3.3 KENT

L Dyson

The North Kent Coast

The north Kent coast stretches from the confluence of the River Darent and the River Thames at the county boundary in the west to North Foreland in the east. It includes the southern part of the Thames estuary, the Medway estuary, the Swale sea channel and numerous islands, such as the Isle of Sheppey, and former islands, such as the Isle of Grain. The coastline is highly indented with one large and many small peninsulae, and numerous tidal inlets. The north Kent coast can be measured at about 104km in length but is far longer if the numerous islands and inlets are also taken into account.

Most of the coast is low-lying, below 5m OD, but there are low cliffs towards the west at Gravesend, on the north side of the Isle of Sheppey, and towards the east around Whitstable, Herne Bay and Margate. Extensive areas of grazing marsh, reclaimed since at least the Medieval period, are protected by sea and counter walls. Changes expected in the next 100 years on the North Kent coast can be summarised as predominantly large scale mudflat loss, with some areas of significant saltmarsh gain in the Medway estuary (North Kent Coastal Habitat Management Plan Final Report 2002). Extrapolation of historical trends suggests future saltmarsh loss on the southern bank of the Thames Estuary and a gain in mudflat. The Medway estuary is a macro-tidal estuary, considered to have a positive sediment budget, and is the largest tributary to the Thames. It has undergone significant modification due to human activity through the construction of flood defences and large-scale digging of clay in the 19th and 20th centuries.

Like the Essex coast, the North Kent Coast is highly important for nature conservation, and much of it is designated under the RAMSAR convention and as a Special Protection Area. The majority of the coastline is also protected by the national designation of SSSI.

Coastal Archaeology in North Kent

Throughout prehistory and history the River Thames has formed a major thoroughfare between the continent and the heart of England. Indeed for substantial periods of time the British Isles have been part of the continental mainland, with the Thames, which moved to its present valley during the Anglian glaciation, forming a tributary of the Rhine. The lower Thames, particularly the area between Crayford and Gravesend, is probably the richest and most well-known area in the UK for Palaeolithic archaeology and Quaternary geology. Following the end of the last glaciation, deep alluvial deposits have accumulated in the river valleys, burying the earlier Holocene land surfaces and preserving artefacts, structures and environmental evidence. The marshes and inter-tidal zone that fringe the Thames, Medway and Swale are also rich in visible evidence of their long occupation. There are numerous examples of maritime and military remains, large medieval churches founded on wealth from the wool trade, and substantial industrial remains such as gunpowder works, and structures relating to the cement, power and chemical industries. Archaeological remains on the north Kent coast have attracted sporadic attention for centuries. From at least the mid-eighteenth century it has been recognised that very large quantities of Roman pottery could be found in the marshes north east of Rochester. Various local archaeological groups have undertaken fieldwork in the coastal zone. In particular the Upchurch Archaeological Research Group has carried out long term monitoring of archaeological sites and monuments in the intertidal zone in the area north of Gillingham and Rochester, and the Oyster Coast Fossil Society have recorded archaeological remains in the Whitstable area. Discoveries of prehistoric trackways and other sites made by the groups have enhanced awareness of the considerable archaeological importance of the Thames and Medway estuaries. In general, however, systematic survey of the north Kent coast had not been carried out until the recent Rapid Coastal Zone Assessment Survey.

