



**7258
Rapid Coastal Zone Assessment Survey
Phase One Desk -Based Assessment –
Inner Humber Estuary**



Cornwall Archaeological Unit

Report No: 2020R041

Front cover: Barrow Haven, North Lincolnshire.

7258

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Phase One Desk-Based Assessment
Inner Humber Estuary**

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Summary

This report summarises the results of the Phase 1 Desk-Based Assessment (DBA) component of the Rapid Coastal Zone Assessment Survey (RCZAS) for the Inner Humber Estuary, forming part of Historic England's national programme designed to enhance and update Historic Environment Records (HER) in coastal areas. It follows on from the preceding Aerial Mapping & Investigation (AI&M) component of the Phase 1 RCZAS (Fleming and Royal 2019).

The DBA was carried out in 2019 and 2020 by Cornwall Archaeological Unit, Cornwall Council and COARS, Southampton University. The aims of the project were to:

- enhance the Humber, North Lincolnshire and North East Lincolnshire HERs;
- inform future coastal, shoreline and flooding management;
- provide an overview of coastal change from the Palaeolithic onwards;
- assess the degree and nature of threat to coastal historic assets;
- provide a broad assessment of the likely archaeological potential and vulnerability of the resource;
- identify future research priorities; and
- enhance public understanding and enjoyment of the coastal heritage.

The survey area covers 247 sq km; from the lowermost limits of the Rivers Ouse and Trent following the River Humber eastwards to the Patrington Channel on the north bank of the estuary and on the southern bank, to the parish boundary between Great Coates and Grimsby. It is a low-lying estuarine landscape of intertidal mudflats, small islands, salt marsh, coastal dunes and wetlands flanked by larger areas of farmland, much of it of a high agricultural grade.

The survey area was sub-divided according to the Flood Areas as set out in the Environment Agency's 2008 Flood Management Strategy for the River Humber.

Overall, the project added, updated or amended 685 records. The new records created totalled 558 for Humber, 100 for North Lincolnshire and 15 for North East Lincolnshire. Many of the new prehistoric and Romano-British records were added from the findings of previous projects, such as the Humber Wetlands Project, that had not been previously incorporated into the HERs. A majority of the records added were of post-medieval and modern date, plotted from historic maps and charts associated with the maritime use of the Humber Estuary. These comprised a wide range of monument types, the most common of which were associated with the commercial use and navigation of the river (jetties, wharfs, breakwaters, landing points, beacons, wrecks) and the defence of the low-lying areas from coastal flooding (groynes, flood and sea defences).

Threats to the coastal historic environment resource can be characterised in two ways: 'natural' threats such as coastal change, rising sea-levels and flooding, and 'anthropogenic' threats including coastal defence schemes, infrastructure works and visitor pressure.

Research priorities and themes identified by the DBA are presented in the context of the regional themes and research aims set out in the Yorkshire and East Midlands research agendas. Specific sites, areas and themes which could benefit from further research or work have been identified, and a number of sites suggested that could be considered for designation assessment.

Acknowledgements

This study was commissioned by Historic England and carried out by Cornwall Archaeological Unit, Cornwall Council and Coastal and Offshore Archaeological Research Services (COARS), University of Southampton.

The project manager was Peter Dudley with mapping and assessment also undertaken by Dr Fiona Fleming and Carolyn Royall of CAU. Dr Michael J Grant of COARS undertook the coastal modelling presented in Section 5 of this report.

The Historic England Lead for the project was Marcus Jecock and the Project Assurance Officer was Jenni Butterworth.

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Our thanks to all the local people who engaged with the project with particular thanks to John French of the Barton Civic Society.

The views and recommendations expressed in this report are those of Cornwall Archaeological Unit and are presented in good faith on the basis of professional judgement and on information currently available.

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Table 10.1 Shoreline management policies

Acronyms and abbreviations

ABP	Associated British Ports
ADS	Archaeology Data Service
AI&M	Aerial Investigation and Mapping
AONB	Areas of Outstanding Natural Beauty
BAe	British Aerospace
BIIS	British-Irish Ice Sheet
BP	Before present
CFMP	Catchment Flood Management Plan
COARS	Coastal and offshore Archaeological Research Services
DBA	Desk-Based Assessment
Defra	Department for Environment, Farming and Rural Affairs
DSM	Digital Surface Model
EA	Environment Agency
EHU	Event Humber
ELS	Event North Lincolnshire
ENL	Event North East Lincolnshire
GIA	Glacio-Isostatic Adjustment
GIS	Geographic Information System
HAA	Heavy Anti-Aircraft
HAR	Heritage at Risk
HBSMR	Historic Buildings, Sites and Monuments Records
HE	Historic England
HER	Historic Environment Record
HLC	Historic Landscape Characterisation
HSC	Historic Seascape Characterisation
ICZM	Integrated Coastal Zone Management
Ka	thousand years ago
LAT	Lowest Astronomical Tide
LEP	Local Enterprise Partnership
LGM	Last Glacial Maximum
LOEPS	Land-Ocean Evolution Perspective Study
MHU	Monument Humber
MHW	Mean High Water
MIS	Marine Isotope Stage
MLS	Monument North Lincolnshire
MMO	Marine Management Organisation
MNL	Monument North East Lincolnshire
NE	Natural England
NHLE	National Heritage List England
NIA	Nature Improvement Areas
NMP	National Mapping Programme
NNR	National Nature Reserve
NRHE	National Record of the Historic Environment
NSL	North Sea Lobe
OD	Ordnance Datum

OS	Ordnance Survey
PAS	Portable Antiquities Scheme
PHS	Port Heritage Summary
RAF	Royal Air Force
RCHME	Royal Commission on the Historical Monuments of England
RCZAS	Rapid Coastal Zone Assessment Survey
RSL	Relative Sea Level
RSPB	Royal Society for the Protection of Birds
SHWAP	South Humber Bank Wildlife and People project
SLIP	Sea Level Index Points
SM	Scheduled Monument
SMP	Shoreline Management Plan
SSSI	Site of Special Scientific Interest
STAND	St Andrews Dock Heritage Park Action Group
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
VOYL	Vale of York Lobe
WAERC	Wetland Archaeology and Environments Research Centre
WWI	World War One
WW2	World War Two

1 Introduction

1.1 Project background

This Phase 1 Desk-Based Assessment (DBA) Rapid Coastal Zone Assessment Survey (RCZAS) for the Inner Humber Estuary was commissioned by Historic England (HE) and carried out by Cornwall Archaeological Unit (CAU) and Coastal and Offshore Archaeological Research Services (COARS), University of Southampton, from November 2019 to October 2020. It follows on from the preceding Aerial Mapping & Investigation (AI&M) component of the Phase 1 RCZAS (Fleming and Royal 2019).

The Inner Humber Estuary has been a significant navigation and trade route since late prehistory, and this role continues today: the four main ports in the estuary (Grimsby, Hull, Immingham and Goole) constitute the country's largest port complex. The ease of trade and navigation, the resources of its coastal edge and hinterland, its close proximity to the North Sea and Low Countries of Europe and the dynamic nature of its coastal and estuarine edge has resulted in an area rich in heritage.

England's coastal zone contains a legacy of historic assets including a complex array of fragile and irreplaceable archaeological and palaeoenvironmental remains, wrecks, hulks, aircraft crash sites, historic buildings and structures, and indeed entire landscapes. In many cases these remains are of national and even international significance due to their circumstances of survival and subsequent exposure at the coast. These remains are, however, vulnerable to a wide range of threats, including anthropogenic pressures, such as those associated with commercial development and shoreline management, interacting with natural processes of coastal change. The coast has always been a dynamic environment, but it is now generally accepted that coastal physical processes are being accelerated and magnified by changes in annual rainfall distribution, relative sea-level rise and an increase in storm incidence, all associated with wider climate change. For the Inner Humber the high risk of fluvial flooding can be added.

Over recent decades it has been recognised by coastal managers and Government that the entire English coastline cannot be maintained in its present form and that, where possible, it is more feasible and cost effective to work with natural processes than to seek to counter them. Coastal and flood management is now viewed more holistically, considering not just the need to protect life and property but also environmental and social factors, as part of the move towards Integrated Coastal Zone Management (ICZM) and the Catchment Flood Management approach.

The ICZM process involves two Government organisations with different remits: The Department of Environment, Farming and Rural Affairs (Defra) organises a programme of Shoreline Management Plans (SMP) and the Marine Management Organisation (MMO) manages the Marine Planning System. A Shoreline Management Plan provides 'a large-scale assessment of the risks associated with coastal processes and presents a policy framework to reduce these risks to people and the developed, historic and natural environment in a sustainable manner' (Defra 2001; 2005: see also Defra 2002 and McInnes 2003 for further information on coastal management). Marine Plans guide those who use and regulate marine and coastal areas to encourage sustainable development while considering the environment, economy and society.

As an estuary, flood risk from tidal surges, fluvial flooding and sea-level rises in the Inner Humber falls within the remit of the Environment Agency (EA) as part of Defra. The EA has an over-arching Flood Plan for the Inner Humber (2008), which is currently undergoing review (2100+ Strategy). As with the coastal management, the process for managing fluvial flooding is collaborative, resulting in partnership working to produce Catchment Flood Management Plans (CFMP).

The process of developing these plans is consultative, drawing on information provided by, and balancing the needs of, sectoral interests. Effective participation by the heritage sector depends in large part on identifying coastal and marine historic assets, evaluating

their significance and potential, and assessing which may be at risk from coastal change. Data collection, interpretation and synthesis for the RCZASs is directed towards these aims.

In 1997 HE (then English Heritage) and the Royal Commission on the Historical Monuments of England (RCHME) published a joint policy statement on the management of coastal archaeological remains (English Heritage and Royal Commission for Historic Monuments England 1996) and a national assessment of English coastal archaeology (Fulford *et al* 1997). These documents were followed by more specific guidance (English Heritage 2003; 2006). The assessment highlighted the poor quality of archaeological records relating to the coast and the policy statement recommended that: 'The record of coastal archaeology held nationally and locally should continue to be actively developed and enhanced in order to permit effective management of the resource and to facilitate understanding of England's development as a maritime nation.'

Whilst the advantages of thematic surveys on the coast were acknowledged by the assessment, it was also noted that the quality of the available record of coastal remains was such that in many areas, detailed studies would need to be preceded by rapid baseline surveys, hence the development of the RCZAS programme. The RCZAS is a broad assessment of the range of historic assets identified at the coast, their significance and their vulnerability. An update of the assessment, reviewing the results of the RCZAS programme to 2013, has recently been published (Murphy 2014).

A majority of England's coastline has been covered by RCZAS projects and the eastern edge of the Inner Humber survey area abuts the boundary of the completed Yorkshire and Lincolnshire RCZAS (Brigham *et al* 2008).

1.2 Aims

The broad Aims of this project are to:

1. provide an enhanced Historic Environment Record (HER)/Sites and Monuments Record (SMR) and National Record of the Historic Environment (NRHE) record for coastal and near-shore marine heritage assets (including palaeoenvironmental deposits), to a nationally agreed common minimum data standard, in order to permit an improved curatorial response to strategic coastal and marine planning or management initiatives at a national and regional level;
2. provide a factual basis for the initial curatorial response to individual applications for commercial developments or schemes, in advance of more detailed evaluation and mitigation related to Environmental Impact Assessments (EIAs) and/or planning applications;
3. enhance public understanding and enjoyment of coastal and maritime heritage; and
4. assist Local Authority curatorial archaeologists in development control.

The Objectives of this project are to:

1. provide updated data for the survey area which is compatible with the needs of other coastal and marine managers, parallel coastal surveys, industry and researchers;
2. provide an overview of coastal change across the survey area from the Palaeolithic onwards;
3. provide an assessment of the degree and nature of threat to the survey area's coastal historic assets which has regard to the models of future coastal change presented in relevant Shoreline Management Plans (and Flood Management Plans);
4. provide a broad assessment of the likely archaeological potential and vulnerability of all stretches of the coast defined in the project scope;
5. provide a sound basis for developing management and research priorities for the survey area in respect of sites and areas of potential with different levels of importance and under different levels of threat, based on:
 - the identification of areas or sites meriting further survey or evaluation;

- the identification of areas or sites requiring positive management action;
- the identification of significant historic assets meriting consideration for protection by means of designation, whether as Scheduled Monuments, Protected Wrecks, Listed Buildings, Registered Parks and Gardens or Historic Battlefields, as defined in the National Heritage List for England (NHLE);
- the identification of areas where heritage assets may be at high risk of damage or destruction; and
- the establishment of future research priorities for the coast within the survey area.

1.3 Methods

1.3.1 GIS database and archive searches

Concordance between the Humber, North Lincolnshire and North East Lincolnshire HERs and HE's NRHE was ensured from the beginning of the project. Geographic Information Software (GIS; ArcGIS 10.2 and later, 10.5) was used to provide a single platform to carry out the initial production of Excel-based gazetteers and as a structured way to update and create records which formed the reference base for the later update of the HERs. The gazetteers included new sites that were created and the existing records that were updated by the archive searches and data collection.

Data was MIDAS compliant, and the standard word-lists included in INSCRIPTION were employed. Positional data was supplied in the OSGB36 datum and all GIS work followed the latest guidelines for HE projects involving GIS (Historic England 2015). The GIS methodology and metadata for the project database and subsequent enhancement of the HERs is set out in Appendix 5.

The existing HER data was supplied from the relevant Historic Buildings, Sites and Monuments Records (HBSMR) database as shapefiles and selected to the entire survey area. The AI&M data for the survey area, completed by CAU prior to this Phase 1 DBA, was made available to the project team. When the existing HER data was supplied in November 2019, not all of it had been integrated into the relevant HERs.

In addition to the HER data, other data sources included:

- NRHE records (as shapefiles);
- the Portable Antiquities Scheme (PAS) database;
- Defence of Britain records (available from the Archaeology Data Service – ADS);
- Ordnance Survey (OS) 2019 Master Map Topography and Local Vector Mapping;
- early OS map editions (supplied by HE);
- c 1840 parish Tithe Award maps and apportionments (available via local archives and www.thegenealogist.co.uk);
- Estate maps (available via local archives);
- early Admiralty charts held by the United Kingdom Hydrographic Office (UKHO);
- the SMP for Flamborough Head to Gibraltar Point; and
- additional, local datasets;
 - updates from journals, books; and
 - Events Records (in particular, archaeological assessment reports).

1.3.2 HER Enhancement

During this stage the relevant HER was enhanced with the results of the archive searches, using the GIS database and accompanying Excel worksheet that had been created.

For each HER area the data was inputted into HBSMR software and the final upload and join undertaken by Exegesis. For the limited number of sites requiring updating, this data was inputted by the relevant HER team using the GIS database and accompanying Excel worksheet supplied by CAU.

1.3.3 Preparation and dissemination of the project report

This stage involved compiling the project report text and the production of gazetteers and generation of illustrative material.

1.3.4 Project Design for Phase Two Field Survey

A draft project design was prepared for Phase-2 field survey (omitting costs and Gantt Chart). It defines the objectives for Phase Two but will remain dormant until funding becomes available.

1.4 Structure of this report

Following on from this introductory section, Section 2 describes the survey area, provides a rapid overview of its coastline and landscape character and influential strategic historic environment projects which can provide further background and reference to this report. Section 3 sets out the heritage and natural environment designations within the survey area. Section 4 concerns coastal and marine management summarised for each Flood Area and SMP area within the extent of the survey. Section 5 is an overview of coastal change from the Palaeolithic to the present day undertaken by COARS and includes a detailed explanation of the geology and superficial deposits of the area. Section 6 is a resumé of previous archaeological and historical work divided by relevant Flood Area. Section 7 is an assessment of historic maps and charts and Section 8 assesses other datasets such as the RCZAS AI&M component, the HERs, the NRHE, wreck sites, the PAS, droits from the Receiver of Wreck, Lidar, and BGS boreholes. Section 9 is an assessment of areas of results and Section 10 appraises threats to the coastal historic environment resource. Section 11 presents the opportunities for further research, collaboration, outreach and fieldwork that could be taken forward to a Phase Two component of the RCZAS, with Section 12 providing a succinct statement of the potential impact of the project. Section 13 is a summary of the project archive and Section 14 is a list of references, primary and secondary sources and websites. At the end of the report, Appendix 1 is a list of Scheduled Monuments within the survey area, Appendix 2 a list of Grade I and Grade II* Listed Buildings, Appendix 3 a list of UKHO charts relevant to the survey area, Appendix 4 summarises the new sites identified by period and monument type, and Appendix 5 sets out the GIS method.

2 Survey area

2.1 The survey area

The survey area covers 247 sq km; from the lowermost limits of the Rivers Ouse and Trent, following the River Humber eastwards to the Patrington Channel on the north bank of the estuary and to the parish boundary between Great Coates and Grimsby on the southern bank (Fig 2.1). The eastern edge of the project area abuts and slightly overlaps the Yorkshire and Lincolnshire Coast RCZAS (Brigham *et al* 2008); the boundary of which broadly corresponded with the Patrington Channel (East Riding of Yorkshire) and the mouth of the Old River Freshney, Grimsby (North East Lincolnshire).

It is a low-lying estuarine landscape of intertidal mudflats, small islands, salt marsh, coastal dunes and wetlands flanked by the higher slopes and scarps of the Lincolnshire and Yorkshire Wolds and the North Lincolnshire Edge.

It includes a mixture of predominantly high-quality agricultural land, semi-natural and natural habitat, large urban areas and nationally important ports such as Kingston-upon-Hull (or Hull as it is mostly known), Immingham and the western edge of Grimsby.

The estuary is the second largest in the United Kingdom (UK) after the Severn, and the largest on the east coast of Britain. It drains a large catchment area (approximately 20 per cent of England) with several rivers and tributaries flowing into the estuary, including the Ouse and Trent (Environment Agency 2011).

