British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

The British Geological Survey

Environment Agency begin to solve the subsurface jigsaw puzzle using 3D geological models created by the British Geological Survey

The Environment Agency is the environmental regulator in England and Wales responsible for protecting and improving the environment and promoting sustainable development. As part of this role, the Environment Agency manages our groundwater resources both from the perspective of maintaining and improving water quality, and from drinking-water supply and flooding points of view. In 2009, the British Geological Survey developed a 3D geological model of East Yorkshire, to help the Agency meet its regulatory obligations under the Water Framework Directive.

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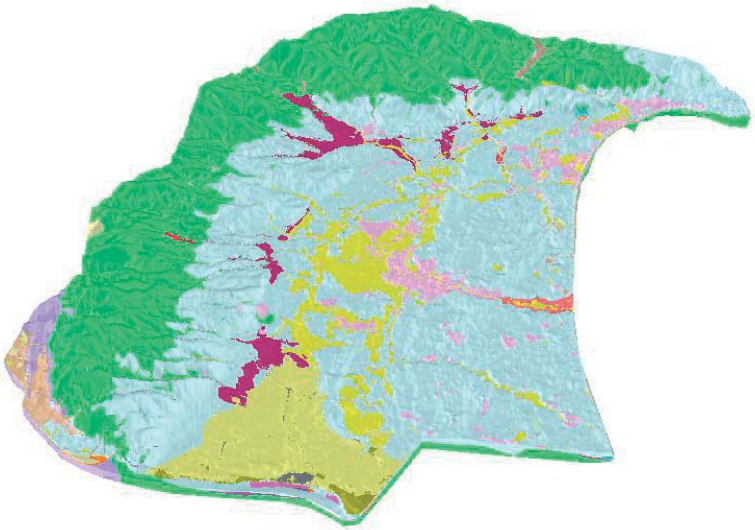
Name	Rolf Farrell
Company	Hydrogeology Technical Advisor Environment Agency
Project	Development of a 3D geological model to help provide an improved understanding of groundwater vulnerability around public water supply boreholes
Key benefit	Rolf Farrell explains: "The 3D geological model built by the British Geological Survey has helped my colleagues and I develop a much better conceptual model of the aquifer between Hull and Flamborough Head, which has in turn helped us to develop our groundwater management strategy"



Beneath East Yorkshire

The Holderness area is underlain by Cretaceous Chalk bedrock. Apart from where the Chalk is exposed on the Yorkshire Wolds, the area is entirely covered by Quaternary superficial deposits. These deposits, which were the focus of the Holderness 3D geological model, dominantly comprise glacial till, overlain in places by fluvial sediments. BGS geologists, Helen Burke and Dave Morgan, created the 3D geological model by drawing more than 70 cross-sections, using data from almost 1400 borehole records. Using these cross-sections and the surface geological mapping, they were able to create a block model using GSI3D (software developed by the BGS and Insight GmBH).

Revealing the subsurface

Through development of the 3D model, Helen and Dave were able to identify extensive sand and gravel units both beneath and within the till sequence, plus a deep sand and gravel-filled channel. These concealed units, which wouldn't be visible on a 2D geological map, are key for understanding aquifer vulnerability and recharge as they provide potential preferential pathways from the land's surface to the groundwater.

Facilitating decision-making

Helen Sharp, who commissioned the 3D geological model from the BGS, is responsible for advising whether activities on the land's surface are likely to result in a deterioration of the groundwater quality. She explained:

> "Three-dimensional geological modelling benefits the Environment Agency in several ways–3D models of complex river and glacial deposits can help improve our conceptual understanding of groundwater recharge and manage the pressures on groundwater quality. We have used the model to: inform recharge on a groundwater modelling project; provide input to our new groundwater vulnerability maps; identify potential groundwater flooding locations, and explain very complex Quaternary deposits to non-technical audiences. We also use it as a planning tool to help understand the likely impacts of developments and Environmental Permits on groundwater quality."

In this way, the 3D geological model is helping the Environment Agency make crucial decisions about the management of land use, water resources, public water supply and contaminated land, in order to protect and improve the environment, whilst encouraging sustainable development.

Using the model

The 3D geological model is a powerful communication tool alone, allowing visualisation of the subsurface, but for more detailed analysis, synthetic drill logs and cross-sections can be generated that enable conceptualisation of the vertical sequence of geological strata. This is particularly powerful as the East Yorkshire superficial deposits are difficult to interpret hydrogeologically due to their heterogeneity. The geological geometries from the 3D model can also be incorporated into groundwater flow models and used to assess the impacts of groundwater abstractions and the potential impacts of drought and climate change.

Availability

BGS has developed geological models in strategically important areas of the UK including London, Merseyside, the Clyde Basin and East Yorkshire and is expanding coverage continuously.

For more information or to enquire about availability or commission a 3D model please contact:

Enquiries

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