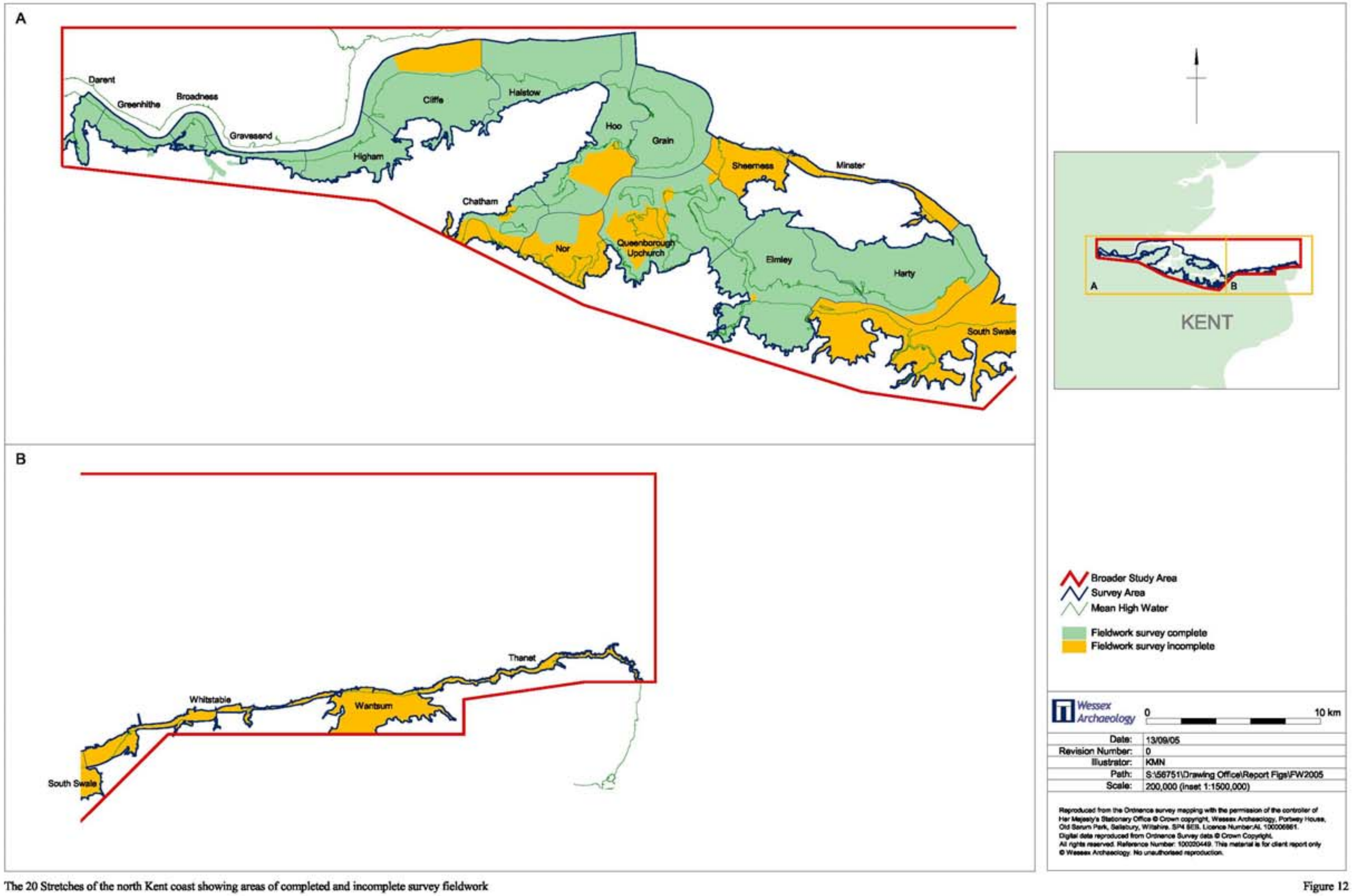

Fig 3.3.1 North Kent coastal survey area (image: Wessex Archaeology)

Fig. 3.3.2 Survey of hulk during north Kent coastal survey (photo: Wessex Archaeology)

Fig. 3.3.3 Wooden fish-trap, Shornmead, Kent (photo: Wessex Archaeology)

Fig. 3.3.4 Recording Shellness WWII minefield control tower, north Kent coastal survey (photo: Wessex Archaeology)

North Kent Coast Rapid Coastal Zone Assessment Survey

A Rapid Coastal Zone Assessment Survey (RCZAS) of the historic environment of the north Kent coast is being undertaken by Wessex Archaeology on behalf of Kent County Council with funding from Interreg IIIB and English Heritage. The work originated as one of a number of pilot coastal zone surveys undertaken in England with the aim of refining methodologies and practice. The aim of the north Kent coast RCZAS is to enhance information in the county Sites and Monuments Record (SMR) in order to allow more informed decision-making in relation to strategic coastal planning and management initiatives, and for individual development proposals.