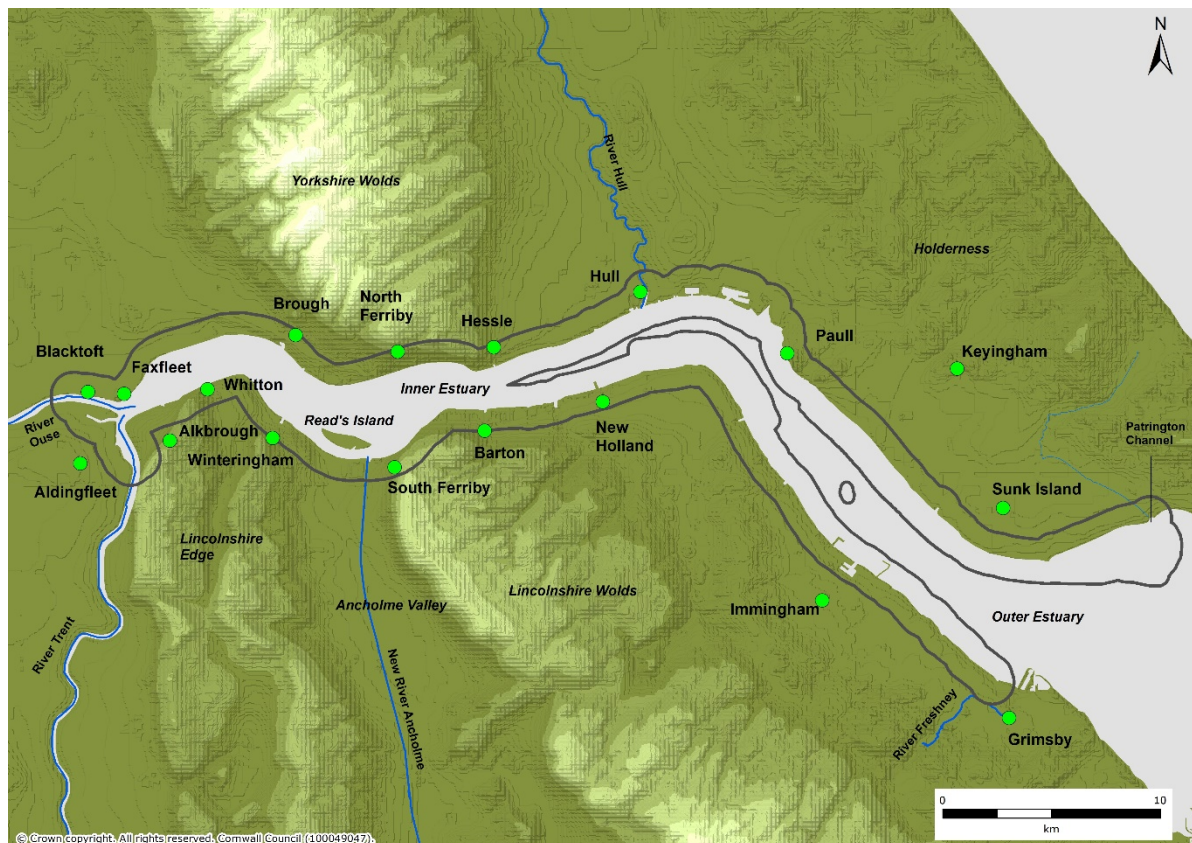


Figure 2.1 Map showing the main settlements, rivers and topographic detail in the survey area. The Patrington Channel is labelled to indicate the extent of the Yorkshire and Lincolnshire Coast RCZAS.

As with other RCZAS projects, the survey area extends 1km inland from Mean High Water (MHW) and 1km out from MHW to cover Lowest Astronomical Tide (LAT). At Foulholme Sands, Paull Holme Sands and off Skitter Ness the area was extended to cover the tidal mudflats there and west of the Humber Bridge the whole estuary was included to cover the navigable channel, the various sands of which form drying hazards to shipping and Read's and Whitton Islands.

The survey area falls within the bounds of several Unitary Authorities (Fig 2.2). Much of the northern bank of the River Humber lies within East Riding of Yorkshire Unitary Authority although the urban area of Hull is a separate Authority. At the western end of the survey area, the boundary between East Riding of Yorkshire and North Lincolnshire Unitary Authorities follows approximately the old course of the River Don between the River Ouse and River Trent. To the east of the Trent, the survey area follows the southern side of the estuary from Alkborough to North Killingholme Haven, still within North Lincolnshire Unitary Authority. Eastwards from here to the edge of Grimsby is part of North East Lincolnshire Unitary Authority. Where the River Humber is narrow, until just east of the Humber Bridge, the division between North East Lincolnshire and East Riding of Yorkshire/City of Hull follows the middle of the Humber.

The river is managed by Associated British Ports (ABP). ABP manages several ports in the estuary (at Hull, Immingham and Grimsby) and is also the Port Authority responsible for managing the entire estuary for safe navigation and shipping movements.

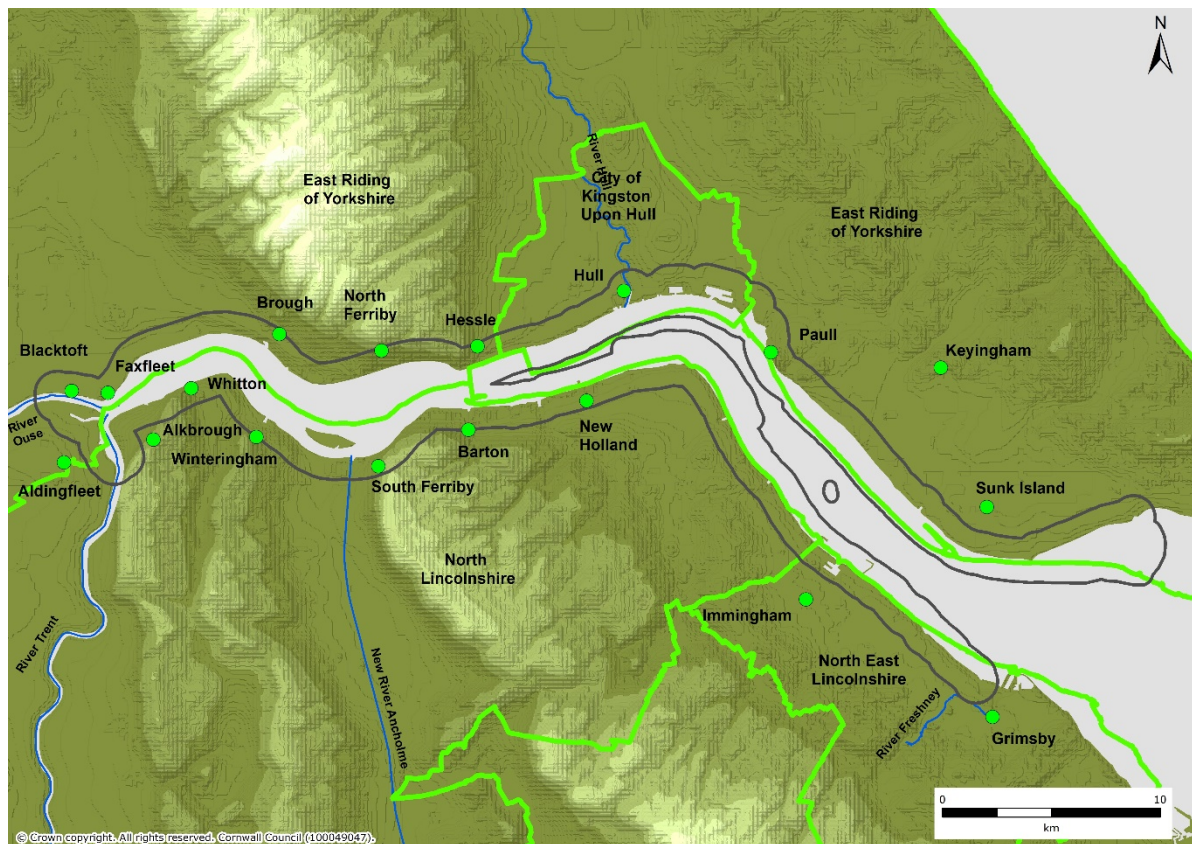


Figure 2.2 Map showing the local authorities in the survey area.

2.2 The Character of the estuary

The following section briefly introduces and describes the predominant characteristics of the coastline and estuary within the survey area, broadly corresponding with divisions in the EA's 2008 Flood Areas. The following overview starts in the east on the north bank, and proceeds around the estuary in an anti-clockwise direction.

2.2.1 Skeffling and Welwick to Paul Holme Strays

In the east, the north bank of the Humber is a low-lying shallow coastline. The estuary opens to its largest extent opposite Welwick and Skeffling. Close to the North Sea, the water is often murky and brown, rich with sediment brought in by the tide and mainly derived from erosion of the Holderness coast that lies to the immediate north. As the tide drops large expanses of mudflats are exposed at Sunk Island Sands and Foulholme Sands. A narrow strip of salt marsh and reeds has formed against the hard-coastal edge, an engineered edge formed by a flood defence bank, which protects rich agricultural land

reclaimed from former intertidal mudflats, including large areas at Cherry Cobb Sands and Sunk Island.

It is a quiet landscape, lightly populated with dispersed settlement in the form of isolated farmhouses and dwellings; connected by a network of straight relatively traffic-free roads and trackways.



Figure 2.3 The drain at Salthaugh Clough, Near Stone Creek, Sunk Island.

The fields are large, predominantly cultivated (as the agricultural land is Grade 2), and interspersed with numerous drainage ditches, most of which are straight, but others are sinuous, these being the remnants of former rivers and streams (Fig 2.3). The drainage systems empty into two creeks, the Patrington Channel and Stone Creek, the latter including a sluice to manage the Keyingham Drain. Towards Welwick, the flood defences are about to be set back as part of an active managed realignment scheme; an earlier scheme at Paull Holme Strays has allowed the estuary to inundate the fields and revert back to salt marsh, now forming a Yorkshire Wildlife Trust reserve.

2.2.2 Paull

Fort Paull and Paull Church stand on a slight rise, a relative island of high ground which forms a strong vantage point despite only reaching a maximum height of 12m OD. There is a low cliff here with a rocky foreshore exposed at low tide and many people come here to walk next to the estuary (Fig 2.4). The village has an intimate relationship with the coastal edge, sheltering behind a flood-defence wall: in places, the defences come right up to people's homes. A focal point of the coast here is Paull lighthouse, positioned to guide vessels entering the approaches to Hull Roads. From Paull there are good views to Hull and east to the mouth of the estuary. The short stretch of coastline to Hedon Haven is low-lying reclaimed land, which requires the protection of the flood defence bank that continues north from Paull village.



Figure 2.4 Looking west from Paull Point Battery along the flood defences to Paull, Hedon Haven and to the cranes of King George and Queen Elizabeth Docks, Hull.

2.2.3 Hull

Hull is a large urban area, a nationally strategic port and centre of industry; all factors which have led to the creation of a hard-engineered coastline with almost 10km of near continuous port-development in the form of wet docks and sea walls built to defend the city and port from inundation. Hedon Haven and the Holderness Drain have been canalised, the two channels draining the low-lying surrounding area, much of which is urban, developed land.

The River Hull bisects the urban area into two; the river enabled the early development of Hull as a port but has also posed a severe flooding risk to the surrounding low-lying area. At the mouth of river, are the towers of the River Hull Tidal Barrage, built in 1980 to enhance the flood defences of the city. Upstream from the barrage, the river is flanked by historic port infrastructure including old quay walls, wharfs and small docks (Fig 2.5) – the banks are the focus of a new flood defence scheme. Hull is a coastal city, the road layout a grid-system which is largely orientated in relation to the position of the estuary and the River Hull. Industrial development follows the path of the River Hull towards of Wincolmlee.

Returning to the estuary, there is little or no intertidal area. Hull Roads forms the main channel allowing large shipping to enter the port; the channel is regularly dredged to maintain depth.

From St Andrew's Dock to Hessle Haven the A63, the busy main artery into Hull, is located behind the sea wall as is, for some part, the train line to Brough and York. The wall itself also forms the route of the Trans-Pennine Trail, a long-distance multi-use path which runs to the centre of Hull and onwards to Hornsea but also has a branch running to the western edge of the King George Dock (Fig 2.6).



Figure 2.5 The River Hull. Looking from the Scale Lane footbridge up the river to the remaining mill at Clarence Street, Drypool, with the Arctic Corsair (former Hull based deep-sea trawler) (left) and the Grade II Listed former Trinity House buoy depot (NHLE 1197668) (right).



Figure 2.6 External Ro-Ro Ferry berth at King George Docks, Hull. (Photograph taken by CAU in 2015).

2.2.4 Hesse Haven to North Ferriby

This is where the Humber cuts the Wolds, the river narrows and is contained between hard chalk cliffs at Hesse. The white cliffs form a distinctive landmark that also form an aid to navigation and the gravelly (as opposed to muddy) foreshore reflects the outcrop of hard rock. At Hesse Cliff, the Humber Bridge now links Lincolnshire to Yorkshire, carrying the A15 across the river. Much of the area surrounding the bridge is taken up by urban development and road infrastructure, in which Hesse Country Park forms an island of green space. The Park is run by East Riding Council and is a 48-acre mixture of woodland, open meadows and wildlife ponds partly formed within a large redundant chalk quarry (Fig 2.7).

There is no flood defence bank along this part of the coast. Starting at Hesse Haven is the Yorkshire Wolds Way, a long-distance footpath which quickly turns inland away from the estuary edge, leaving the riverbank to form the route of the Trans-Pennine Trail.

Hesse Haven is a small shallow tidal creek with a concrete and shuttered steel-built wharf on its eastern side and a soft western edge formed by a chalk gravel foreshore and reed beds. The wharf is commercially run, offering repair facilities for coastal craft and the transfer of waste recyclable material and scrap by shallow short-sea vessels (Ports and Harbours of the UK website).



Figure 2.7 Looking from the flood defence bank at Far Ings nature reserve near Barton, North Lincolnshire across the River Humber and Humber Bridge to the chalk outcrop of the Yorkshire Wolds and Hesse Country Park.

2.2.5 Brough

The area is low-lying, located to west of the edge of the Yorkshire Wolds, this area is low-lying and the coastal edge of this low-lying area is defined by a flood-defence bank, with a narrow stretch of intertidal mudflats at low tide. At Red Cliff, the low cliff is formed by boulder clay which is easily eroded and gives rises to a silty, sandy and gravelly foreshore.

A larger area of sands and mud stand offshore, in the form of Redcliff Sands, which is separated from the coast by the Redcliff Channel. Brough, North Ferriby and the surrounding large villages of Welton and Melton form a cluster of settlement in this area, with smaller areas of agricultural land interspersed with industrial development, including

Brough Aerodrome and the buildings of BAE Systems, reputed to be Britain's oldest remaining aircraft factory (BAE Systems, Brough, East Yorkshire webpage). A haven at Brough is now little used, other than by small recreational craft (Fig 2.8).

Along the river's edge much of the land has been reclaimed and improved. To the east of Brough aerodrome is open ground with several large, flooded quarry pits at Welton Common, now run as Welton Waters Adventure Centre. The centre includes a sailing club, and a focus for activities such as wakeboarding, windsurfing, water skiing and other water sports (Welton Water Sport Club website). The Trans-Pennine Trail utilises the flood defence bank for its route.

2.2.6 Brough Haven to Blacktoft

A rural area, with low-lying good agricultural land, predominantly rectangular fields divided by green hedges, drainage ditches and remnant streams. Much of the area has been reclaimed from the estuary and Broomfleet Hope and Crabley Creek fossilise the channel which once divided Broom Fleet Island from the mainland. The island is now largely indistinguishable from the surrounding farmland (Fig 2.9).



Figure 2.8 Brough Haven. David Wright, 2008 / Brough Haven / CC BY-SA 2.0 (Brough_Haven_-_geograph.org.uk_-_753287.jpg).



Figure 2.9 Looking to Island Farm, Broomfleet Island, from near Broomfleet. Now joined to the mainland the traces of the former channel which once separated the island is visible as a low earthwork.

Settlement is in the form of small linear villages (Broomfleet, Faxfleet and Blacktoft) and isolated single farms, linked by quiet straight roads which reach out towards the coastal edge from the higher ground and villages aligned along the B1320, outside the survey area.

A flood defence bank protects the farmland. At Weighton Lock, is the entrance to Market Weighton Canal, which helps to drain an extensive area of low-lying land. The canal is now only partially navigable to the River Foulness but above this, silt make sit impassable. The sluice is a Grade II Listed Building (NHLE 1031829) and the entrance lock a Scheduled Monument (NHLE 1005217). The canal now forms a significant part of the EA's flood management strategy for the area.

As with the other areas, there is flood defence bank defending the land from inundation. Against the bank is a narrow strip of rushes, apart from at Faxfleet Ness, where a broader sweep of reedbeds extends over a larger area.

At Faxfleet Ness and Trent Falls, the channels of the Rivers Ouse and Trent join the Humber Estuary. To the east of Faxfleet Ness, the estuary gradually opens to form a wider channel up to approximately 0.7km wide.

Offshore from Broomfleet, in the River Humber, is Whitton Island. The island splits the River Humber in two, with the navigable channel on the southern side of the island. Whitton Island is a larger area of saltmarsh which has developed on the muds and sands on Whitton Sand. Owned by ABP, a long-term lease enables the Royal Society for the Protection of Birds (RSPB) to manage the island for the benefit of wildlife (RSPB Whitton Island webpage).

