

Natural attenuation of anthropogenic groundwater pollution in a peri-urban floodplain setting

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Riparian floodplains commonly provide an important connection between the terrestrial and aquatic systems within the urban environment. Floodplains can act as both a conduit and a barrier to fluxes between the two systems and provide a highly biochemically active zone, with the formation of reducing conditions leading to removal of nitrate through denitrification and influencing the transport and mobilisation of phosphate and other trace elements.

A hydrogeochemical investigation is being conducted in Port Meadow, an area of the floodplain of the River Thames in Oxford, to explore the nature and functioning of a floodplain environment in which there is evidence of natural attenuation of anthropogenic pollution.

Port Meadow is an EU Special Area of Conservation (SAC) and lies in a peri-urban setting to the north west of the city of Oxford. It is subject to frequent periods of inundation which affect the geochemical processes occurring, particularly with regard to oxidation and reduction in the shallow groundwater system. Port Meadow is also the site of a former domestic waste dump, which closed in the early 1980s.

The floodplain deposits comprise a thin layer of alluvium underlain by river sands and gravels; these are underlain by the relatively impermeable Oxford Clay Formation. The general direction of groundwater flow through the deposits is south west from the waste dump across the meadow towards the River Thames. A series of monitoring wells downgradient of the landfill, including two transects of three nested piezometers, have been sampled throughout the year to characterise the redox zones that have developed in the shallow floodplain deposits around the waste dump and to assess the seasonal variability in groundwater chemistry.

A combination of dissolved inorganic and organic chemistry and groundwater residence time/contamination tracers, CFCs and SF₆, are being used to make inferences regarding groundwater flow rates and pathways and potential contaminant migration. Fluorescence analysis is being used to characterise the type, relative abundance and sources of dissolved organic matter within the groundwater system.

This work provides a basis for further monitoring and investigation to understand more about the processes occurring in this complex system. This understanding will help to better assess the natural attenuation capacity of riparian floodplains which may have an important role in reducing potential contaminant fluxes from aquifer to river. This has relevance to both the surface water quality standards required by the EU Water Framework Directive and its daughter Groundwater Directive.