Phase One of the survey comprised a desk-based assessment of the historic environment of the north Kent coast from the River Darent in the west to North Foreland in the east. The vertical extent of the study area was from 0m OD (Mean Low Water) to +5m OD. The former generally represents the county boundary whilst the latter is generally above the extent of Holocene alluvial deposits. All readily available archaeological, documentary, cartographic and air photographic sources were studied and 1864 new records were created and incorporated directly into the Kent SMR. In addition a simple digital elevation model of coastal change from the Mesolithic to the present day, based on modern bathymetry and topography, covering the area between 30m below Chart Datum and 50m above Ordnance Datum, was provided.

The desk-based phase has been followed by a phase of field survey that aims to check existing records and identify and describe new, previously unrecorded, monuments and finds. The Phase 2 survey has focussed primarily on the inter-tidal zone as the area subject to most change, due mainly to coastal processes, coastal protection works and built development. At the present time there is also no clear funding mechanism for mitigation of the effect of natural coastal processes on the historic environment. The methodology for the field survey has been developed and refined over five seasons of fieldwork (Wessex Archaeology 2006 North Kent Coast Rapid Coastal Zone Assessment Survey Phase II Field Assessment Year Two Report and earlier reports). From the outset it was decided that it would be most efficient to be able to access the digital SMR in the field and similarly to be able to edit existing records, and create digital data for new records, also in the field. It was therefore necessary to find software and equipment that could be taken into quite harsh field conditions. The most cost-effective equipment was found to be a handheld Trimble GeoXT which combines a Trimble GPS receiver and a computer running ‘Pocket GIS’ Windows mobile software for Pocket PCs. This unit was found to have a lateral and vertical accuracy to within one metre, which is considered adequate for this type of survey. More precise surveying would obviously be required for detailed monument survey and to obtain sea-level index points. A second survey unit which had been used during the earlier phases of the field survey and comprised a GPS in a backpack and a linked handheld PC, was also carried as a back up.

The estuaries along the north Kent coast contain many islands, and it has been necessary to use a small workboat (W4.65 Avon inflatable) to gain access for survey. In future it may also be helpful to use the workboat to access areas of firm ground near low water which are not easily accessible from land because of large expanses of soft mud.

The field survey comprised an extensive ‘walkover’ survey of the high water mark and a sample of the intertidal zone of each stretch of coast. Depending on access and time constraints a proportion of the area above high water was also surveyed. Possible walkover routes were identified before going into the field but health and safety issues relating to the soft mud found along much of the north Kent coast often meant that it was a case of assessing which was the safest route to use when in the field. Walkovers were generally undertaken by teams of two people, except when the workboat was being used, in which case two two-person teams were used. Data recorded in the field, including GPS derived polygons for existing and new records, were converted into ArcMap shape files and incorporated into the SMR database.

A total of 221 new monuments were recorded and 230 updated during the 2004 field survey, and 198 added and 379 updated in 2005. Highlights among the new discoveries include a prehistoric submerged forest at low water in the west of the study area, the remains of possible prehistoric brushwood trackways, possible Roman pottery and salt-working sites, substantial wooden fish-traps, and numerous post-medieval wrecks and WWII defence structures.

Pilot Deposit-modelling Survey

In addition to the RCZAS, a second project has been assessing and developing methodologies for deposit modelling. Coastal wetlands are often characterised by areas of deep alluvium. Archaeological investigation in advance of construction of a tunnel under the River Medway revealed a sequence of Holocene alluvial deposits up to 14m thick, and even deeper sequences are known elsewhere along the north Kent coast. Such deposits can contain excellently preserved waterlogged artefacts, structures and environmental indicators, and sometimes preserve whole landscapes with detailed evidence of past activities. These sequences are under threat from coastal erosion, coastal defence works, built development in the inter-tidal zone and deep sub-surface impacts such as tunnels and dredging for navigation and other channels. By their very nature, such sequences may mask the presence of important archaeological remains, which may be very deeply buried and not easily accessible using standard evaluation techniques. It is therefore important to develop cost-effective methodologies for improving understanding of deep alluvial sequences and the archaeological information they contain, and for predicting where particularly significant archaeological remains might be located.