2.2.7 Twin Rivers

Located at the nook of the join between the River Ouse and Trent, at the beginning of the Humber Estuary, in an area of low-lying reclaimed land to the east of the villages of Ousefleet and Adlingfleet (both outside the survey area). Reclaimed and improved from the 17th century with the channelling of the Old River Don, the area forms good

agricultural land (Grade 2; Grade 1 close to Ousefleet). Older settlements are located on islands of relative higher ground with banks built to reclaim farmland and protect it from seasonal flooding. The low-lying fields are bordered by straight-edged drainage ditches and in places, the twisting course of former stream channels are fossilised in the landscape, while others have been adapted and canalised to help drain this once extensive area of marshland.

A flood defence bank forms the edge of the farmland, with a narrow margin of salt marsh and reedbeds along the edge of both rivers. With the drop of the tide are narrow strips of intertidal mudflats with the largest extent, a triangular wedge located at the confluence of the Ouse and Trent. It is a quiet, rural area with public access largely restricted to the flood defence bank and to Blacktoft Sands. Adjacent to Trent Falls and the Blacktoft Channel, at the confluence of the Rivers Ouse and Trent, Blacktoft Sands, is a large RSPB reserve considered to be the largest reedbed in England (RSPB Blacktoft Sands webpage).

2.2.8 Alkborough

At Alkborough, the North Lincolnshire Edge forms a ridge of hard limestone which has directed the flow of the Trent in a northerly direction. The ridge forms a steep scarp down towards the Rivers Trent and Humber, below which is Alkborough Flats, a large expanse of reclaimed land, some of which has been 'rewilded' with a purpose made breach in the flood bank which defends the entire riverside. The breach is a managed realignment of the flood defences; the first such scheme undertaken in the Humber Estuary.

The Flats are now managed by the RSPB as a nature reserve (Fig 2.10).

The foreshore is formed by areas of alluvium and bedrock outcrops; one of the natural outcrops is named 'The Devil's Causeway' but was once thought to be the remains of a Roman road. Offshore, the Whitton Channel (a navigable channel) separates the main part of the coast from Whitton Island and Whitton Sand; the form and extent of which regularly changes.



Figure 2.10 Looking from the scarp of the North Lincolnshire Edge to Alkborough Flats and the managed realignment scheme (and RSPB reserve) across the River Humber to Faxfleet with the western edge of Whitton Island (also a RSPB reserve) to the right.

2.2.9 Whitton to Winteringham

A rural area of undulating farmland which forms a gentle rise reaching to the low-lying edge of the river where the nucleated villages of Whitton and Winteringham are located. As with many other areas next to the Humber, the low-lying farmland is protected by a flood defence bank, with a narrow strip of rushes and intertidal mudflats against it on the estuary side. The farmland is productive, with large fields, mostly cultivated land, dissected by various drains that empty into the Halton Drain. There is a light dispersed settlement pattern, formed predominantly by single farmsteads and surrounding farm buildings. In the lower areas, close to the Humber, the land has largely been reclaimed from intertidal mudflats and saltmarsh.

Whitton Ness forms an outcrop of harder rock and here the intertidal area is a mix of intertidal mudflats and rocky foreshore.

Offshore, within the River Humber, there are extensive intertidal mudflats and sands, the largest being Pudding Pie Sand. This is divided by the South Channel, still a navigable channel, but only for small pleasure craft, many of which utilise Winteringham Haven. The Haven is a small inlet and harbour, home to the Humber Yawl Club, a yacht club with a fleet of sailing dinghies, small cruising boats and yachts (Humber Yawl Club website).

2.2.10 Winteringham Ings to South Ferriby

An area of reclaimed low flat land situated in the Ancholme Valley, opposite Ferriby Sluice, at the mouth of the River Ancholme. Ferriby Sluice is a small hamlet clustering around the eastern side of the river; the river has a long history of being manipulated to improve the drainage of the area, mainly for agricultural improvement. A large sluice, the main part of the structure which dates to the 19th century and is Scheduled (NHLE 100544), is managed by the EA to maintain the river's water levels which can swell quickly during periods of high rainfall.



Figure 2.11 Low-lying farmland at Winteringham Ings, North Lincolnshire.

In addition to its use as a drainage channel and for water supply, the river is also used for recreational boating (small craft). The river is navigable from Ferriby Sluice to Bishopbridge, 19 miles (30.4km) upstream. Vessels can access the Humber for only short

time either side of high tide due to the intertidal mudflats (Inland Water Ways Association website).

The area is a mixture of cultivated farmland and industry with the chimney, conveyors and associated tips of South Ferriby cement plant forming a local landmark although the plant is now earmarked for closure (Figs 2.13 and 4.5). The A1077, the main road between Scunthorpe and Barton-upon-Humber, runs parallel to the edge of the river, and parallel to the flood defence bank. The bank extends eastwards to the village of South Ferriby which nestles at the foot of high chalk ridge of the Lincolnshire Wolds.

Here the River Humber splits, with the narrow South Channel, separating Winteringham Ings from Read's Island. Read's Island is a small almond-shaped area of rough pasture and mud and sand flats, now managed by the RSPB as a nature reserve. The extent of the island is constantly changing, influenced by flood and erosion events. Its area has fluctuated ever since the island came into being in the late 19th century.

2.2.11 South Ferriby and Barton Cliffs

The harder chalk strata of the Lincolnshire Wolds create a higher ridge of rolling hills, falling to low white cliffs and a rocky foreshore. The cliffs and white of the chalk are noticeable landmarks in an area of otherwise low-lying land and softer alluvium, the hardness of the chalk ensures that no flood defence bank is required on this stretch of coast. The area is agricultural, dominated by fields, hedges and drainage ditches but with little settlement other than at South Cliff Farm. In the past, the chalk has been quarried here and three large quarries survive as cut faces with the remains of their jetties surviving along the foreshore.

2.2.12 Chowder Ness to Goxhill Haven

A low-lying flat area, mainly of Grade 3 agricultural land with villages located slightly inland, away from the edge of the estuary, except for at Barton-upon-Humber; the largest town on the Lincolnshire side of the survey area. Originally, a thriving port the medieval town of Barton expanded in the 18th and 19th centuries on to the lower-lying land, closer to the estuary, predominantly in the form of small residential terraces and industrial development. The significance of the port waned partly due to the silting of Barrow Haven (and competition from other ports on the estuary); the former inlet leading to the historic core of the town, is now canalised and unnavigable beyond the Haven itself. The Haven is formed by a small muddy creek and is used to moor small recreational craft.



Figure 2.12 Looking to the Humber Bridge from the edge of Barton Haven at The Water's Edge Country Park.

Defending the Haven and the surrounding land for the entire length of this area is a flood defence bank, now a popular place to walk and enjoy views to and across the estuary and the Humber road bridge which looms above Barton (Fig 2.12). The Water's Edge country park and Ropewalk Arts Centre are located close to the Haven.

Behind the protection of the bank is a dense concentration of flooded quarry pits dug into the alluvial sediments that fringe the estuary to provide clay for the brick and tile industry. The last remnant of the industry at Barton survives in the form of the William Blyth tile works which uses traditional methods to hand-make roof tiles and pottery. Several of the flooded quarries are now managed by recreational fishing clubs and at Far Ings and Pasture Wharf the flooded pits form Lincolnshire Wildlife Trust reserves.

Barrow Haven is a small, narrow tidal inlet, similar to Barton Haven, where a small number of day craft and converted barges are moored (Fig 2.13). The Old Ferry Wharf is a small family-owned wharf which handles small, short-sea or coasting vessels engaged in the trade of bulk and palletised bags, steel products and bricks, tiles and Baltic timber (Old Ferry Wharf website).



Figure 2.13 Small recreational craft moored at Barrow Haven, North Lincolnshire.

A railway connects Barton to New Holland, New Holland being the most significant port in this area. Formerly the rail ferry crossing to and from Hull, the port now specialises in the timber trade. A large jetty extends offshore to the navigable channel and a dock is able to accommodate short sea vessels. The settlement of New Holland is a large village, originally developed as part of the creation of the port.

2.2.13 Goxhill Haven to Halton Marshes

A low-lying quiet rural area of flat farmland with dispersed and scattered settlements, predominantly single farms and the occasional small hamlet. A small tile and pottery factory is located to the west of Goxhill Haven.

Small tidal inlets can be found at Goxhill Haven and East Halton and the entire coastline is defended by a flood defence bank which forms part of a coastal footpath. The intertidal area is formed by mud banks with saltmarsh and reeds forming much of the foreshore. For a majority of the area the flood defence bank sits tight against the coastline but between Skitter Ness and East Halton Skitter there is a larger area of saltmarsh against the bank.

2.2.14 North Killingholme Haven to West Grimsby

This low-lying area is dominated by large-scale port infrastructure and associated industrial development. Much of the coastline is formed by hard engineered structures in the form of terminals, jetties, quays, and docks.

The ports are nationally significant and are located here because of the close proximity of the River Humber's deeper water channel. It currently has four areas of port-related activity:

1. Port of Immingham – run by Associated British Ports (ABP);
2. South Killingholme Jetty – located to the west of the Port of Immingham and run by an independent commercial operator;
3. Humber Sea Terminal – located at North Killingholme Haven and run by C.RO Ports Killingholme Ltd (Fig 2.14); and
4. Humber Port – in development by Able UK.



Figure 2.14 The Humber Sea Terminal. (Photograph taken by CAU in 2015).

The associated areas of port infrastructure not only include terminals, warehouses and silos, cranes, gantries and conveyors but also extensive coal and ore heaps, large areas of car parking for car exports and imports, and depots for haulage carriers and containerised freight.

Significant industrial development includes the Phillips 66 petrochemical works, a gypsum factory and a power station at Stallingborough.

Interspersed between the ports and their associated development is low-lying agricultural land in the form of large fields drained by ditches and divided by hedges, all defended from inundation by a flood defence bank. At North Killingholme Haven, the flooded quarry pits now form the Killingholme Haven Pits nature reserve managed by the Lincolnshire Wildlife Trust. Public access to the coast is more limited in the port areas, where the coastal footpath has mostly been diverted around the port infrastructure.

2.3 Overview of relevant historic environment reports

This section provides a rapid overview of helpful national, regional, thematic and chronological overviews and projects that are useful to understanding the heritage, historic landscape and seascape and research potential of the Inner Humber RCZAS survey area.

In terms of historic environment research frameworks, the Yorkshire Archaeological Research Framework has been completed (Roskams and Whyman 2007) and Lincolnshire falls within the Archaeological Research Framework for the East Midlands (East Midlands Research Framework website).

At a national level *'The People and the Sea: A Maritime Archaeological Research Agenda for England'* (Ransley *et al* 2013) also provides valuable background material.

2.3.1 Heritage at Risk

The Heritage at Risk (HAR) programme helps HE to understand the overall state of England's designated heritage assets. The programme identifies those that are most at risk of being lost as a result of neglect, decay or inappropriate development (Historic England 2020a, 2020b).

Published annually, the HAR Register encourages people to become actively involved in looking after designated heritage assets precious to them and helps to direct any public funding to the most needy and urgent cases.

In 2020, there were five designated heritage assets identified at risk within the survey area, including:

- St Andrew's Dock, Hull (Conservation Area);
- Paull Holme Tower and moated site (Scheduled Monument);
- Paull Point Battery (Grade II Listed Building and Scheduled Monument);
- a heavy anti-aircraft gun site near Marsh Cottage, Barrow-upon-Humber (Scheduled Monument); and
- Old Winteringham Roman Settlement (Scheduled Monument).

2.3.2 England's North Sea Ports

Historic England's 'England's North Sea Ports' project aimed to improve the understanding of the heritage values, significance, vulnerability and adaptability to change of port-related heritage (both designated and non-designated) in 19 major ports along England's North Sea coast, including Hull, Immingham and Grimsby (Cornwall Archaeological Unit 2016a; 2016b; 2016c).

For each port, an illustrated 'Port Heritage Summary' (PHS), was undertaken to raise awareness and understanding amongst all parties interested in a port's future development, contributing towards the sustainable management of its port-related heritage. Each summary focused on the historical development of the port, its present character and its port-related heritage, the values attached to that heritage and the issues and opportunities it presents for future development.

The final summary report for the project provides a generalised chronological development of the ports studied, demonstrates the value of characterisation and outlines the opportunities for further research (Cornwall Archaeological Unit 2016d).

2.3.3 Historic Landscape Characterisation

Historic Landscape Characterisation (HLC) is a method which interprets, maps and describes, the main historic influences and attributes which define the present-day landscape. It is a map-based method which covers every parcel of land by identifying the form of its predominant surviving historic features and time-depth. Accompanying descriptive texts for each landscape 'Type' identified provide further information.

HLC is designed to inform a broad range of applications including spatial planning, conservation and wider approaches to heritage management.

Two Historic Landscape Characterisation (HLC) projects have been conducted within the survey area; Lincolnshire (Lord and MacIntosh 2011) and Yorkshire (Wastling and George 2018).

Each HLC report introduces the county and provides descriptive texts for the Character Areas within them. The Character Areas are unique areas that share a distinctive combination of landscape characteristics. Each descriptive text includes a summary of the historic development of the landscape and provide a good introduction to understanding the area.

2.3.4 Historic Seascape Characterisation

Historic Seascape Characterisation (HSC) maintains the historic characterisation principles used in HLC but recognises the need for a different expression in the coastal and marine environment. The coastal zone, both landward and seaward of Mean Sea Level (MSL), is an area of overlapping terrestrial and maritime perceptions, best understood by the assessment of both landward and seaward perspectives.

The survey area has been characterised by the Yorkshire to Norfolk Area 1 HSC project (Aldred 2011), the data for which has now been amalgamated with other HSC projects and converted to form a single national dataset of inshore and offshore areas (Land Use Consultants 2017). As with HLC there are supporting descriptive texts.

2.3.5 Humber Wetlands Project

The Humber Wetlands Project was a programme of wetland archaeological research which involved the assessment of archaeological and palaeoenvironmental data in six low-lying areas surrounding the Humber Estuary; Hull Valley (Van de Noort and Ellis 2000), Ancholme and Lower Trent Valley (Van de Noort and Ellis 1998), Holderness (Van de Noort and Ellis 1995), Lincolnshire Marsh (Ellis *et al* 2001), Vale of York (Van de Noort and Ellis 1999) and Humberhead Levels (Van de Noort and Ellis 1997).

Funded by English Heritage the large-scale survey involved a combination of borehole survey, palaeoenvironmental analysis, fieldwalking, test-pitting and small-scale archaeological excavation to enhance understanding of the wetland archaeological resource. In 2004 Robert Van de Noort summarised the results of the project into a popular edition published by Windgather Press, *'The Humber Wetlands; the archaeology of a dynamic landscape.'*

3 Designations

3.1 Heritage designations

The survey area contains a wealth of heritage assets, with some designated as Scheduled Monuments (SM), Listed Buildings (LB), and Conservation Areas. There are no Registered Parks, Gardens or Registered Battlefields or Protected Wrecks within the survey area.

3.1.1 Scheduled Monuments

There are 14 Scheduled Monuments in the survey area (Fig 3.1): 8 are in the East Riding of Yorkshire, two in Kingston-upon-Hull, and four in North Lincolnshire (see Appendix 1 for the full list of Scheduled Monuments).

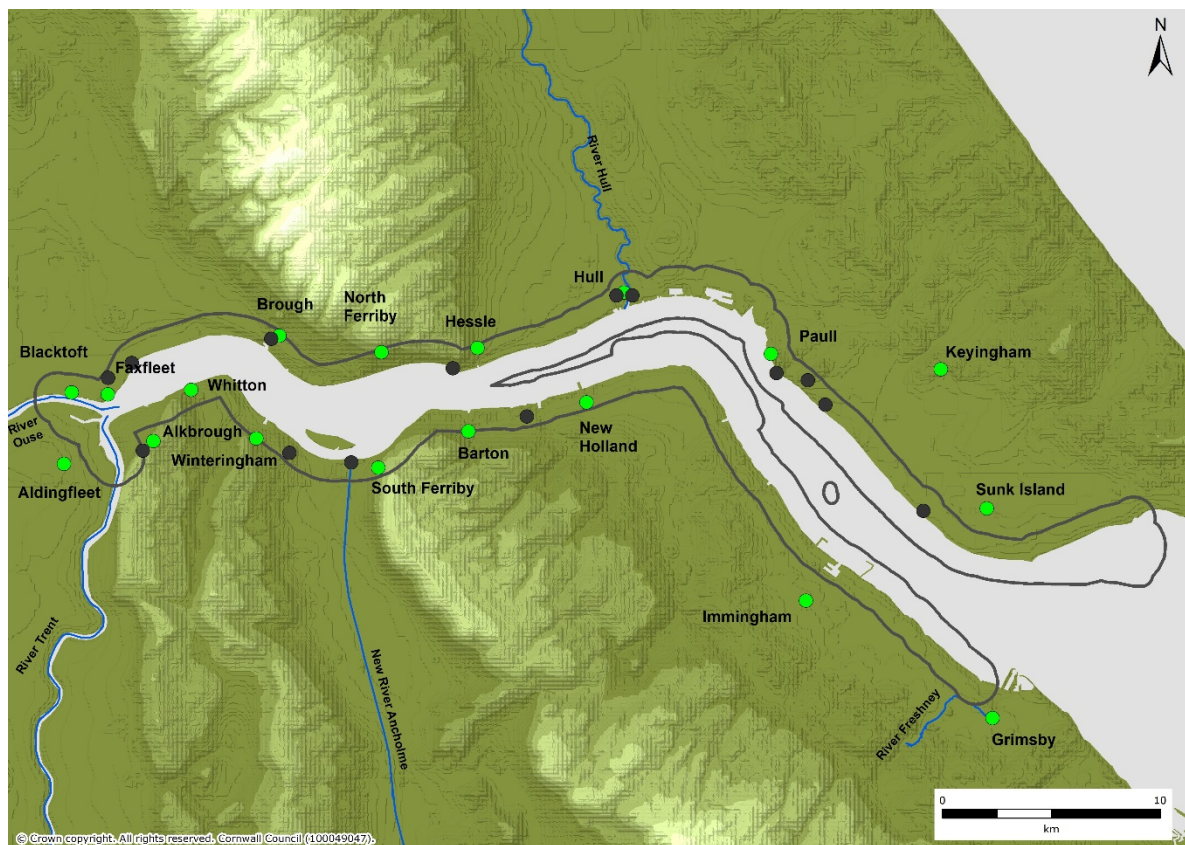


Figure 3.1 Map showing the Scheduled Monuments (black dots) within the survey area.

