2022_01_BGS_Jackson: Chalk stratigraphy and its role in managing groundwater abstractions in Chalk river catchments

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The Chalk aquifer supports ecologically very important Chalk rivers and is also a major source of water for public supply. The baseflow contribution from the aquifer sustains river flow and associated freshwater habitats, importantly during dry periods. In south-east England, the environmental regulator, working with water companies, has sought to minimise the impacts of groundwater abstraction on river baseflow, aiming to leave more water in the environment. However, balancing water supply to the region’s large population with the objective to maintain and enhance healthy aquatic ecosystems is an ongoing process. To improve the management of the resource further, better understanding is needed about when and where groundwater abstraction affects river baseflow. This will become more important as the UK’s weather becomes more seasonal as climate changes, and droughts become more intense [1].

The variation of abstraction impacts in time and space is controlled by surface water catchment characteristics, but also by the structure and properties of the Chalk aquifer [2]. In the River Colne catchment groundwater level measurements at different depths indicate significant vertical hydraulic gradients. This may be due to low hydraulic conductivity horizons within the Chalk, but because such data are rare, understanding is limited. The hypothesis is that vertical heterogeneity significantly controls groundwater levels along a chalk hillslope and with depth. If low hydraulic conductivity horizons exist above the level from which groundwater is pumped, then could the impacts on river baseflow be spread more widely over space and time during droughts than is currently thought?

The principal method used to test this hypothesis will be numerical groundwater modelling of the River Colne catchment, at a range of spatial and temporal scales. The research will investigate how heterogeneity in aquifer properties controls behaviour, but also address limitations and uncertainty in models conventionally applied to such systems. The project will use of a suite of modelling tools previously developed to investigate the Chalk aquifer [e.g. 3-6], underpinned by a range of other activities, including: data-based analyses, geological modelling, hydrogeological conceptualisation, and field work. Field work could include geological interpretation of chalk exposures, the installation of loggers/sensors, river flow gauging, and the running of pumping tests. The project is in collaboration with Affinity Water and will make use of their data and knowledge, in addition to a range of other available geological, hydrogeological, and hydrological datasets.

4. https://doi.org/10.5194/hess-17-2083-2013
5. https://doi.org/10.5194/hess-20-143-2016
6. https://doi.org/10.1016/j.envsoft.2019.03.018

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