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What happens below construction pits? - The long-term erosion of temporary barriers to groundwater flow

Alraune Zech¹, Joris Dekker¹, and Thomas Sweijen^{1,2}

¹Department of Earth Science, Utrecht University, Utrecht, The Netherlands (a.zech@uu.nl)

²Crux Engineering, Amsterdam, The Netherlands

Injection of grout material is widely used to create a temporary flow barrier at construction sites in the Netherlands. We investigate the long-term erosion behavior of a grout layer by means of semi-analytical expressions for groundwater flow and transport.

A typical grout injection contains sodium-meta silicate, water and solidifier forming a temporarily impermeable 'waterglass'. The combination of a waterglass layer and vertical walls allow for dry excavations below the groundwater table. After construction is finished, the waterglass remains in the subsurface and erodes over time. A question concerning the potential risk to groundwater quality remains: How high is the concentration of dissolved waterglass in the groundwater leaving the site?

Numerical simulations allow to describe the flow and transport for site specific conditions. However, it's missing an analytical expression to predict the transport behavior for arbitrary settings. We approximate the erosion behavior by a set of semi-analytical equations. The challenge here is the change in permeability of the waterglass layer from almost impermeable to fully permeable. We define a dilution ratio relating the flux into the construction site to the flux through the layer as a measure of dissolved waterglass concentration leaving the site. We also determine the impact of design parameters such as construction site aspect ratio, depth of the waterglass layer and its thickness. We checked our results against numerical simulations for a range of parameter settings. Preliminary results show that erosion is initially slow and accelerates until the temporary injection layer is completely gone.