3.1.2 Listed Buildings

There are 367 Listed Buildings in the survey area (Fig 3.2). Table 3.1 below shows the number and grade of Listed Buildings within each Local Authority.

Local Authority	Grade I	Grade II*	Grade II	Total
Kingston-upon-Hull	7	15	274	296
East Riding of Yorkshire	3	1	29	33
North Lincolnshire	1	3	34	38

Table 3.1 Listed Buildings (with Grade) within each Local Authority.

Appendix 2 at the end of the report provides a list of the Grade I and Grade II* Listed Buildings within the survey area.

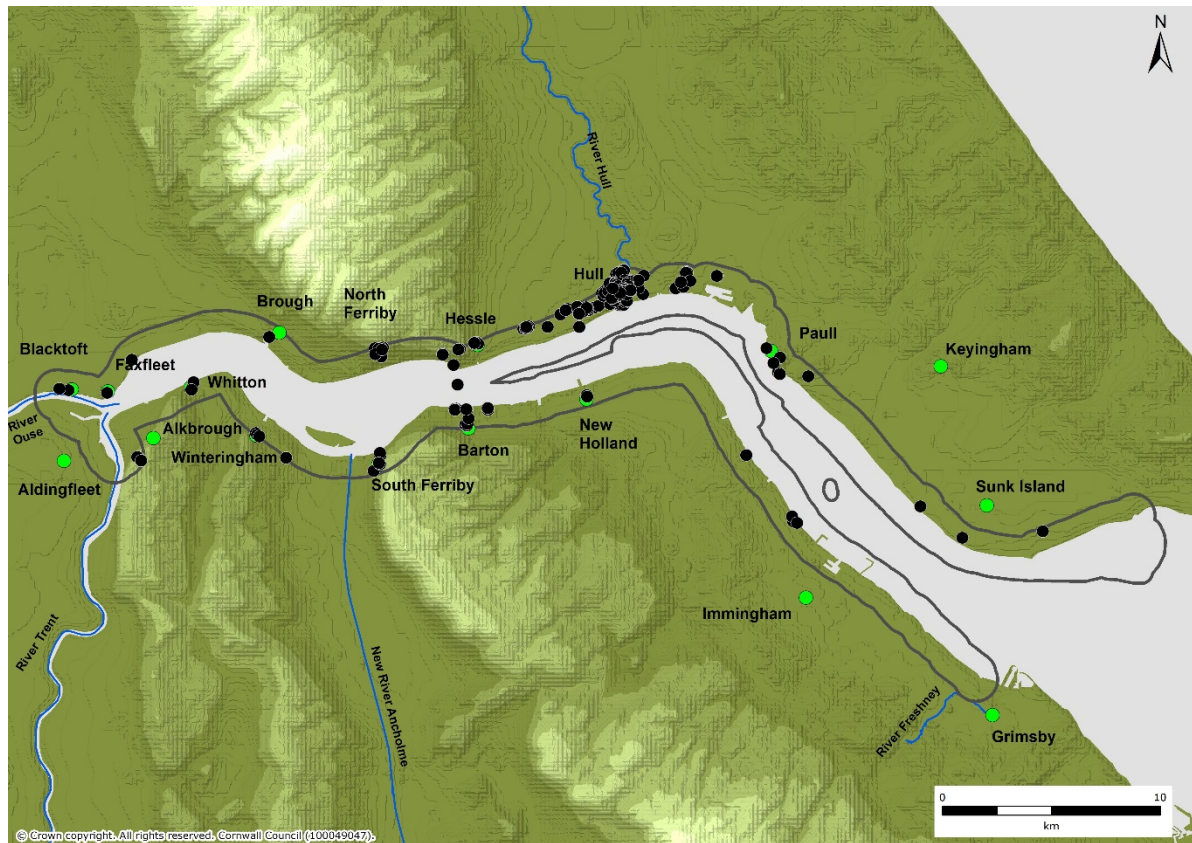


Figure 3.2 Map showing the Listed Buildings (black dots) within the survey area.

3.1.3 Conservation Areas

There are 19 Conservation Areas within the survey area. Table 3.2 below lists the Conservation Areas within each Local Authority.

Conservation Areas are designated by Local Planning Authorities as areas of special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance. They may vary in character, form and size but their designation means that they are all worthy of protection as areas of special integrity and merit. They usually contain a higher concentration of buildings which are Listed but this is not a prerequisite of designation.

The St Andrew’s Docks Conservation Area is currently on HE’s 2020 HAR register (see Sections 2.3.1 and 11.2.5).

Local Authority	Conservation Areas
Kingston-upon-Hull	Boulevard, Charterhouse, Coltman Street, Hessle Road, Georgian New Town, Holderness Road (west), Jameson Street, Marfleet Village, Old Town, St Andrew’s Dock.
East Riding of Yorkshire	Brough, Hessle Southfield, Hessle Town, North Ferryby, North Ferryby Parkfield, Sunk Island.
North Lincolnshire	Alkbrough, Winterringham, Barton-upon-Humber.

Table 3.2 Conservation Areas within each Local Authority in the survey area.

3.2 Natural Environment designations

The Humber Estuary is an internationally important area for wildlife. It is one of the top ten sites in Europe for wintering wildfowl and waders supporting internationally important populations of several species. The wide range of habitats in and around the estuary support a large range of mammals, fish, invertebrates and plants, some of which are rare or threatened (Environment Agency 2011).

3.2.1 European Marine Site

The entire marine area (i.e., land covered continuously or intermittently by tidal waters) of the Humber Estuary has been designated as a European Marine Site (Environment Agency 2011). The European Union's (EU) Habitats and Birds Directives set out a number of actions to be taken for nature conservation within the marine site including:

- under the Habitats Directive – promotion of the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements; and
- under the Birds Directive – protection of all wild birds and their habitats, with special measures for migratory birds and those that are considered rare or vulnerable.

3.2.2 Ramsar, Special Area of Conservation and Special Protection Areas

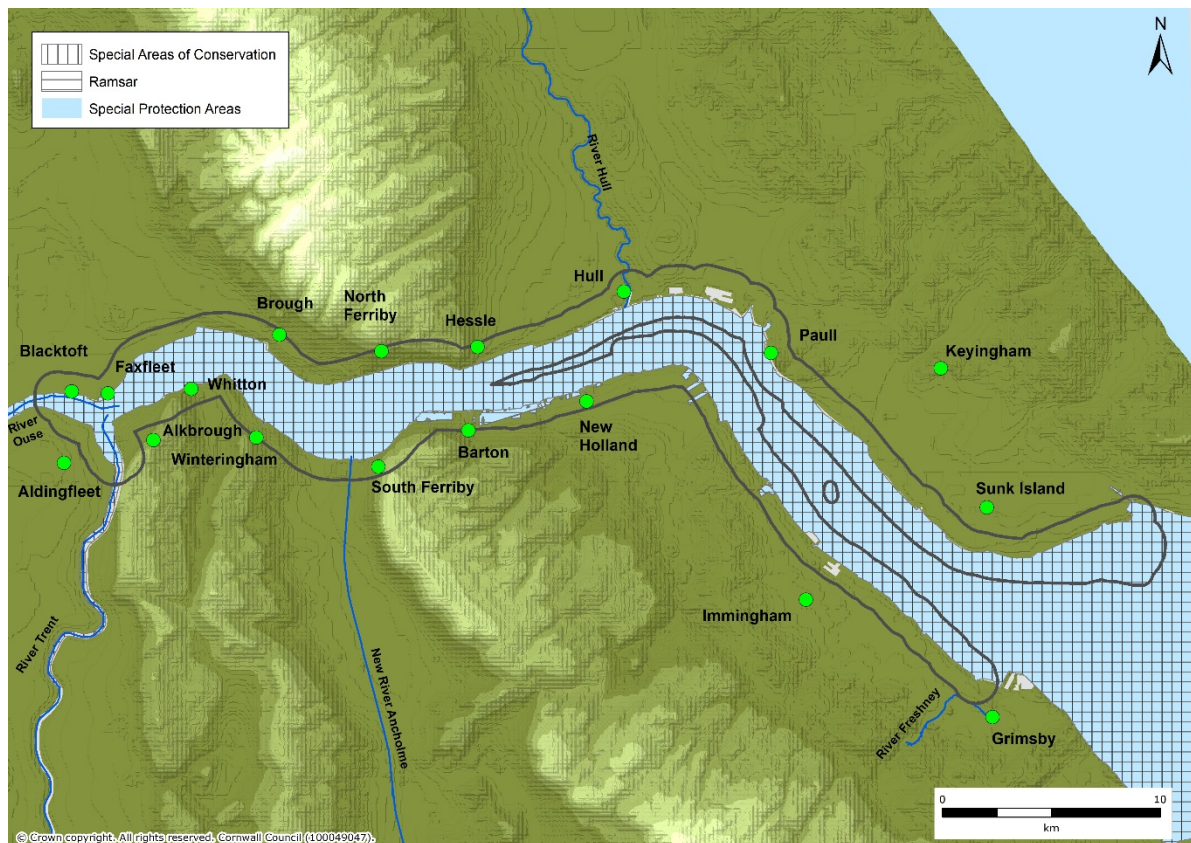


Figure 3.3 Map showing the Ramsar, Special Area of Conservation and Special Protection Area designations within the survey area. (The area of the SPA extends into and includes parts of the North Sea).

The entire marine area of the Humber Estuary (and the Rivers Trent and Ouse) is a Ramsar site (Fig 3.3).

The international Ramsar Convention of 1971 requires its government signatories to agree to identify and protect their most significant wetlands for wildlife, especially waterfowl. Under the Convention, each government must select its best wetlands according to very clear criteria, and these Ramsar sites are then protected from development in all but the most exceptional cases.

Under European Directives the entire marine area of the estuary has also been designated a Special Area of Conservation (SAC) and a Special Protection Area (SPA) for birds and other wildlife.

In relation to Brexit, the Great Repeal Bill will 'bank' all existing EU derived legislation, incorporating it into UK law. This includes the Nature Directives, and other directives listed above. However, there still remains uncertainty about what legislation will be retained in UK law in the longer-term.

3.2.3 Sites of Special Scientific Interest

The entire marine area of the Humber Estuary (including some of the coastal land and inlets) is designated as a Site of Special Scientific Interest (SSSI) (Fig 3.4).

The SSSI citation explains, '[the estuary] is a nationally important site with a series of nationally important habitats. These are the estuary itself (with its component habitats of intertidal mudflats and sandflats and coastal saltmarsh) and the associated saline lagoons, sand dunes and standing waters. The site is also of national importance for the geological interest at South Ferriby Cliff (Late Pleistocene sediments) and for the coastal geomorphology of Spurn. The estuary supports nationally important numbers of 22 wintering waterfowl and nine passage waders, and a nationally important assemblage of breeding birds of lowland open waters and their margins. It is also nationally important for a breeding colony of grey seals *Halichoerus grypus*, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*, a vascular plant assemblage and an invertebrate assemblage' (Natural England, Humber Estuary SSSI citation).

The North Killingholme Haven Pits SSSI corresponds with the area of the Lincolnshire Wildlife Trust reserve. The Pits are important as large saline lagoons with an exceptionally rich fauna, and their significance as roosting and feeding grounds for waterfowl, especially in winter.

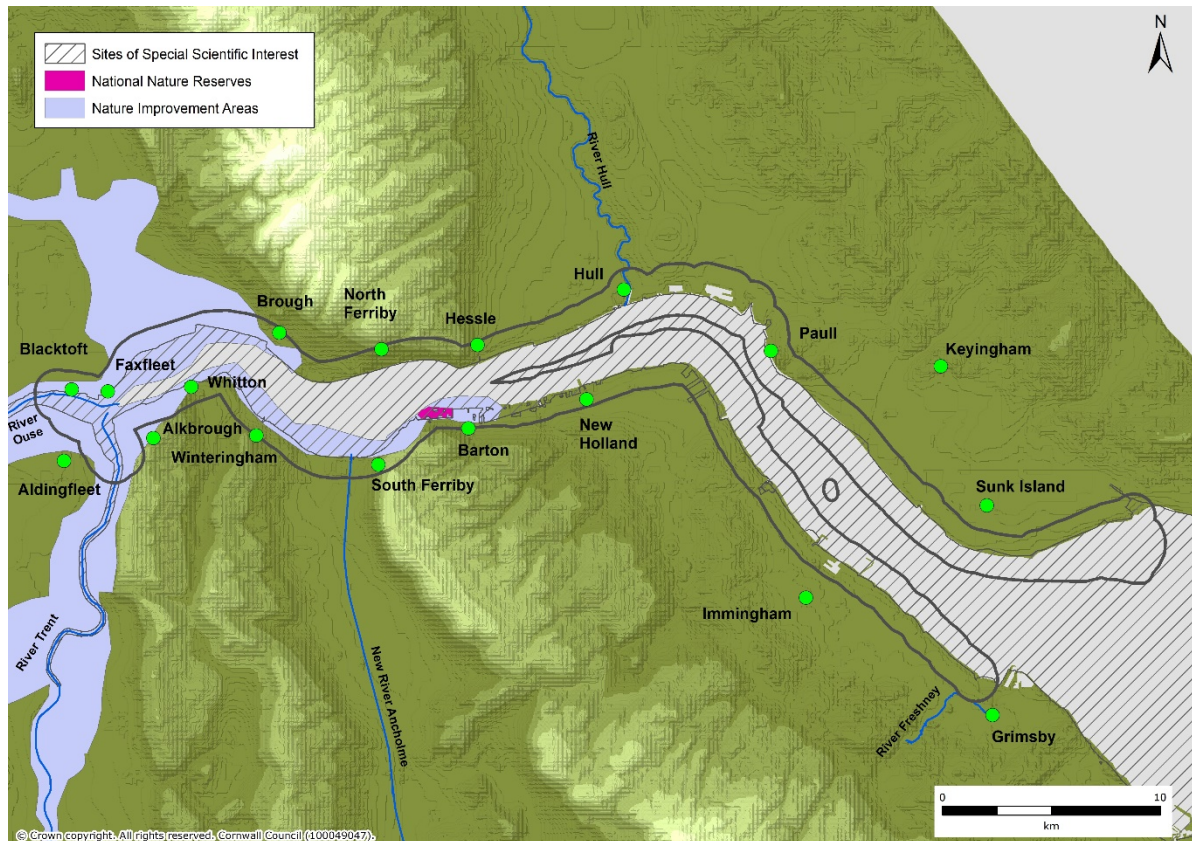


Figure 3.4 Map showing the Sites of Special Scientific Interest (hatched), the extent of the Humberhead Levels Nature Improvement Area (blue-grey) and the National Nature Reserves (pink).

3.2.4 National Nature Reserves

Natural England (NE) is responsible for designating areas as National Nature Reserves (NNR) to secure protection and appropriate management of the most important areas of wildlife habitat, to provide a resource for scientific research and to provide for recreation provided this does not compromise the wildlife habitat.

The Far Ings (Barton upon Humber) is the only NNR within the survey area (Fig 3.4). A Lincolnshire Wildlife Trust reserve the flooded pits and reedbeds of Far Ings form important habitat for migrating birds and a stronghold of the bittern (Lincolnshire Wildlife Trust, Far Ings webpage).

3.2.5 Nature Improvement Areas

The western coastal edge of the estuary (within the survey area) is part of the Humberhead Levels Nature Improvement Area (NIA). This extends along the coastal margin from Pasture Wharf nature reserve at Barton (Lincolnshire) and Brough (East Riding of Yorkshire) to Trent Falls, including the marine edge of the estuary, Whitton Island and Read's Island (Fig 3.4).

Section 2 of the Natural Environment White Paper published in June 2011 refers to the integration of people and nature and the implementation of NIA and in July 2011 Defra launched a new grant scheme competition administered by NE to establish NIAs. These are large, discrete areas intended to deliver a step change in nature conservation, where a local partnership has a shared vision for their natural environment.

4 Coastal and marine management

The survey area is covered by two main strategies to manage flooding and coastal change (Fig 4.1). As an inland expanse of water, fed by several major rivers and surrounded by low-lying land liable to flooding and tidal surges, the majority of the estuary falls within 'The Humber Flood Risk Management Strategy' (Environment Agency 2008). The eastern end of the survey area, broadly corresponding with the outer Humber Estuary, comes within the 'Flamborough Head to Gibraltar Point Shoreline Management Plan', which primarily deals with managing coastal erosion, tidal flooding and sea-level change (Scott Wilson 2010). The Inner Humber Estuary is also vulnerable to tidal surges, as experienced on 5 December 2013 when the surge was the highest yet recorded. Spatially, there is an overlap between the SMP and Flood Strategy in the area of Sunk Island (East Riding of Yorkshire) and eastwards from the eastern jetty at Immingham (North East Lincolnshire). Within this overlap, the risks and interventions identified in the SMP and Flood Strategy mirror each other, although the format and scope of the reports differ (see below).

