The Thames Estuary is set for redevelopment but major regeneration projects of this scale require a thorough understanding of what will be found beneath the mud, as **Dave Morgan** explains.

Modelling the Thames Estuary

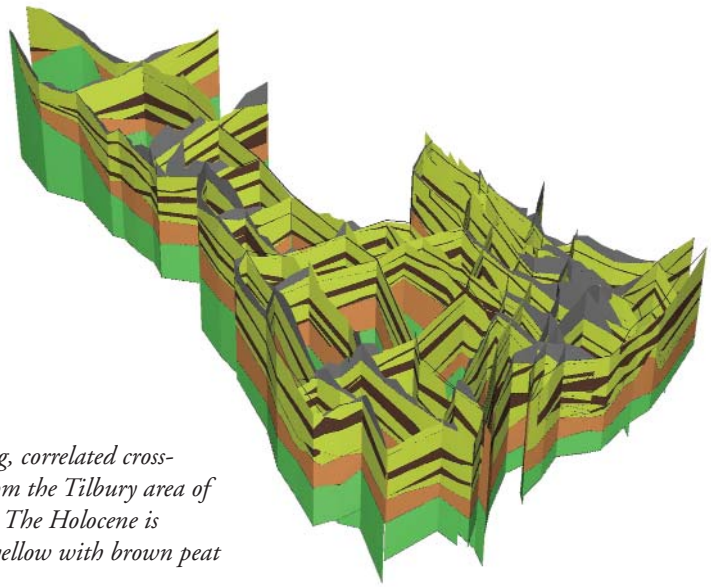
Recent major initiatives such as the 2012 London Olympics and the Thames Gateway regeneration will result in large-scale development of the low-lying, flood-protected ground on either side of the River Thames. These initiatives have stimulated a renewed interest in the geology of the area, and as part of an ongoing coastal and estuarine evolution theme, the BGS is modelling parts of the Thames Estuary.

The estuary work is pooling the resources of a number of other related projects:

- urban geology: Thames Gateway
- geochemistry: Gbase
- engineering geology: PropBase
- the NERC Isotope Geosciences Laboratory: Holocene sea-level change in the Thames.

The research will contribute to the understanding of the evolution of the estuary during the past 11 000 years (the Holocene). An appreciation of how the river and its estuary have responded to past changes of sea level is regarded as essential in predicting how the region may react to future climate change. The project also aims to deliver geological information to interested parties such as planners, engineers and archaeologists in a format that is readily understood by the non-geologist.

The combined studies are currently focused on the River Thames floodplain from the Tilbury–Thurrock area eastwards to the River Medway and Southend-on-Sea. The Holocene deposits at surface comprise alluvium and intertidal deposits — mostly 'mud'. At depth the sequence includes interbedded mud, peat, sand and gravels reflecting changes of environment which were either river-dominated (freshwater peats) or estuary-dominated (clay, silt and sand).



Intersecting, correlated cross-sections from the Tilbury area of the model. The Holocene is shown in yellow with brown peat layers.

" we have just completed a drilling programme at sites mainly along the south side of the river from Dartford to the Isle of Grain "

Unravelling and chronicling the geological events that have occurred within the estuary during the past 11 000 years is a major challenge. The initial collaborative effort involved collating the numerous known but disparate studies held by the Survey for the region into a geographical information system (GIS).

Courtesy of Last Refuge Ltd (photo Dae Sasitorn/www.lastrefuge.co.uk)

The River Thames as seen from Dartford.

This application provides an overview of the available information and enables easy access to the reference data. For example, the BGS National Geological Records Centre holds more than 20 000 borehole records within in the study area, of which 3500 that contained sufficient detail of the Holocene deposits were selected.

These data, combined with in-house digital modelling software have been used to construct a network of correlated cross-sections leading to a three-dimensional model of the subsurface.

Such models illustrate the geometry of the suballuvial sequence ranging from simple layered beds to a complex of interleaved sediments and cross-cutting channels. So far, based on peat-rich layers the model has revealed three distinct zones from west to east.

- From central London to West Thurrock a persistent single peat is present.
- Between the West Thurrock and Tilbury/Gravesend up to five peat layers are separated by silt and sand.
- East of Tilbury/Gravesend the peat sequence is very difficult to correlate as it comprises numerous isolated peat occurrences. These peats may have been contiguous with the main units upstream but subsequently dissected by shifting channels and tidal creeks, or extensive peat development may not have occurred.

The Holocene model so far remains somewhat tentative as it is based on received borehole data, and is not well constrained by carbon dating of organic deposits or first-hand inspection of the sediments. We have just completed a drilling programme at sites mainly along the south side of the river from Dartford to the Isle of Grain. Core samples from this campaign will be logged in detail and a range of physical, chemical and dating tests will be undertaken. This information will aid the correlation of data from the archived boreholes, will improve the three-dimensional model and will contribute to the understanding of how the estuary evolved, and how it may respond to future climate and environmental changes.

> " an appreciation of how the Thames and its estuary have responded to past changes of sea level is regarded as essential in predicting how the region may react to future climate change "

Apart from satisfying the scientific curiosity of geologists the outcome of such research informs a range of external groups from environmental organisations, local councils concerned with planning issues and developers, to archaeologists. The work also satisfies an increasing need to present geological information in a visual format that is understood by other professionals, such as engineers, or by interested members of the public curious about the past.

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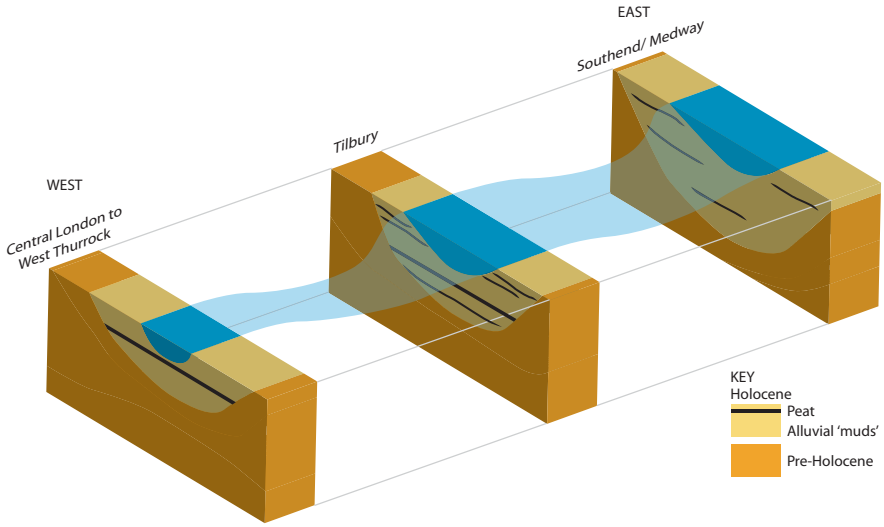

A simple model of the Holocene sequence.