In this context a pilot deposit modelling study was commissioned as part of Action 2A. The project was undertaken by Dr M Bates, University of Wales, Lampeter and supported by Dr R Bates, University of St Andrews (Bates and Bates 2006 Deposit modelling: A Geoarchaeological pilot study in the Kent/Essex Thames estuary – see below). The first stage comprised a review of recent literature on methods and techniques for investigating deeply buried or sub-marine sequences of fluvial, estuarine or marine sediments and producing sub-surface models at different scales. For most areas of the UK in which deeply stratified Pleistocene and Holocene sediments are present, geological maps only show the near surface sediment types, and it is difficult to ascertain the nature of the deposits at depth. Borehole logs obtained for geological purposes can help but the records may not be sufficiently detailed, and terminologies used by engineering geologists may differ from those used by geoarchaeologists. At the present time regional scale-mapping using borehole information is the norm for the north Kent coast area. Site-scale information is commonly available but it is difficult to scale up to the local level.

Part of the northern end of the Hoo peninsula was chosen as an area for a case study of local-scale modelling. An area was selected for site investigation to improve understanding of complex deposits where Pleistocene deposits enter the Holocene floodplain. Binney Farm, Allhallows was chosen for this work because previous development-related fieldwork in the area has shown that the geological sequences are more complex than suggested by the BGS mapping, and interglacial sediments of unknown age had recently been discovered to the west of the site. The investigation used a combination of geophysical and boreholing techniques, and aimed to demonstrate whether:

1. Electro-magnetic (EM) surveying techniques are able to differentiate near surface (upper 3m) differences in sediment types within typical Holocene sequences;
2. Electrical resistivity sectioning can produce sequences that match the EM survey techniques in the near surface zone and extend the electrical sectioning into the deeper sub-surface zone (3-15m);
3. Electrical sectioning can differentiate geological sequences from Pleistocene and Holocene deposits;
4. Careful placing of ground truthing locations (boreholes/test-pits) can significantly enhance understanding of the geophysical data;
5. Combined datasets can provide a detailed picture of sub-surface stratigraphy and site evolution.

The survey instrument used to map the near surface geoelectric units was the Geonics EM-31 with digital acquisition. The site was surveyed with data recorded at 1m intervals along lines spaced at 20m intervals perpendicular to the projected lines of any channels. The lines were surveyed using surveyors tape and compass with the corner points surveyed using the EDM and DGPS.

2D electrical sections were surveyed using a Syscal Junior 2D resistivity geo-electric profiler. Electrode spacings from 1m to 5m were tested at the site with different survey configurations and offset programmes. Ground truthing of geoelectric units was achieved using boreholes drilled either by a Terrier drill rig or a shell and auger drill rig.

The electromagnetic survey was conducted across nearly the full width (c.400m) of the low-lying floodplain between the Allhallows and the former Binney Island to the east. The results suggest the presence, near surface, of low resistance (conductive) units narrowing in a south-westerly direction and being replaced by fingers of more resistant (non-conductive) sediments. A zone of very high resistance exists to the south eastern parts of site suggesting the presence close to the surface of coarse, relatively resistive sediments, perhaps gravels or sands. These results can be interpreted as depicting the distribution of Holocene channels within the marsh system with more conductive units representing channel fills. These appear to equate with recent drainage features on the marsh surface. This information would predict the location of sediments of finer grained texture (clays/silts/organic sediments) within the low resistance zones that might be suitable for palaeoenvironmental investigation. The edges of these zones are likely to be those zones in which channel marginal structures (jettys, trackways etc.) may be present.

Ground truthing through the drilling of the boreholes and microfossil assessment of the contained foraminifera and ostracoda indicated that a thick sequence of laminated sands and silts is present beneath the Holocene superficial sediments. These deposits are certainly of pre-Holocene date being separated from the Holocene deposits by a gravel unit of braided channel character. This evidence enables the geophysical results to be re-interpreted and the moderately conductive units adjacent to the Holocene channel fill re-interpreted as Pleistocene sediments.

The results clearly demonstrate that the electromagnetic surveying techniques are able to differentiate near surface differences in sediment types within typical Holocene sequences (upper 3m of stratigraphy) and Pleistocene sequences. Matching results from the electrical resistivity sectioning and the EM survey techniques in the near surface zone (upper 3m) has been achieved, and geophysical survey has been extended, using the electrical sectioning, into the deeper sub-surface zone (3-15m). Electrical sectioning can be used to differentiate bedrock sequences from Pleistocene and Holocene deposits, although this is difficult without ground truthing. The geophysical survey data have allowed a number of scenarios to be developed for interpreting the subsurface sequence. This has allowed a number of critical locations to be selected for the careful placing of ground truthing locations (boreholes/test pits) that can be used to test the models. Other case studies of local-scale modelling have also been examined as part of the study.