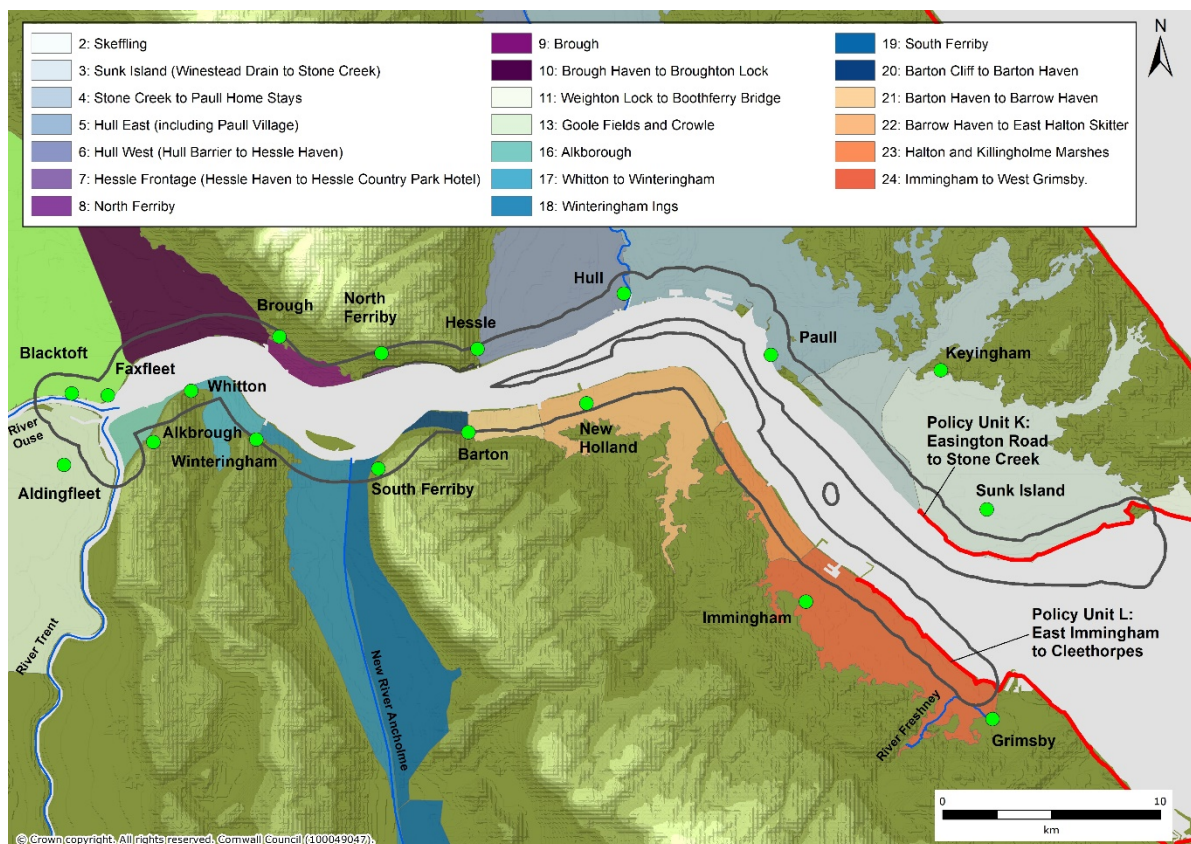


Figure 4.1 Flood Areas (see legend) and the two SMP Policy Units within the survey area (the extent of the greater part of the Yorkshire and Lincolnshire Coast SMP is shown with a red line).

While the SMP assesses the risk of coastal erosion and sea-level change within three pre-defined chronological epochs that begin in 2005 and run to 2105 (see Section 10.3) the Flood Strategy outlines the flood defences that will require updating, realignment, or from which management will be withdrawn, over a 20- to 30-year period from 2008.

The estuary flood risk management strategy echoes that of CFMP and these have been undertaken for the large rivers that discharge into estuary (Section 4.3).

The project also falls within the MMO's East Inshore Marine Plan (Section 4.4).

The production of all these plans and strategies is led by the EA and is informed by detailed evidence bases. They are collaborative pieces of work, undertaken through partnerships with Local Authorities and in the area of the Humber, together with ABP,

combined with extensive engagement with other stakeholders. As the risk of flooding and coastal erosion increases, the plans and documents are constantly being revisited.

4.1 The Humber Flood Risk Management Strategy

'The Humber Flood Risk Management Strategy' is the EA's long-term plan for managing flood risk from the Humber Estuary (2008). The strategy covers the threats posed by tidal surges, fluvial flooding and high rainfall.

The Strategy outlines the need for improvements to flood defences and the managed realignment for flood alleviation areas and habitat creation. Several of these schemes are now being undertaken, for example The Humber: Hull Frontage Scheme.

The 2008 strategy is currently being updated, especially in the light of the pressure on funding flood defences and the increased risk of tidal flooding, coastal erosion and flooding, as illustrated by the damage caused in the tidal surge of December 2013 and several flooding incidents including in the winter of 2019/2020.

Due to the national economic importance of the estuary and the scale of flood risk, the EA, with 12 Local Authorities from around the Humber and the Humber Local Enterprise Partnership (LEP), have formed Humber 2100+, a partnership to develop a strategy that will address the risk and enable sustainability for the next 100 years (Environment Agency, Humber 2100+ webpage).

The partnership is currently evaluating three potential strategic approaches:

1. **Managing the tide**, using a combination of improved flood defences, existing and additional flood storage, and occasional planned flooding of land. Improved resilience and changes to land use in some areas would also be required to adapt to rising sea levels and high tides.
2. **Adapting to the tide**, by continuing to improve or maintain defences in some areas, and changing land use in others, to allow defences to be deliberately altered or moved back in some locations over time. This would create greater capacity for flood storage and large-scale planned flooding of land and allow a response to the fact that it may not be possible or safe to maintain or continue to raise defences where they are at present. This would be in combination with improved resilience across the estuary.
3. **Keeping out the tide**, by constructing a tidal surge barrier, most likely in the outer estuary. This would be a complex and long-term option. Defences on the seaward side of the barrier would need to be improved, and there would be continued maintenance of defences inland of the barrier in combination with improved resilience across the estuary.

At present, however, the 2008 strategy remains the main overview of managing flood risk for the estuary and of the 27 Flood Areas identified by the strategy 23 are located within the survey area (Fig 4.1). The following sections present an overview of the management issues identified in each Flood Area.

4.1.1 Yorkshire – Flood Area 2: Skeffling

In 2008, the EA considered that the flood defences in this Flood Area were generally in good condition, with minor repairs expected every few years and a major improvement required in the next 20 years.

The Flood Area contains farms and high-grade agricultural land that is drained to the estuary, either by gravity or by being pumped. Most of the properties at risk are in Weeton (a village on the edge of the floodplain), outside the survey area.

The EA are continuing to maintain the existing defences, however, in the future the relatively small number of properties at risk means that there is potential for this support to be withdrawn.

The Outstrays to Skeffling Managed Realignment Scheme has conditional planning permission granted. The Scheme is a joint initiative by the EA and ABP to create over 400 hectares (988 acres) of new mudflats and saltmarsh. A new embankment will be built further inland to establish a new line of defence and then the old embankment will

be breached so that sea water can pass thorough to create new intertidal habitat (Environment Agency, Outstrays to Skeffling Managed Realignment Scheme webpage).

4.1.2 Yorkshire – Flood Area 3: Sunk Island (Winestead Drain to Stone Creek)

Most of the properties are at the inland edge of the floodplain, in the villages of Keyingham, Ottringham, Patrington or Patrington Haven. Otherwise, the area contains high-grade agricultural land and a few scattered farms. The land is drained to the estuary by a system of ditches leading either to the Winestead Drain (which is pumped) or to Keyingham Drain (which flows by gravity). Although this and the neighbouring area of Stone Creek to Paull Holme Strays (Flood Area 4) are separated by Keyingham Drain, flooding in one can affect the other.

ABP has created a new intertidal habitat at a site near the Patrington Channel to compensate for losses due to their development at Immingham, and further work is being undertaken on Sunk Island as part of the Outstrays to Skeffling Managed Realignment Scheme. The EA has identified this land for intertidal habitat re-creation to replace losses caused by their flood defence improvements in the estuary and to help manage tidal flooding and sea level rise (Environment Agency 2018).

Some work is needed to protect the existing defences against erosion, and this will probably need to be repeated every few years. In 2008, the EA considered that major improvements were likely to be needed in 20 to 30 years. Currently, most of the banks in this part of the estuary are owned by the Crown Estate. It will become increasingly expensive to maintain the existing defences in the future as sea levels rise and at some point the owners may decide it is not worthwhile carrying on. If maintenance is withdrawn from the existing defences, the EA will look at building secondary banks to protect the villages at the edge of the floodplain.



Figure 4.2 Looking to Immingham in the far distance from the sluice gate at Stone Creek, Sunk Island.

4.1.3 Yorkshire – Flood Area 4: Stone Creek to Paull Home Stays

Most of the properties at risk are at the inland edge of the floodplain, in the villages of Ryehill or Camerton, outside the survey area (Thorngumbald, the village next door, is in Flood Area 5). This Flood Area contains scattered farms and high-grade agricultural land, drained to the estuary by a system of ditches leading to Keyingham Drain.

Although this and the neighbouring area of Sunk Island (Flood Area 3) are separated by Keyingham Drain, flooding in one can affect the other.

In 2008, the EA considered that the existing flood defences were generally in good condition with major improvements likely to be needed in 40 or 50 years. The EA has looked at the future costs and benefits of continuing to maintain the existing defences and concluded that this will become increasingly expensive as sea levels rise.

Although there is uncertainty about the rate at which sea levels will rise and the rate at which the defences could deteriorate, in 2008 the EA considered it unlikely that any changes would be required within the next 20 years.

If maintenance is withdrawn from the existing defences, the managed realignment and construction of secondary banks to protect the villages at the edge of the floodplain will be considered but at this stage, it is not known where these banks will be located.

Paull Holme Strays was the first major managed realignment scheme on the Humber Estuary, with the flood defence bank breached in 2003. The site provides approximately 80ha of intertidal habitat to compensate for the loss of saltmarsh and mudflats in the area (Yorkshire Wildlife Trust, Paull Holme Strays webpage).

The EA has also identified another site to the north west of Stone Creek (Keyingham) as suitable for creating additional habitat but are unlikely to develop it until after 2030 (2008, 9).

4.1.4 Yorkshire – Flood Area 5: Hull East (including Paull Village) and Flood Area 6: Hull West (Hull Barrier to Hesse Haven)

In the past 65 years, there have been three major tidal events in Hull, the most significant being in December 2013 when 264 properties were flooded when the existing defences were overtopped. During high spring tides, water levels in the estuary have the potential to rise by around one to three metres above some parts of the city (Environment Agency 2011). The Humber: Hull Frontage Scheme Information webpage). Most of the properties at risk from flooding are in Hull, although there is a significant number in the smaller communities east of the city including Hedon, Burstwick, Thorngumbald and Paull (Paull being the only village within the survey area).

The Area contains nationally important infrastructure including major industrial and commercial facilities, including petrochemical and port-related developments. Surface water is drained by a combination of sewers (mostly managed by Yorkshire Water) and open channels, all of which flow or are pumped to the estuary.

In 2008, the existing estuary flood defences in this Flood Area were considered by the EA to be in good condition but with several places needing upgrading. These are currently being improved as part of 'The Humber: Hull Frontage Scheme'. This large scheme is now almost complete and when finished, the upgraded flood defences will reduce the risk of tidal flooding for 113,000 properties. Tidal flood defences including at St Andrew's Quay Retail Park, Victoria Pier and Victoria Dock Village have been upgraded and in total, once finished, approximately seven kilometres of tidal flood defences along the estuary frontage will be improved. Work on the scheme is scheduled to be completed by March 2021.

The EA are also monitoring the defensive wall at Paull and, in particular, how to manage the large volumes of spray from waves that can occur during severe storms.

The city of Hull is also at risk of flooding from the River Hull and from surface water overwhelming the drainage system. The EA has developed a separate strategy for the River Hull defences (Fig 4.3) working closely with the other relevant authorities to develop effective approaches for dealing with the complex flooding issues in the city (Environment Agency 2010a).

In 2016, the EA launched a major flood defence scheme repairing flood defences that lie within a 7.5km stretch of the River Hull, helping to protect 63,000 properties in the city. Defences along the River Hull currently provide a one in 200-year protection, meaning that the defences reduce the risk of flooding to a 0.5 per cent chance in any one year. The River Hull is also protected from tidal flooding by the Hull Tidal Surge Barrier, which

is located at the confluence of the River Hull and the River Humber. During high tides and storm surges, the barrier is lowered to prevent tidal waters flowing back up the river. In addition to the EA's scheme, Hull City Council is continuing to carry out work to reduce the risk of surface water flooding in the city (Environment Agency website, press release 23 August 2016).

The EA continues to protect this Area and the defences will need to be improved as sea levels rise. This will be expensive, so the EA will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.



Figure 4.3 Looking down to the mouth of The River Hull and the tidal barrier.

4.1.5 Yorkshire – Flood Area 7: Hessle Frontage (Hessle Haven to Hessle Country Park Hotel)

Due to the local topography and geology of the Humber Gap this Flood Area is small and narrow in extent. As well as residential properties, it contains recreational areas and some commercial and industrial premises. Surface water is drained by a combination of sewers (mostly managed by Yorkshire Water) and open channels, all of which flow or are pumped to the estuary.

In 2008, the existing flood defences were considered to be in a poor condition and to provide a low standard of protection. The shoreline is being worn away by tides and waves in places, which in time will threaten some of the defences.

The EA expects the cost to maintain these defences in the future will become increasingly expensive as sea levels rise and in the long-term, those responsible may decide it is not worthwhile carrying on with the upkeep and other ways of managing the flood risk may need to be considered.

4.1.6 Yorkshire – Flood Area 8: North Ferriby

The area is mainly residential, although there is some farmland and an old landfill site (Church Road) site at the eastern end of the Flood Area. The edge of this site is being eroded by tides and waves, which could release contaminants into the estuary. Part of the main railway to Hull is on the edge of the area but it is considered to be above the level of flood risk.

In 2008, the EA noted that there were two lines of existing flood defences protecting this area both of which were in reasonable condition and provided a good standard of protection.

The EA continued to maintain the defences in 2008 (along the edge of the estuary) but as sea levels rise a managed realignment or withdrawal may be considered, although this decision was considered unlikely to be taken before 2028.

The erosion of the landfill site is continuing to be monitored by the EA and any work needed to secure the site will be separate from the flood defence strategy.

4.1.7 Yorkshire – Flood Area 9: Brough

This Flood Area is sub-divided in two sub areas: 9a, Brough (Welton Water) and 9b, Brough (BAE Works).

Most of the properties are residential and are located at the western end of sub-area 9b, which also contains an important factory and airfield owned by BAE. The eastern end (Welton Water) contains old gravel/clay extraction pits, which are now used for recreation (fishing, sailing), nature conservation and a landfill site. Although not a flood defence issue, the old landfill site (Brickyard Lane) site at the eastern end of the Flood Area is being eroded by waves and tides, which could release contaminants into the estuary. The EA are reviewing the risk of allowing the erosion of the landfill site to continue. Any work needed as a result will be separate from the flood defence strategy.

In 2008, the existing flood defences at the western end had been improved and as a result, they were considered in good condition. Further work was needed to improve the condition of the remaining defences.

The EA will continue to protect Brough and the BAE factory and will improve the standard of defences by building a new bank from the end of the recently completed one across the airfield to high ground behind Welton Water.

However, in 2008, the justification for maintaining the defences at the eastern end of the area could not, the EA considered, be justified as they protected very few properties. Although the EA may not be able to carry on maintaining the existing defences, others may be able to obtain the approvals needed to do so while complying with the relevant regulations.

4.1.8 Yorkshire – Flood Area 10: Brough Haven to Weighton Lock

The properties are scattered throughout the area, which is largely devoted to farming but also contains key infrastructure including road and rail links to Hull and high-voltage power lines. The land is drained by a system of ditches flowing either to the estuary by gravity or to the Market Weighton Canal, which itself flows into the estuary by gravity through Weighton Lock.

In 2008, the existing flood defences between Brough Haven and Crabley Farm had been improved, providing a good standard of protection. The remaining defences were not owned by the EA, but managed by others, and were considered to be in fair to poor condition. Many were thought to be too narrow and difficult to maintain and likely to need improvement in the next 15 to 20 years (of 2008).

In 2008, the EA were considering the possibility of keeping some lengths of the defences lower than others, so that certain areas will be flooded in a managed way to minimise damage during a major event. The benefit of lowering river levels in overtopping events and from the flood storage schemes have been identified in the River Humber and Ouse strategies as a good approach to take forward – this option is potentially being considered by the 2100+ Flood Strategy.



Figure 4.4 Looking from the flood defence bank near Faxfleet to the River Humber (middle left) and the confluence of the River Trent (middle) with the North Lincolnshire Edge (top left) and the River Ouse and the reedbeds of the RSPB reserve at Blacktoft Sands, Twin Rivers (middle right).

4.1.9 Yorkshire – Flood Area 11: Weighton Lock to Boothferry Bridge

Within the survey area, this Flood Area contains the villages of Faxfleet and Blacktoft together with many scattered residential properties and farmsteads. It also contains a large area of high-grade agricultural land (Fig 4.4). This area of low-lying land is drained by ditches that flow either to the River Ouse by gravity or to the Market Weighton Canal (directly or through the River Foulness), which itself flows to the estuary by gravity through Weighton Lock.

The EA in 2008 considered the defences were generally in a reasonable condition, providing an appropriate standard of protection. However, they highlight that the banks of the River Ouse were being eroded in a number of places and that there was concern about the defences in some places, including a stretch to the west of Blacktoft – in 2008 it was considered that these would need improving within the next 15 years.

