Bromate in the Hertfordshire Chalk aquifer: occurrence and hydrogeological controls

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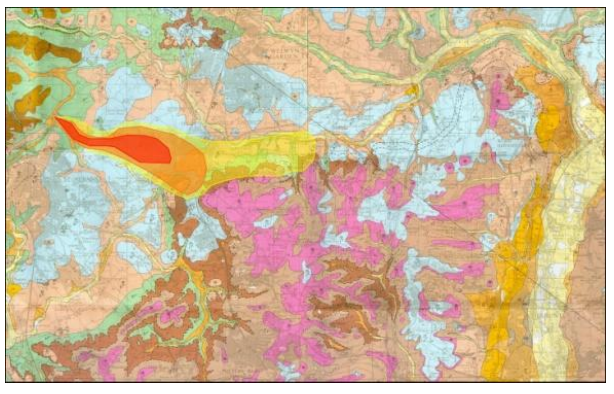
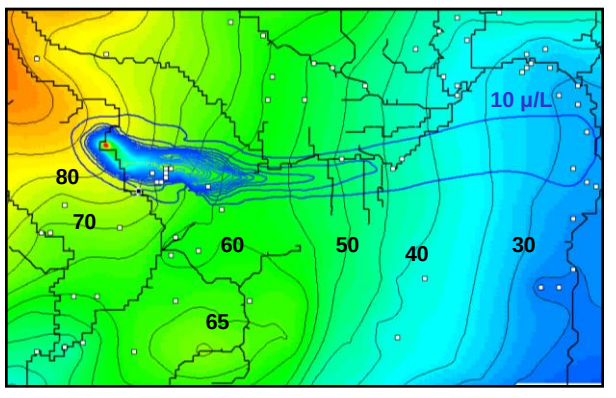
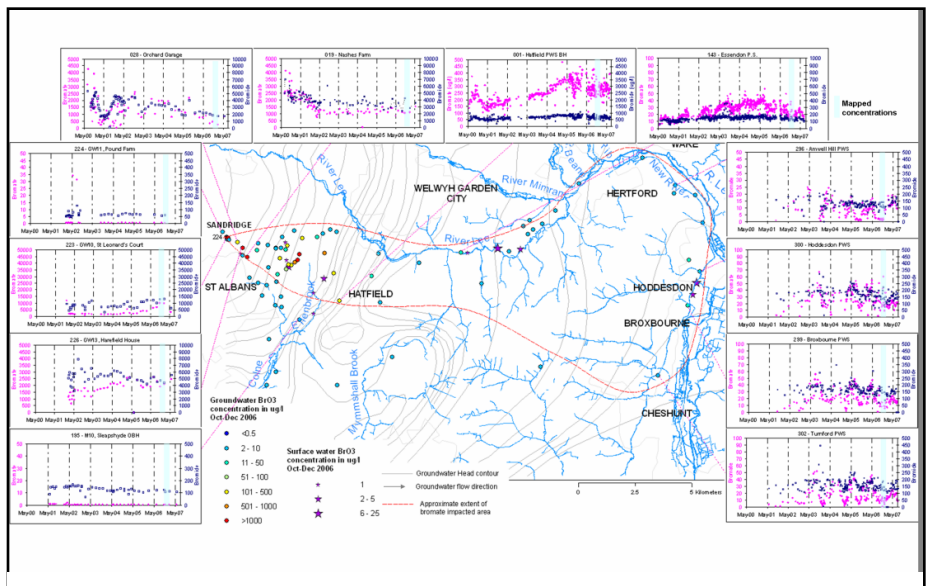
In the most extensive case recorded of 'point source' groundwater contamination in the UK, bromate (BrO_3^-) deriving from a disused industrial site to the north of St.Albans affects groundwater quality across more than 40 km^2 of the Chalk aquifer in Hertfordshire, well exceeding the 2003 Drinking Water Regulation limit of 10 µg/L. The imperative to predict bromate trends at public supply abstractions and other sensitive points raises questions about contaminant transport in the Chalk aquifer in the long-term and at catchment-scale.





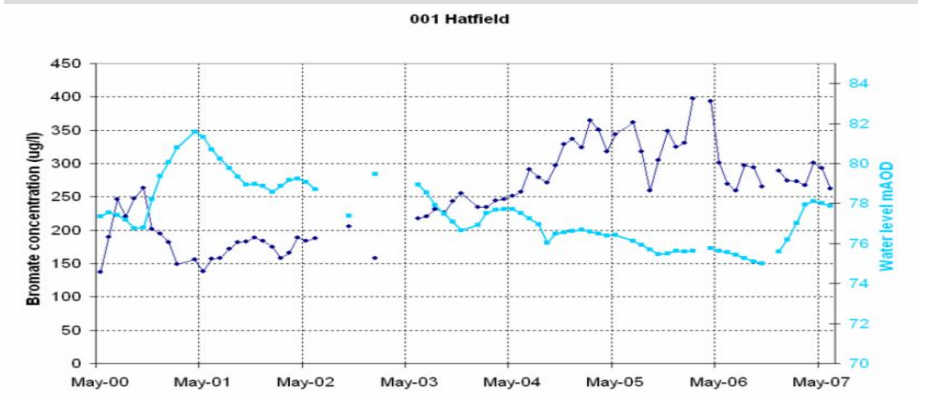
Existing models achieve reasonable simulations of groundwater level and groundwater flow, but do not adequately represent the history and pattern of bromate transport, especially between Hatfield and the Lee valley. We are incorporating double-porosity and karst features into new models of bromate transport across Hertfordshire.