The pilot deposit modelling study has identified a number of limitations on the investigation of sequences and palaeogeographies in the lower Thames Kent/Essex area, including the following.

i) The large-scale mapping provided by the BGS does not reflect the complexity of the subsurface sequences.
ii) Although Pleistocene palaeogeographies are now reasonably well established for the region and are at a scale suitable for placing known sites within a landscape context, their ability to predict the location and characterise the nature of individual sites is poor.
iii) Pleistocene sediment bodies have had a complex post-depositional history and are often characterised by lateral discontinuity.
iv) Within the Holocene and late Pleistocene sequences, preservation and lateral continuity is better but subsurface stratigraphy bears little resemblance to near surface stratigraphy.
v) BGS mapping of the floodplain is too generalised and cannot be used to indicate depth, principal sediment types, or ages/environments of deposition for alluvial sediments.
vi) At present there is a paucity of borehole information available in accessible archives. Detailed modelling can only be undertaken with considerable quantities of point specific data.
vii) Deeper geophysical survey datasets are not presently available for the study area.
viii) Models developed at a regional scale cannot simply be downsized to apply at the local (archaeological site) scale.

Fig. 3.3.5 Geophysical survey, Binney Farm, Hoo, Kent (photo: M. Bates)

Fig. 3.3.6 Shell and auger survey, Binney Farm, Hoo, Kent (photo: M. Bates)

Fig. 3.3.7 Terrier drilling survey, Binney Farm, Hoo Kent (photo: M. Bates)