This Area, as with Flood Areas 10 and 12, is being considered for altering the height of some of the flood defences (see Flood Area 10 for fuller explanation) – this option is potentially being considered as part of the 2100+ Flood Strategy.

4.1.10 Yorkshire and Lincolnshire – Flood Area 13: Goole Fields and Crowle

The part of this Flood Area covered by the RCZAS survey area straddles the area of land between the Rivers Ouse and Trent and is largely used for agriculture, with a dispersed pattern of single farms, except for the small village at Adlingfleet. The broader Flood Area beyond the RCZAS survey area also contains rail link, power station, high-voltage power lines and the internationally important Humberhead Peatlands.

The land is drained by several systems of ditches and pumping stations flowing either to the River Ouse or the Trent.

In 2008, the EA considered that the defences were generally in a reasonable condition, providing an adequate standard of protection although in places, the riverbanks are being worn away and could require localised repair in future. The area is also at risk of flooding

from high flows in the rivers Ouse, Don and Trent as occurred in the Winter of 2019-2020.

The EA inspects all the defences, not just those for which it is directly responsible, and liaises with other owners, informing them if any maintenance or improvements have been identified. This Area, as with Flood Areas 10 and 11, is being considered for lowering of the height of some of the flood defences in order to use the land behind for the storage of water in extreme fluvial flood events (see Flood Area 10 for fuller explanation) – this option is potentially being considered as part of the 2100+ Flood Strategy.

4.1.11 Lincolnshire – Flood Area 16: Alkborough

This Flood Area covers 427ha of low-lying land at Alkborough Flats, located on the southern side of the confluence of the Rivers Humber and Trent.

The existing flood defences were modified by the EA in 2006 so that just under half the area will flood on most high tides while the remainder will be available to store water during extreme events. As a result, water levels in the Trent and the Ouse during flood events are up to 150mm lower than they would be without the changes. The defences are in good condition and in 2008, were expected to last for at least 30 years before any major improvements are needed.

The Flats are now managed by the RSPB as a nature reserve, with the managed breach in the flood defences providing about 170ha of intertidal habitat to replace the losses caused by flood defence works and sea level rise. The remainder of the area provides marshy rough grazing and reedbed habitats.

The EA aims to maintain the existing defences and the new structures, so the scheme continues to provide flood defence benefits by lowering water levels during extreme events.

4.1.12 Lincolnshire – Flood Area 17: Whitton to Winteringham

Most of the properties at risk are in the villages of Whitton and Winteringham, at the edge of the floodplain. The rest of the area is high-grade agricultural land containing scattered farms and a high-voltage power line. The land is drained through a system of channels and Halton Drain to an outfall at Winteringham Haven.

In 2008, the EA considered the existing flood defences to be in good condition except at Whitton Ness where there is a risk that they could be eroded. If this is prevented and regular maintenance continues the defences are expected to last for more than 25 years. They continued to maintain the defences but due to the relatively small number of properties at risk this support is likely to be withdrawn, most probably in the next ten or 20 years.

4.1.13 Lincolnshire – Flood Area 18: Winteringham Ings and Flood Area 19: South Ferriby

Flood Area 18 covers the west side of the Ancholme Valley, and extends beyond the survey area, southwards up the river valley to Brigg, where there is a significant number of properties at risk. Flood Area 19 covers the east side of the valley and includes South Ferriby, a large village, nestled at the foot of the Lincolnshire Wolds on the edge of the flood plain. Flooding in one Flood Area can affect the other.

The remainder of the vulnerable properties are scattered along the Ancholme valley, which is largely devoted to agriculture but also contains the CEMEX cement works (the imminent closure of which was announced in May 2020; Fig 4.5) together with key infrastructure including major road (A1077) and rail links and high-voltage power lines.

In Flood Area 18, very strong tidal currents flow along the channel between the shore in and Read's Island and in 2008 there was a serious to the A1077 road. The EA's South Ferriby and Winteringham Ings Sea Defence Improvements scheme was started in 2019 to reduce the risk of tidal flooding to 140 homes, businesses, A1077 and the CEMEX plant. Clay from the CEMEX quarry was used as part of the construction of the new defences.

However, both Flood Areas are also at risk of inland flooding from high water flows in the River Ancholme, for which a separate CFMP was produced by the EA in 2009 (Environment Agency 2009).



Figure 4.5 The CEMEX plant at South Ferriby, North Lincolnshire in June 2019 – 11 months later its closure was announced.

4.1.14 Lincolnshire – Flood Area 20: Barton Cliff to Barton Haven

This Flood Area is sub-divided into two units; Flood Area 20a (Barton Cliff to Humber Bridge) and Flood Area 20b (Humber Bridge to Barton Haven).

Most of the properties at risk are in the town of Barton, with the rest of the Flood Area formed by disused clay pits and reedbeds, scattered properties and farmland. The area is drained to the estuary by gravity. Associated British Ports has created a small new intertidal habitat at a site to the west of Chowder Ness to compensate for losses due to port development at Immingham.

In 2008 the EA considered that the existing estuary defences were in good condition and did not require major improvement for more than 20 years.

The EA intends to maintain all the existing defences but as there are very few properties at the western end of the area (Flood Area 20a), it is likely that the defences here will be withdrawn and potentially, a secondary shorter defence built near the Humber Bridge to further protect Barton. This option is under review and the decision to change the defences here, will not be made for 20 years or more – potentially as part of the 2100+ Flood Strategy.

4.1.15 Lincolnshire – Flood Area 21: Barton Haven to Barrow Haven

Most of the properties at risk are in Barton with a few near Barrow Haven. The rest of the area contains several disused clay pits (important for their fresh-water habitats), a rail link and farmland.

The existing flood defences were considered in 2008 by the EA to be in good condition but are expected to need major improvement in about 20 years.

In 2008 the EA continued to maintain the existing defences protecting this area and was aiming to improve them as sea levels rise. This was expected to be expensive so the EA

will seek to supplement public funds with contributions from major beneficiaries and from developers, who will be expected to pay the full cost of any new works needed to protect their development.

4.1.16 Lincolnshire – Flood Area 22: Barrow Haven to East Halton Skitter

Most of the property at risk is located in the villages of Barrow Haven, New Holland and on the edge of the floodplain at Goxhill (Fig 4.6). There are port facilities at Barrow Haven and New Holland, with both having industrial and commercial development and a railway line located inland. The rest of the area contains high-grade agricultural land with scattered farms.

The land is drained to the estuary by gravity. The EA has identified a suitable site for creating new intertidal habitat at East Marsh, north of East Halton Skitter, Goxhill. This is needed to replace the losses to habitat caused by flood defence improvements and sea level rise. However, the site's development depends on whether the existing defences continue to be maintained and this is unlikely to be until after 2040.

While the existing defences were considered to be in good condition in 2008, they were expected to need major improvement in the next 20 to 30 years. There is a possibility, however, that the EA could protect most of the properties at risk in Goxhill, Barrow and New Holland by building a secondary line of new defences – this option may be potentially considered by the 2100+ Flood Strategy. If this option is undertaken, the EA considered it unlikely that funding would allow the existing defences which protect the rest of the Area to be maintained.



Figure 4.6 Looking north across the River Humber from the flood defence bank and coastal footpath at Goxhill Haven, North Lincolnshire.

4.1.17 Lincolnshire – Flood Area 23: Halton and Killingholme Marshes

This Flood Area is sub-divided into two units; Flood Area 23a (Halton Marshes) and Flood Area 23b (Killingholme Marshes).

The Halton Marshes Flood area includes farmland and dispersed settlement in the form of single farmsteads but near to Killingholme Marshes, the area becomes increasingly dominated by large-scale port infrastructure in the form of the Humber Sea Terminal.

Both Areas lie within the proposed South Humber Bank development site which has been allocated for estuary related industry or commercial activities. Most of the properties at risk fall into this category, including wharf facilities and a major petrochemical plant. There is also a significant area of high-grade agricultural land.

The land drainage is designed to cater for these developments and releases surface water into the estuary through a combination of pumped systems and gravity.

In 2008, the EA noted that the foreshore was being worn away, resulting in the existing flood defences along the whole frontage, particularly at Halton Marshes, being extremely vulnerable in the short-term. The EA has since announced a programme of improving the sea defences at Halton and Killingholme Marshes (Environment Agency, new flood defences press release webpage).

4.1.18 Lincolnshire – Flood Area 24: Immingham to West Grimsby.

Most of the residential properties at risk are in the towns of Immingham and Grimsby, although there are some in Stallingborough and Healing (all settlements outside the survey area).



Figure 4.7 A ship being loaded at Immingham inner dock. (Photograph taken by CAU in 2015).

A large part of the Area lies within the proposed South Humber Bank development site and has been allocated for estuary related activities. It already contains major industrial and commercial facilities, including wharves, storage areas, petrochemical and power plants (Fig 4.7). The area also contains important road and rail links and high voltage power lines, while most undeveloped land is used for agriculture.

As with Flood Area 23, this Area is located within the Strategic Flood Risk Assessment to inform planning decisions and future development. The land drainage is designed to cater for the level of development and releases surface water into the estuary through a combination of pumped systems and gravity.

In 2008, the existing flood defences were considered to provide a good standard of protection, however, the foreshore was noted as being eroded away, weakening the defences along much of the frontage.

Following the devastating 2013 tidal surge which threatened the Port of Immingham, a plan to update the flood defences has been put into place. Phase 1 (already completed) has replaced the existing tidal lock doors with significantly larger ones that could be locked into position and Phase Two, which will improve the defences along the port frontage, is being developed, but with works envisaged to be completed in 2021 (Environment Agency 2019). The EA has also announced a programme of improving the sea defences between Immingham and Freshney (Environment Agency, new flood defences press release webpage).

4.2 The Flamborough Head to Gibraltar Point SMP

A SMP provides a large-scale assessment of the risks associated with coastal processes and presents a long-term policy framework to reduce any negative effects for people and the environment. An SMP forms an important part of the wider planning framework alongside CFMP for flooding (see Sections 4.1 and 4.3).

SMPs are high-level non-statutory planning documents for achieving coastal and flood defence protection.

Only the eastern end of the survey area, corresponding with the outer Humber Estuary, falls within *'The Flamborough Head to Gibraltar Point Shoreline Management Plan'* (Scott Wilson 2010).

The two Policy Areas that fall within the survey area are - (see Fig 4.1):

1. SMP Policy Unit K, Easington Road to Stone Creek [north bank of the River Humber, Yorkshire]; and
2. SMP Policy Unit L, East Immingham to Cleethorpes [south bank of the River Humber, Lincolnshire].

These areas of the estuary are included within the SMP boundary because it has been shown that sediment 'cells' straddle the mouth of the Humber, so that coastal processes along the Holderness coast of Yorkshire also have an impact along the Lincolnshire coastline (Scott Wilson 2010, 7).

4.2.1 Policy Unit K: Easington Road to Stone Creek

Policy Unit K is within SMP Policy Development Zone 2 and Character Area 11, Easington Road to Stone Creek. Policy Unit K also falls within Flood Areas 2 and 3 as defined in the EA's Humber Flood Risk Management Strategy (see Sections 4.1.1 and 4.1.2).

The overarching policy is to 'hold the line' and maintain the standard of flood protection in all three defined epochs (i.e., 20, 50 and 100 years from 2005). To ensure sustainable flood defences, and meet the requirements of environmental legislation, the SMP considers that the limited Managed Realignment of defences will be required (now in the pipeline: Outstrays to Skeffling Managed Realignment Scheme). The SMP iterates that any Managed Realignment of defences will have to not adversely affect property or known designated and significant historic environment assets. This SMP highlights that the process will be informed by the EA's 2008 Humber Flood Risk Management Strategy.

The policy for the north bank of the Humber will ensure continued protection from coastal erosion and coastal flooding for assets in the floodplain. The SMP states that all property, all known designated and significant historic environment assets and the majority of agricultural land will continue to be protected (it does not, however, consider non-designated heritage assets). However, in order to ensure sustainable defences and meet the requirements of environmental legislation, limited managed realignment of defences is likely and some Grade 2 agricultural land is likely to be lost as part of realignment.

In addition to managing the risks of tidal inundation, it is considered that increased drainage pumping may also be required to provide flood protection to the low-lying areas as sea levels rise.

4.2.2 Policy Unit L: East Immingham to Cleethorpes

Policy Unit L is within the Policy Development Zone 3 and Character Area 12, East Immingham to Grimsby Docks.

The SMP outlines that the coastal defences will be held in their current position and their function will be maintained in all three epochs.

The policy for the south bank of the Humber will ensure continued protection from coastal erosion and coastal flooding for assets in the floodplain, including the significant industry, port and residential areas between Immingham and Grimsby.

It is considered that this policy will also ensure that infrastructure associated with Grimsby and the villages within the area, designated historic environment assets and agricultural land at the rear of the towns continue to be protected from coastal erosion and flooding. The decision to continue to 'hold the line' means that erosion of this frontage is prevented resulting in a reduction in supply of sediment to intertidal and subtidal habitats.

The interruption of natural processes as well as coastal squeeze caused by sea level rise is likely to result in loss of intertidal habitat within the Humber Estuary, which has the potential to adversely affect the landscape as well as the designated environmental sites of the of the Humber Estuary.

4.3 Catchment Flood Management Plans

Catchment Flood Management Plans (CFMPs) are plans prepared by the EA with other key decision-makers within a river catchment to identify flood risks and to establish management policies which will deliver sustainable flood risk management for the long-term.

Catchment Flood Management Plans consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding), which is covered in SMPs. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs.

Several large rivers discharge into the Humber Estuary and CFMPs have been developed within the survey area including for the rivers Ouse, Trent, Ancholme, Freshney and Hull (Environment Agency 2009; 2010a; 2010b; 2010c).

CFMPs cover the entire catchment of a river from its watershed to the coast, and the area covered by each CFMP can overlap with the low-lying and coastal areas covered by the SMP and Humber Estuary Flood Management Strategy. As with the Humber Estuary Flood Management Strategy, the CFMP reports tend not to directly refer to individual historic monuments at threat but instead, explain that Historic England will be consulted in regard to designated heritage as a key stakeholder.

4.4 East Inshore Marine Plan

The MMO's East Inshore Marine Plan area includes the coastline stretching from Flamborough Head to Felixstowe, extending from MHW out to 12 nautical miles, including the Humber Estuary and other inland waters subject to tidal influence (Defra 2014).

At the heart of the Plan is the aim to ensure the sustainable development of the marine area in a way that benefits society whilst respecting the needs of local communities and protecting the marine ecosystem.

The Plan conforms with the Marine Policy Statement and other national policies including the National Planning Policy Framework and National Policy Statements.

The Localism Act also places a duty on the MMO to cooperate with other public authorities to work together on planning issues: 'to reflect genuine shared interests and opportunities to make common cause'. To meet the requirements for compatibility set out in the Marine and Coastal Access Act and contribute to integrated coastal zone management, specific attention has been given to assessing the policies in Local Development Frameworks and related plans.

The East Inshore Marine Plan notes that heritage and archaeological features are prevalent across the area and includes highly significant finds such as early human activity, prehistoric boats and historic landscapes. Tourism and recreation rely on the

preservation of the historic environment and heritage assets, a healthy marine environment including good water quality, clean beaches, abundant wildlife and a healthy ecosystem to attract people.

Objective 5 of the Plan is to conserve heritage assets, nationally protected landscapes and ensure that decisions consider the seascape of the local area. This objective relates to the historic environment, nationally important landscapes and seascapes. It recognises the need to consider, if developments are appropriate to the area, they would be located in and have influence upon, and as far as possible do not compromise the value of such assets and characteristics.

5 Overview of coastal change from the Palaeolithic to the present

Dr Michael J Grant, COARS

5.1 Geology

The oldest rocks in the study area are Triassic (251–200 million years ago) in age, with a band of Mercia Mudstone running north-south along the Trent Valley and with Sherwood Sandstone to its west. The sandstone forms part of a larger deposit running parallel to the Pennines. To their east are a number of much narrower deposits dating to the Jurassic period (200–161 million years ago). These form a significant band running northwards through North Lincolnshire into the East Riding. As they extend north the bands narrow, with the majority terminating in the vicinity of Market Weighton leaving only the Lower Lias to continue in a north-westerly direction following the western boundary of the Yorkshire Wolds. The other formations located within this band are, west to east, Middle Lias, Upper Lias, a significant band of Inferior Oolitic limestone lying east of Scunthorpe, Great Oolitic limestone and thin wedges of clay formations from the Middle and Upper Jurassic periods. The Oolite Group of limestones form the Lincolnshire Edge escarpment, separating the Trent and Ancholme Valleys. The eastward extent of the survey area is formed by Chalk dating to the Upper Cretaceous period (66–100 million years ago), which dips gently eastwards and forms the extension of the Lincolnshire and Yorkshire Wolds escarpment. The Humber Estuary crosses the geology in an east-west direction, cutting through the Wolds at the Humber Gap (Figure 5.1).

