Towards a MAR system for sustainable drinking water production in the Flemish polders (Belgium)

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ABSTRACT

In the western part of Flanders (Belgium) groundwater resources are limited because of the hydrogeological structure of the subsurface. Additionally, availability from surface water varies seasonally. Especially in periods with little precipitation, the water resources useful for the production of drinking water experience a severe stress. Therefore, the coastal zone came under attention. Fresh groundwater resources in coastal areas are, evidently, concentrated in freshwater lenses. However, to maintain these reserves in the long term a delicate balance between extraction, natural recharge and boundary conditions must be managed. Managed aquifer recharge (MAR) provides a mean to increase the extraction of water and enhances retaining the freshwater volumes on the long term.

A creek ridge with a fresh water lens (the Avekapelle creek ridge) in the polder area of the Western coastal plain of Flanders was selected for MAR. The intention is to infiltrate water originating from different sources (e.g. river water, polder drainage water, reclaimed waste water) depending on the ability. Doing so, water which is otherwise lost to the sea could be reclaimed. The infiltrated water could be extracted by a number of wells after aquifer passage. In the lowest part of the phreatic aquifer, brackish to saline water is still present necessitating additional treatment (ultrafiltration and reverse osmosis) of the extracted water. However, over time salinity of the extracted water will decrease because of the infiltration. At some point in time fresh water will be pumped and the treatment will only be based on meeting safe drinking-water quality.

In this contribution we focus on the infiltration and recovery of water on the creek ridge. There are a number of different options that will be considered. Infiltration could be done by an infiltration ditch, shallow horizontal wells or deeper wells. Recovery could be realized with wells with different screen lengths or locations or with scavenger wells. The intention must be to minimize the salinity in the recovered water and to optimize the complete freshening of the aquifer taking into account technical feasibility and costs. 3D density dependent modelling is used to simulate the current situation as reference and to weight different scenarios against each other.

With SWIM having its 50th anniversary, this research is a fine example of a field site from which evolving research was presented over the years. A first general groundwater study was presented at SWIM10 (1988) whereas field experiments on infiltration and recovery were presented at SWIM15 (1998). During SWIM17 (2002) a concept for MAR was shown whereas we turn now to a practically feasible system.

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