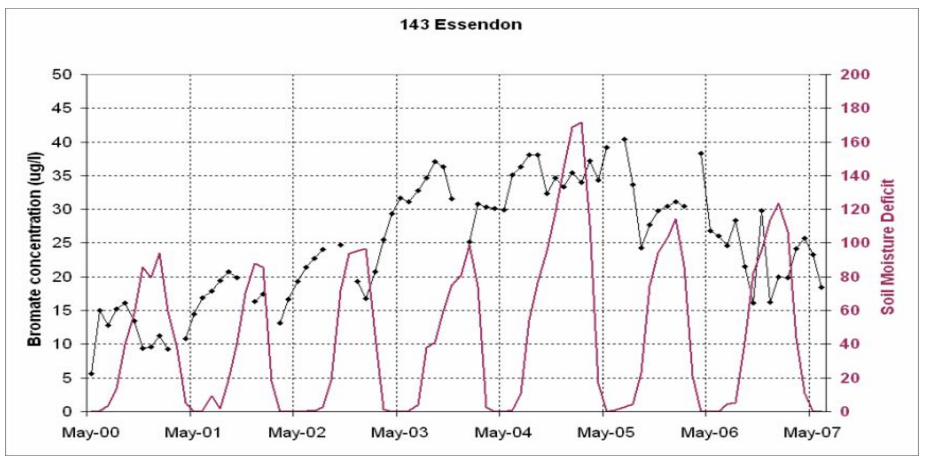
Bromate trends, 2000-2007



Time series of bromate and bromide in groundwater are illustrated for May 2000 to June 2007. The spatial distribution, shown for Oct-Dec 2006, is in general stable, *ca.* 200-400 µg/L at Hatfield, with a slight fall immediately down-gradient of the site and occasional excursions >20 µg/L at the northern Lee valley wells.

The influence of recharge



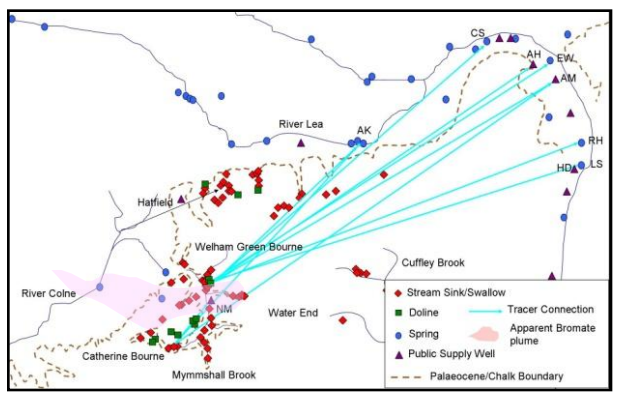


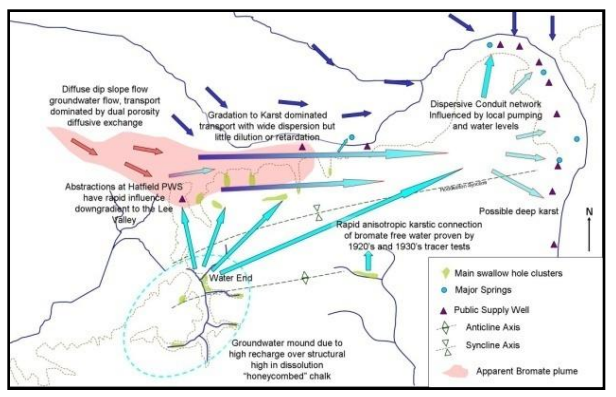
The diluting effect of focussed recharge is indicated by seasonal fluctuations in bromate concentration down-gradient of the source, related to variations in soil moisture deficit and groundwater levels. Bromate concentrations rise as water levels fall (and as SMD increases).

Key questions

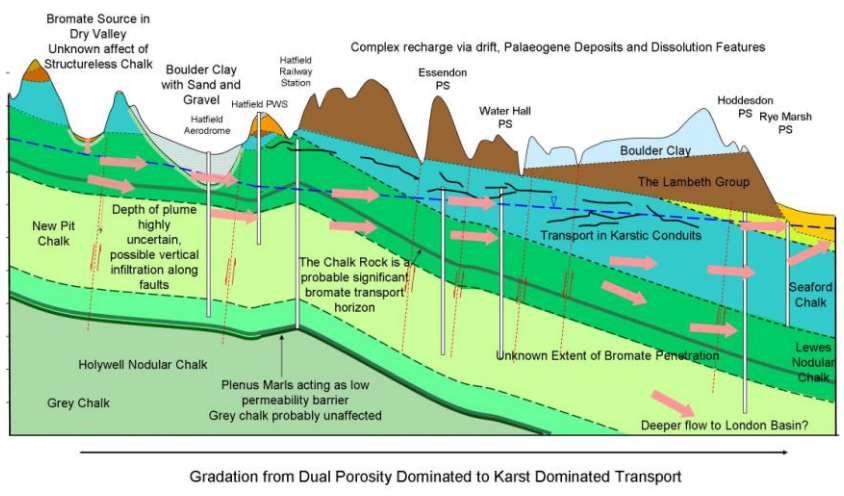
- What are the relative influences of Chalk matrix porosity and Chalk karst on contaminant transport at the catchment scale?
- What is the influence of hydrostratigraphy and aquifer structure?
- How does recharge and groundwater abstraction affect bromate transport?

Influence of karst and aquifer structure





The alignment of significant karst features in the Chalk, and surmised routes of rapid connection demonstrated by historical tracer tests, are coincident with the leading edge of the bromate 'plume' to the east of Hatfield.



Additional tracer tests are planned, including borehole dilution tests to explore the depth of groundwater flow in the Chalk.

Find out more…

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