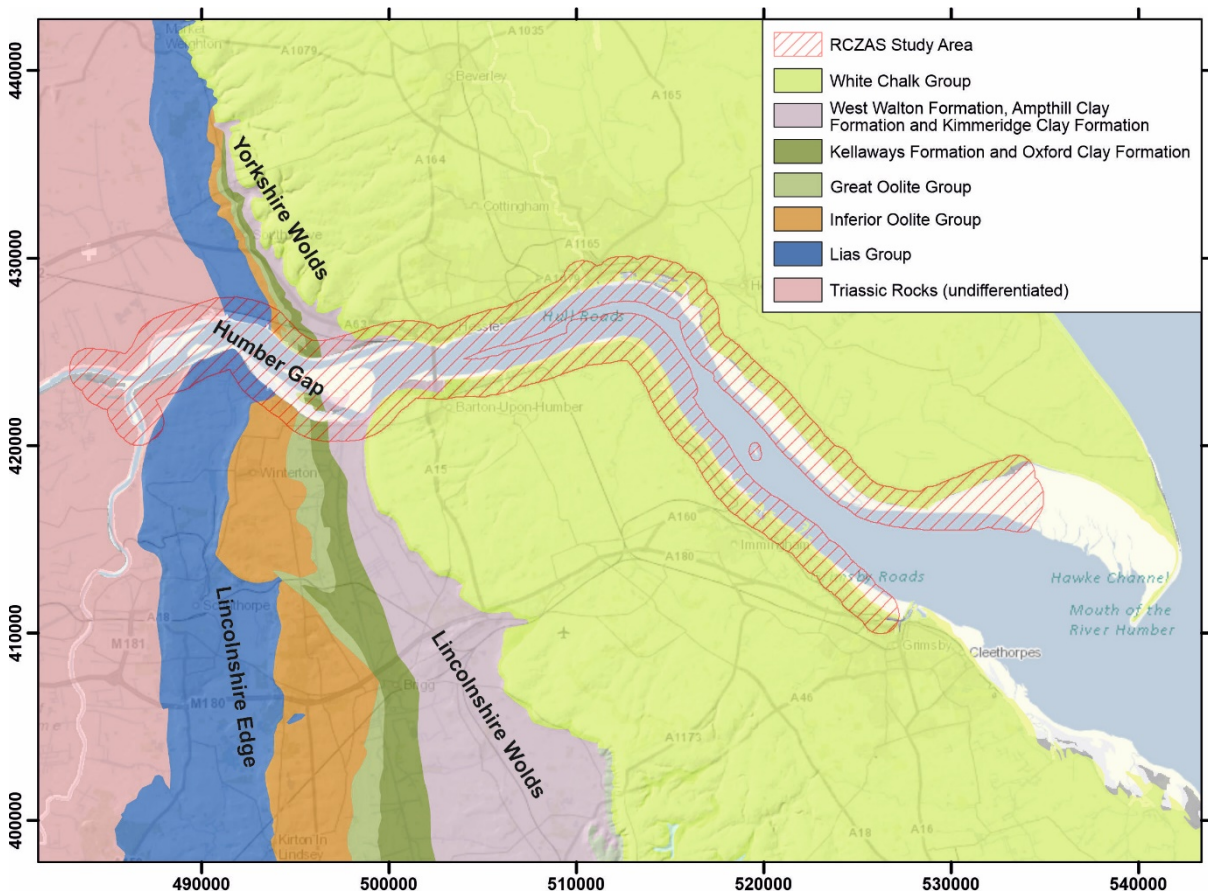


Figure 5.1 Solid Geology of the Inner Humber RCZAS study area. Contains British Geological Survey materials © UKRI 2018. Contains Ordnance Survey data © Crown copyright and database right 2020.

5.2 Pleistocene Deposits and pre-Devensian Glaciation

During the Pleistocene (2.6 million years ago until 11.7 thousand years ago (ka) or the start of the Holocene), repeated glaciations affected the Humber region. The earliest glaciation known to have covered the area occurred during the Anglian period (Marine Isotope Stage (MIS) 12; c 478–424 ka). The most recent phase of glaciation occurred during the Late Devensian period (MIS 2; 29–11.7 ka), the extent and timing of which has been intensively investigated (Clark *et al* 2012; Bateman *et al* 2018; see below). Evidence for a lowland glaciation between the Anglian and Devensian has, however, been the subject of long-standing debate. Some authors (for example, Gibbard and Turner 1988, 1990; Gibbard and Clark 2011; Gibbard *et al* 2018) apply the term 'Wolstonian' to the interval between the Hoxnian Interglacial (MIS 11; 424–374 ka) and the Ipswichian Interglacial (MIS 5e; 123–109 ka), even though two distinct Interglacials are present in this period: Purfleet (MIS 9; 337–300 ka) and Aveley (MIS 7; 243–191 ka). For the North Lincolnshire area, Straw (1963; 1983; 2000; 2011; 2018) has long promoted glaciation during multiple stages, with glaciation during MIS 8 (300–243 ka). Evidence proposed in support of this theory include the deposition of the Immingham Channel deposits during the MIS 8 deglaciation and a later Ipswichian (MIS 5e) interglacial deposit at Kirmington (Straw 2018). Glaciation pre-dating the Aveley Interglacial is also suggested by the preservation of MIS 7 deposits at Bielsbeck Farm, south of Markey Weighton, in the Foulness Valley (Halkon 1999; 2003; Schreve 1999). At Sewerby, near Bridlington, the Ipswichian (MIS 5e) raised beach stratigraphically overlies the Basement Till (equivalent to the Weton Till of east Lincolnshire), a glacially-derived deposit found extensively across the Holderness region, indicating that it must be pre-MIS 5e in age (Catt 2001), while at the Humber Gap, glacial erratics in a shingle deposit, at the base of the South Ferriby Cliff sequence, also indicate a pre-MIS 5e glaciation (Frederick *et al* 2001). Evidence for a pre-MIS 5e glaciation is also presented by White *et al* (2016) for the deposition of the Lincolnshire Wragby Till within the Trent valley system. They suggest this is MIS 8 in age and infer that there is no evidence for a lowland glaciation on the western flank of the southern North Sea Basin north of the Wash during MIS 6 (191–123 ka).

While the Pleistocene glaciations significantly modified the landscape, changes also occurred during the interglacial marine transgressions when sea levels were higher. Straw (2018) has proposed that marine transgression during the Aveley Interglacial (MIS 7) initiated the formation of a cliff, cut along the eastern margins of the Yorkshire and Lincolnshire Wolds, which was reactivated during the Ipswichian Interglacial (MIS 5e) resulting in the deposition of a raised beach and producing the abraded Marsh Platform in Lincolnshire. The Ipswichian cliff (see Figure 5.2) and raised beach, best exposed at Sewerby (Reid 1885; Lamplugh 1888, 1889, 1891; and see Catt 2001) is recognised as a break-in-slope on the eastern dipslope of the Yorkshire Wolds, where it runs south until exposed in the Humber Gap at Hessle (Reid 1885; Walton 1894; Crofts 1906; Sheppard 1908), and then continues on the southern shore along the eastern side of the Lincolnshire Wolds (Figure 5.2). It was during the Ipswichian Interglacial that the Kirmington re-entrant was part flooded by the sea, leading to the formation of the Interglacial deposits by a barrier beach migrating over saltmarsh that had accreted behind it (Straw 2018; Catt 2007). During the Ipswichian Interglacial, marine conditions are known to have reached as far as Rawcliffe, west of Goole (Gaunt *et al* 1974). Between these marine transgression phases, Shaw (2018) suggests that an emergent phase during MIS 6 was associated with lower sea-levels allowing the deepening of the Humber Gap and concomitant erosion of Wragby Till and Kimmeridge Clay within the Ancholme valley.

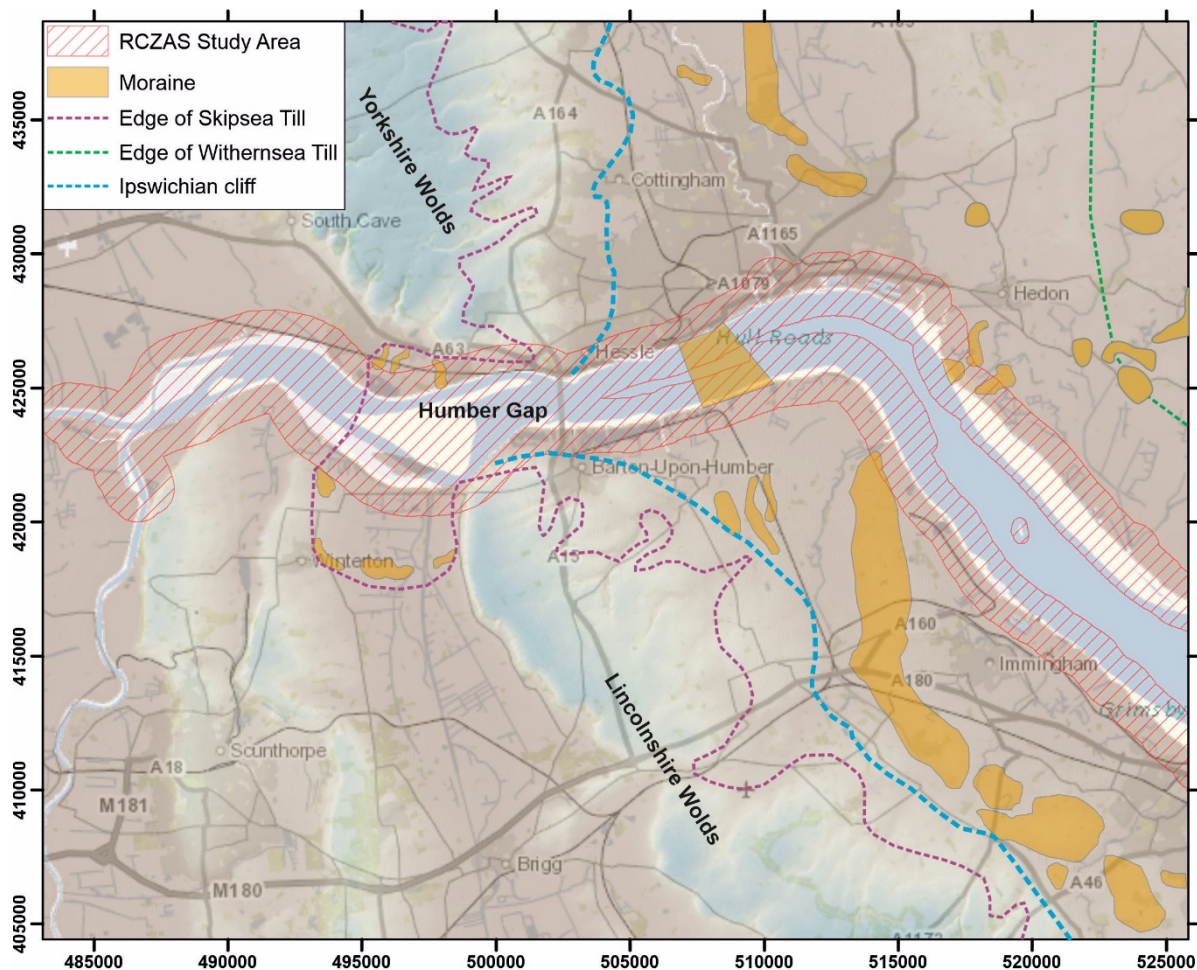


Figure 5.2 Positions of the Ipswichian cliff line, extent of the Skipsea and Withernsea Tills, and distribution of moraines (excluding moraine ridges) across the Humber Gap region. Adapted from Catt (2017), Clark *et al* (2014), Bateman *et al* (2017) and Rees *et al* (2000). Contains Ordnance Survey data © Crown copyright and database right 2020.

5.3 Late Devensian Glaciation and Lake Humber

The pattern of Late Devensian (c 30 ka–1.7 ka) glaciation is well understood, although the timing of events has been repeatedly revised in recent years as research progresses through dated stratigraphical and geomorphic evidence indicating either ice-free or ice-inundated conditions (e.g., Bateman *et al* 2008, 2015, 2017; Bateman and Buckland 2001; Fairburn and Bateman 2016; Clark *et al* 2004, 2012; Evans *et al* 2017).

During the Last Glacial Maximum (LGM) in MIS 2, the British-Irish Ice Sheet (BIIS) attained its overall maximum size by 27 ka, although absolute maximal extents varied in time from region to region (Clark *et al* 2012). Prior to 22ka, the extent of the proto-Lake Humber (see below) and position of the North Sea Lobe (NSL) of the BIIS is unknown. However, glimpses of the Middle Devensian environment are provided by the periglacial river deposits in the Finningley sequence dated to MIS 3 (40–35 ka) which show the local presence of a tundra with dwarf-shrubs heath and bare ground (Buckland *et al* 2019).

During MIS 2, a number of proglacial lakes were formed as a result of the watershed drainage being disrupted and blocked by ice (Clark *et al* 2012). The single most prominent of these was the proglacial Lake Humber (Fig 5.3), which formed to the south of the Vale of York Lobe (VOYL) and to the west of the NSL, covering an area of c 4500km² at its maximum extent (Clark *et al* 2004; 2012; Bateman *et al* 2008; 2017). The first to conceive a proglacial Lake Humber was Henry Carvill Lewis (1894), who envisaged a great North Sea glacier blocking the mouth of the Humber where it crosses through the

4km-wide Humber Gap between the Yorkshire and Lincolnshire Wolds. Currently about 20 per cent of the drainage of England passes through this point (Versey 1940; Rees 2006), so any blockage here would create an extensive lake to the west within the Humberhead Levels and extending into the Vales of Trent and York.

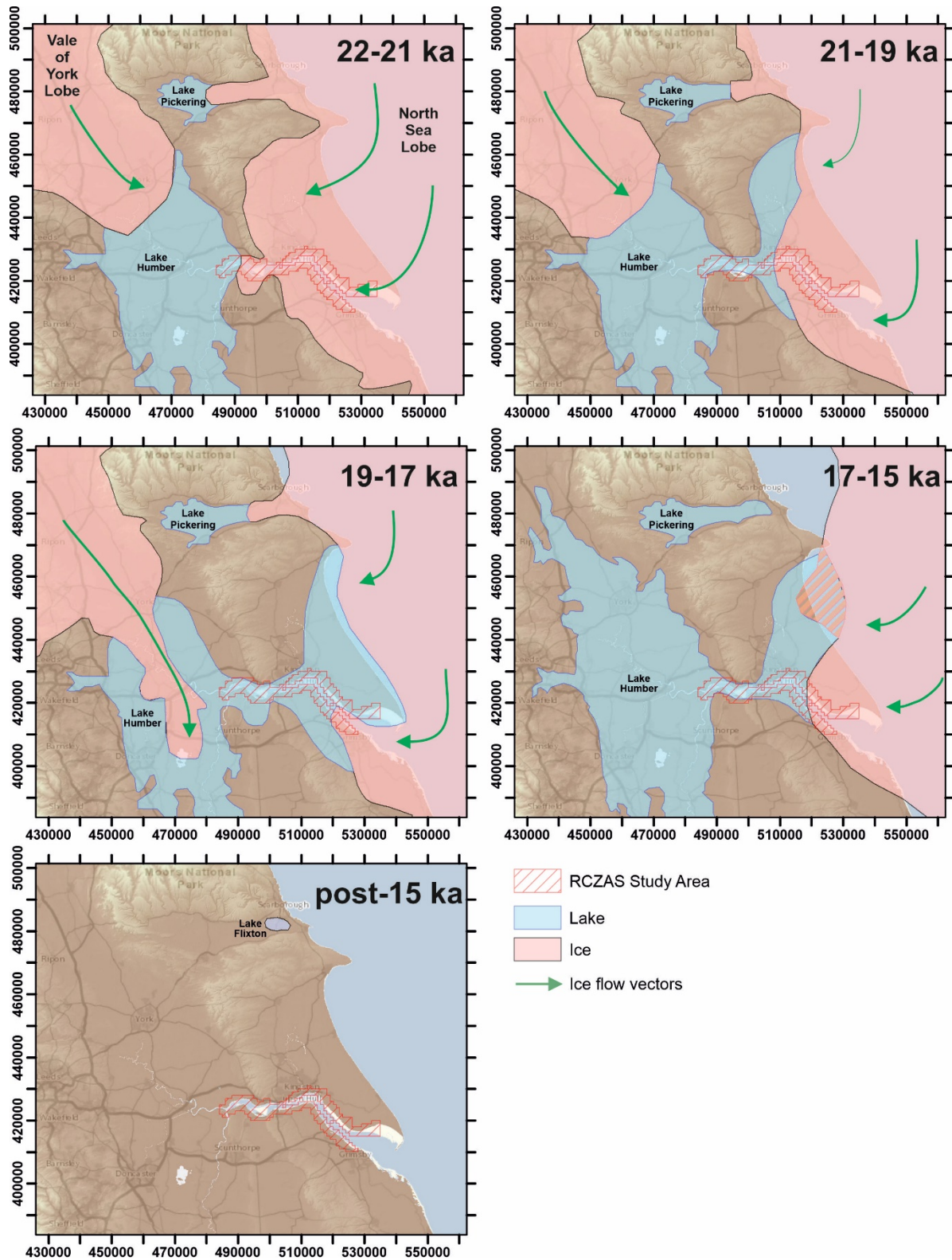


Figure 5.3 Lake Humber. The extent of any glacial lake within the Ancholme Valley is not shown, though various authors have suggested that it also extended down the length of this valley at its greatest extent. Modified from Bateman et al (2018).

The earliest onshore advance of the NSL is associated with the deposition of the Skipsea Till at c 21.6 ka, which had retreated offshore again by c 18 ka. The arrival of the Skipsea Till is demonstrated by its stratigraphic position above a series of silts with organic remains at the site of Dimlington on the southeastern tip of Holderness. The position of the Dimlington Silts, below the later Skipsea and Withernsea Till, but overlying the earlier Basement Till, have given their name to the Dimlington Stadial, a British chronostratigraphic term used for the main part of the Late Devensian glacial sub-stage between c 26–13 ka (Rose 1985; Bateman *et al* 2011).

Impounding of Lake Humber would have occurred at this time and it is assumed that the NSL advanced into the Humber Gap and the northern end of the Ancholme Valley, creating the moraine ridges at North and South Ferriby, Horkstow and two indistinct moraine ridge complexes located around Brough-Elloughton (3km to the west of North Ferriby) (Figure 5.2 and 5.3). The extent of flooding within the Ancholme Valley is not clear, with some authors suggesting it might have extended south past the Lincoln Gap (a gap similar to the Humber Gap but in the Lincolnshire Edge, near Lincoln) and connected with Lake Fenland centred over Cambridgeshire (see Fairburn and Bateman 2015; Clark *et al* 2004; Evans *et al* 2001). Bateman *et al* (2017) estimate that the ice thickness within the Humber Gap at this time could have been 100–200m. At the same time, the NSL was also advancing up the Vale of Pickering, forming Lake Pickering, while in the northwest the VOYL was advancing southward perhaps to a position at or near the Escrick moraine, south of York.

