity, coupled with the induced polarisation (IP) response, helps identify the direction and depth of water infiltration (Figure 1e and 1f). The low chargeability of the area is attributed to the well-sorted glacial sediments (Figures 1b and 1d). Furthermore, the data show a correlation between changes in the inflow to the pond and variations in resistivity and groundwater levels observed in nearby wells. The sediment layers, the water table, and the 1-meter-deep washed sand filter media are also discernible (1g). Both the DCIP and Ground Penetrating Radar (GPR) results indicate a similar groundwater level in the pond, around 5 meters deep. High-resolution (with 170 MHz antenna) GPR measurements are conducted before and after water infiltrates the pond to capture shallow depth changes with precision.

The next steps involve estimating the soil's hydrological properties and integrating these findings into a hydrogeological model. This model will optimise water management and simulate future scenarios involving increased water demand and climate change impacts. Additionally, it will explore the potential for monitoring biofilm growth in sand filters.

Acknowledgements: This research is funded by the EU Interreg North Sea region via the "*Blue Transition – how to make my region climate resilient"* project, Sydvatten AB and Sweden Water Research (SWR).