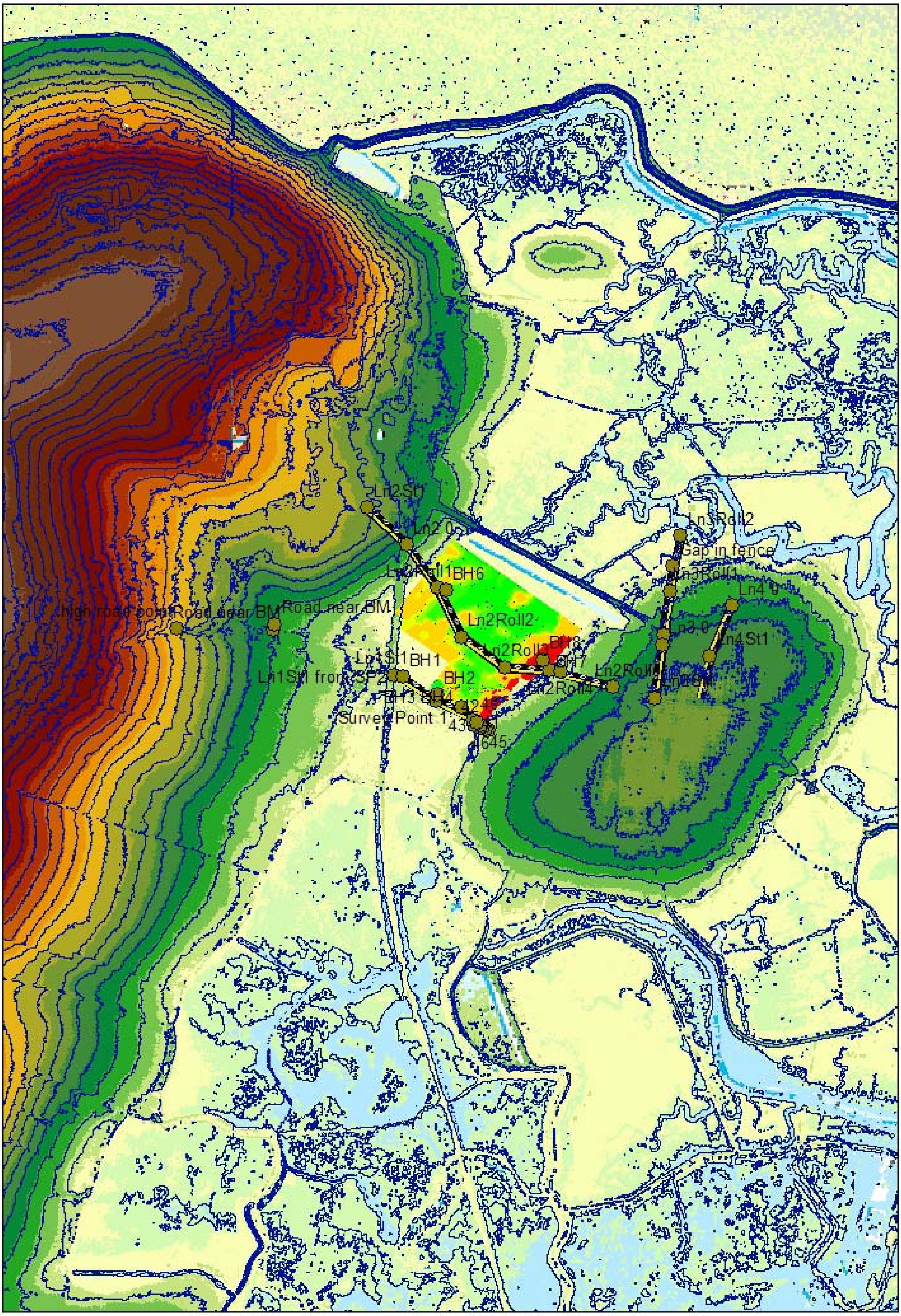

Fig 3.3.8 Map of survey area at Binney Farm, Hoo, Kent (photo: M. Bates)

In order to progress future modelling of the Kent/Essex Thames estuary area, considerable investment in data gathering and interpretation is required. Further work is required in developing and refining methodologies for investigation, in developing a larger number of case studies, and applying methodologies and testing models at a variety of scales. Major development projects should be preceded by the construction of a ground model (following appropriate data gathering), thereby enabling areas to be targeted for detailed investigation. This approach has been demonstrated with positive results in advance of the CTRL Section 2. There is a particular need for further work in the transitional zone between wet and dry landscapes i.e. the intertidal and shallow marine zone, where techniques are often at the limit of their applicability. There is an urgent need for better publication of Holocene case studies and models, and for the rigorous testing of such models. In the short term, 'publication' via the web would get the information into the public domain and allow researchers access to data, enabling models to be developed and improved information to be used in relation to future development and coastal protection proposals.

Discussion

The projects outlined above contribute to a number of objectives and areas of research set out in An Archaeological Research Framework for the Greater Thames Estuary (Williams and Brown 1999). In particular, the development of non-intrusive techniques such as geophysics for the location of sub-surface deposits and features, and undertaking baseline survey to provide a framework for defining further research priorities in the intertidal zone.

The methodology for the RCZAS of the north Kent coast is now well established and highly effective. The baseline survey is now about two-thirds complete. The results of the survey are presently being used in assessing the significance of the historic environment in connection with flood risk management programmes (Thames Estuary 2100), and Shoreline Management Plans for the coast from the Hoo Peninsula to South Foreland, and the Medway estuary and Swale sea channel. It is also being used in relation to spatial development plans and historic environment strategies for the area.

Geophysical survey combine with limited boreholes has been shown to be a very cost-effective method for broadly characterising the sediment sequence over large areas. Such an approach should be a first stage in assessing the potential of alluvial areas proposed for development, allowing a strategy to be devised for more detailed survey and investigation as appropriate.

Future Work

In the immediate future, funding will be sought to complete the baseline survey of the north Kent coast. Once baseline survey is complete there will be a need to set up mechanisms for ongoing monitoring of archaeological remains in the intertidal zone. Observations during the RCZAS and by local groups have demonstrated that the coastal environment is highly dynamic with archaeological landscapes disappearing over periods of 5-10 years in some areas. Although targeted funding may be available in relation to specific coastal management and development proposals, it is likely that local archaeological groups will continue to play a significant role in the ongoing monitoring and recording of the historic environment of the North Kent Coast.

There is an urgent need to improve the dissemination of geoarchaeological and deposit modelling reports and to make accessible to researchers and contractors information on boreholes in the region. Further models of coastal sequences should be prepared, tested in the field and used to improve curatorial responses to development and management proposals.