The proglacial Lake Humber persisted between 21–17 ka, expanding eastward as the NSL ice retreated from the Humber Gap. The NSL eastward retreat was punctuated by a number of still-stands (a pause in the glacier retreat which resulted in deposition) resulting in the moraine ridges at Halton to Waltham (and its equivalent north of Hull) and at St Andrew's Docks (Bateman *et al* 2017; Rees *et al* 2000; Fig 5.2). While the exact timing of this retreat is not fully understood, and even mapping of moraines is disputed, deposits overlying the Skipsea Till at Dimlington and Skipsea indicate that the NSL had retreated offshore before 17 ka, and possibly as early as 18 ka, with any onshore extension of the NSL likely restricted to along the Outer Humber Estuary. The westerly extent of the NSL was likely not far offshore but the absence of relict shorelines above 25m indicates that any pro-glacially dammed lake waters on Holderness were not directly linked to Lake Humber. At the same time, the VOYL advanced south as far as Wroot in North Lincolnshire (around c 18.7 ka; Friend *et al* 2016), before a marked northwards recession to the York and Escrick moraines. It was during this time that Lake Humber likely attained its highest elevation of approximately 33m OD (Bateman *et al* 2017).

Between c 17–15 ka, re-advances of ice are recorded at Skipsea and Dimlington, associated with the deposition of the Withernsea Till. This period also coincides with the deposition of the Kelsey Hill Gravels (Mill Hill Member, Lewis 1999). These gravels form a low sinuous ridge up to 15m high, widening southwards, linking the villages of Ridgmont, Thorngumbald, Ryhill and Keyingham. The rich fauna contained within the gravels (Prestwich 1861; Penny 1963) has been at the centre of considerable controversy over the origin of the landform-sediment assemblage (Geikie 1877; Reid 1885; Sheppard 1895; Sheppard and Stather 1907; Bisat 1940; Carruthers 1948; Baden-Powell 1956). The stratigraphic position of the Kelsey Hill Gravels, between the Dimlington Stadial age Skipsea and Withernsea tills, suggests that sedimentation was a product of glacier marginal fluctuations. However, interpretations of the exact depositional environment range from marine to glaciofluvial (Lamplugh 1925; Penny 1963; Eyles *et al* 1994), with Catt and Penny (1966) suggesting that they have a typical esker-like form, so could have an englacial origin. At this stage the VOYL had retreated further northwards, with Lake Humber levels dropping to 25m, 20m and 15m, and lake waters possibly continuous with those on Holderness (Bateman *et al* 2017). After 15 ka, there is no further evidence for glacier ice or Lake Humber, with the NSL having receded from the Holderness coastline permitting free drainage.

The repeated advance and retreat of the ice, and deposition of glaciolacustrine sediments associated with the proglacial lakes, has led to a complex series of superficial deposits

across the study area (Figs 5.4 and 5.5). These include some that may have been deposited directly from the ice in sub-glacial channels, as well as those deposited sub-aerially from melt-waters which become less easily distinguished from normal fluvial deposits progressively further downstream as melt-water influence, strong seasonal variations and the excessive supply of sediment decreases with distance downstream. Since a high proportion of the material is derived directly from the rocks eroded by the glacial ice, the pebble content of the sand and gravels will depend on which glacial advance event the deposits are associated with. Ice-wedge casts and cryoturbation (churning by seasonal changes to the level of frost) layers frequently occur at one or more level within them indicating the severity of the climate during breaks in their deposition. Away from these glaciofluvial deposits, head and clay-with-flints are found across the area, the product of rock decomposition, mass movement and/or cryoturbation under periglacial conditions, though only the thicker deposits are generally recognised owing to their frequent incorporation in landslip materials and blown sands.

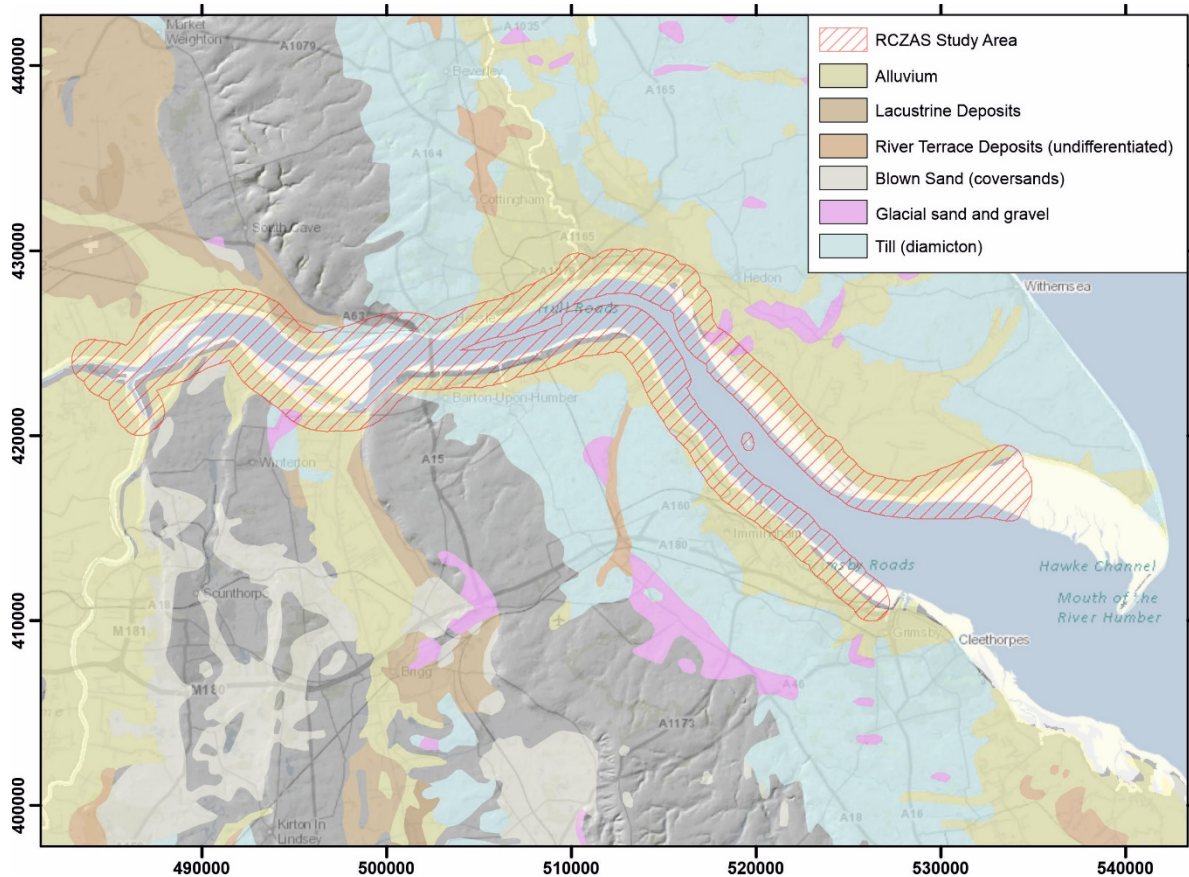


Figure 5.4 Simplified superficial geology of the Inner Humber RCZAS study area. Contains British Geological Survey materials © UKRI 2018. Contains Ordnance Survey data © Crown copyright and database right 2020.

The deposits left after glacial retreat have also led to widespread aeolian deposits (coversands) across Lincolnshire. They are often very thin and may be included in the finer upper layers of fluvial deposits. Exceptions occur at the foot of the north-south topographic ridges, where up to 7m (though generally less than 2m) of well-sorted fine-grained sand occur on the dip slopes (Gaunt *et al* 1992). Two widespread and distinct organic horizons provide stratigraphic markers below and within the coversand which have been used to generate a regional stratigraphy for these deposits. A basal peat is shown by the analysis of pollen and coleoptera (beetles) to represent unconfined tundra mires with semi-permanent snow-fed pools that formed in a cold but not arctic climate (Buckland 1982). This is overlain by the main body of coversand, often with an intersecting sand and organic laminae horizon indicating conditions at the threshold between peat formation and sand deposition (Bateman 1995). Radiocarbon dating of the

organic horizons, coupled with thermoluminescence dating of the coversands themselves, have indicated that the main phase of coversand deposition was between c 12.5–11.4ka during the Younger Dryas (Loch Lomond) stadial, immediately prior to the onset of the Holocene warm phase (Bateman 1998).

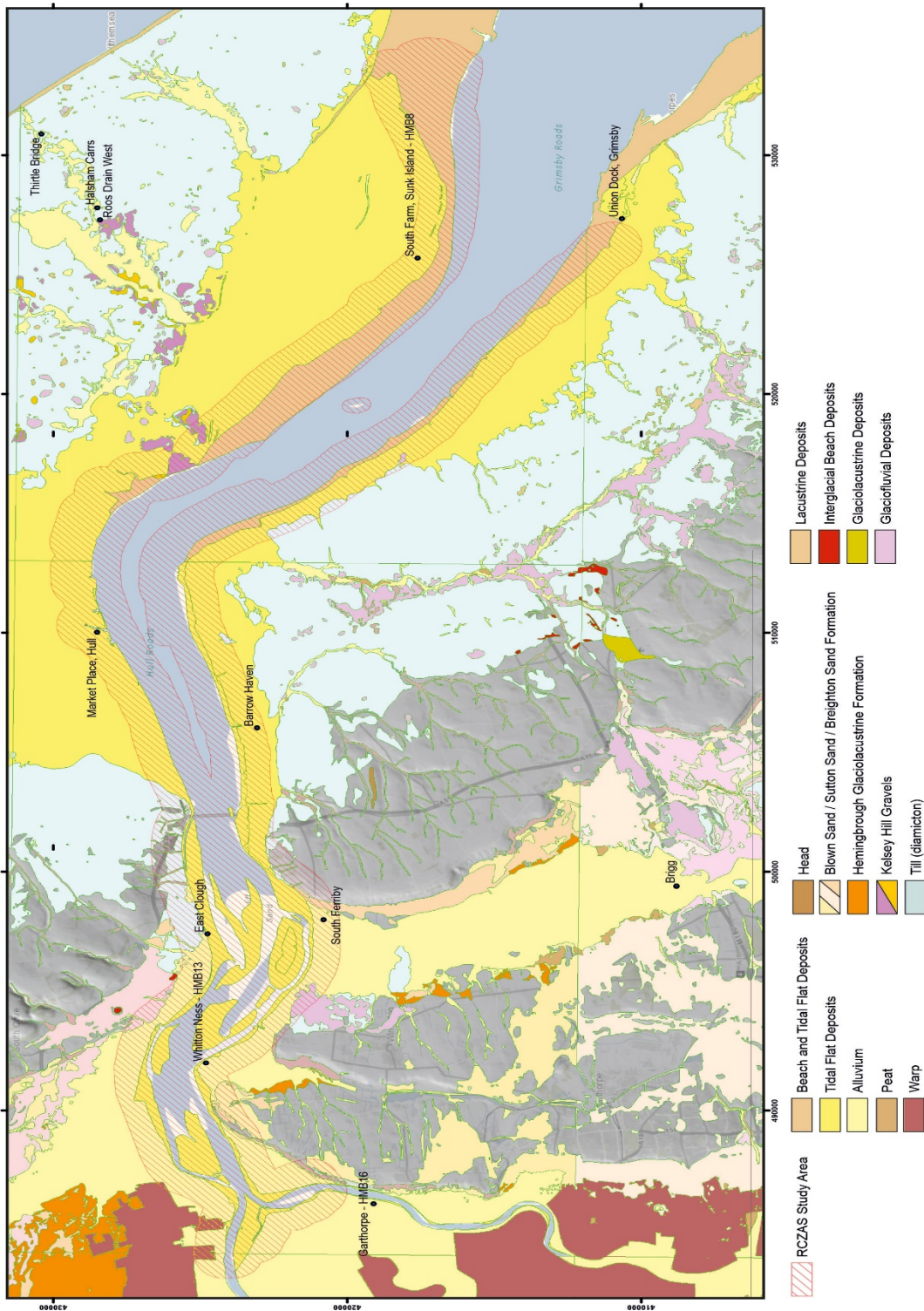


Figure 5.5 Detailed superficial deposits along the Inner Humber Estuary. Selected radiocarbon dated sequences mentioned in the text. Contains British Geological Survey materials © UKRI 2018. Contains Ordnance Survey data © Crown copyright and database right 2020.

5.4 Humber Estuary Holocene Stratigraphy

During the Land-Ocean Evolution Perspective Study (LOEPS) Rees *et al* (2000) undertook a characterisation of the distinctive sediment bodies within the fill of the estuary. While previous studies had sought to focus on the correlation of peats within the region, due to their laterally persistence, this study utilised geochemistry and mineralogy to identify a series of distinct bodies of sediment, which they termed suites (Fig 5.6).

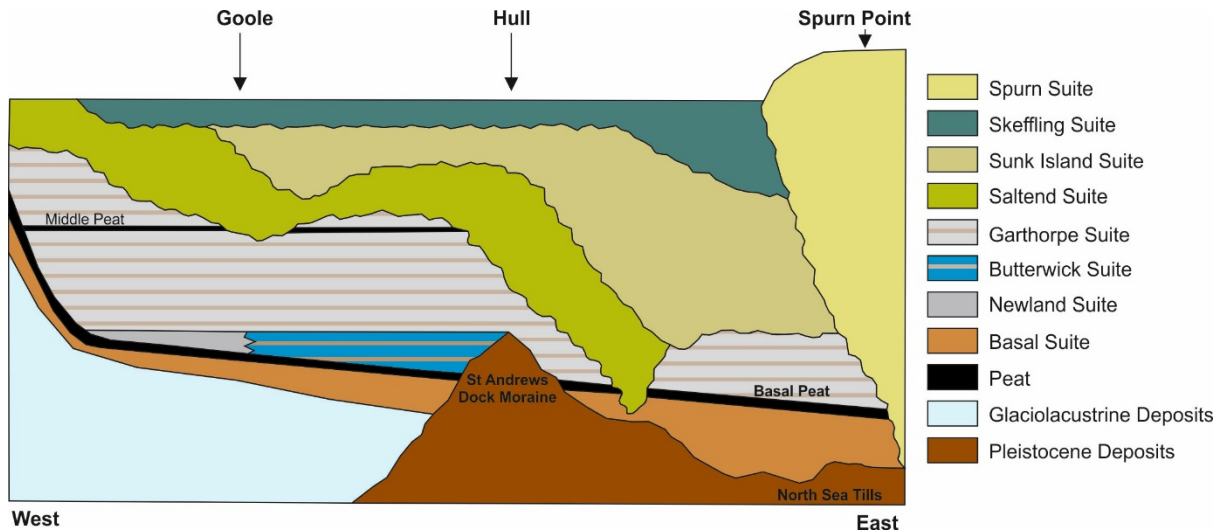


Figure 5.6 Schematic longitudinal section of the Humber Estuary, showing the suites defined by Rees *et al* 2000 (redrawn from Rees *et al* 2000).

The Basal Suite unconformably overlies Pleistocene sediments and Mesozoic geology and is typically less than 5m in thickness (Figure 5.7). It is dominated by fine-to medium sands, with sandy muds, and is poorly laminated but often contains organics, and may be topped by a peat referred to as the 'Basal Peat', which is entirely freshwater in origin. The age of this suite is diachronous (occurring in different periods) and in areas such as Sunk Island may be pre-Holocene in age. Radiocarbon dating of the peats from within the Inner Estuary, such as at Garthorpe HMB16 along the River Trent, have provided ages of c8000 cal BP.

In the far west of the lower part of the Ouse Valley (west of RCZAS study area), the Newland Suite comprises a lower laminated mud which transitions into an upper coarse-to fine-grained sands, and represent channel deposits with limited marine influence, likely deposited between c 8000–7400 cal BP. East of this is the Butterwick Suite, also found in the Trent and Ancholme Valleys, and in the Humber as far east as St Andrew's Dock. The suite comprises interbedded grey-brown sands and (commonly) laminated muds, which contain many roots and stem fragments (in contrast to the Newland Suite). Marine shells are also present in cores from the Trent Valley west of Scunthorpe, with this suite deposited within a tidally influenced environment, likely deposited between c 8000–7400 cal BP. The extent of these suites appears to be controlled by the presence of the till-bedrock sill extending across the estuary at St Andrew's Dock, Hull, on the eastern side of the Humber Gap. The presence of this sill may explain the limited marine influence in the western part of the estuary during the deposition of the Newland and Butterwick Suites.

The Garthorpe Suite overlies the Newland and Butterwick Suites or, where absent, the Basal Suite. The suite is of considerable thickness and dominated by poorly laminated muds with shell fragments. Root and stem traces and peaty horizons are also common, and in the eastern part of the estuary may contain the 'Basal Peat' that is more commonly found within the Basal Suite. Higher in the suite is the widespread 'Middle Peat', also known as the 'Bronze-Age Peat', located a few metres below Ordnance Datum.

Much of this suite was likely deposited in a saltmarsh environment. In the east, seaward of Sunk Island, deposition of the suite started by at least 8500 cal BP (South Farm, Sunk

Island HMB8), while in the west, where it overlies the Butterwick and Newland Suites, deposition probably commenced c 7400 cal BP (see Fig 5.10). Within the core from Whitton Ness (HMB13), samples from this suite are dated as late as 4370 cal BP and may be younger in other areas.

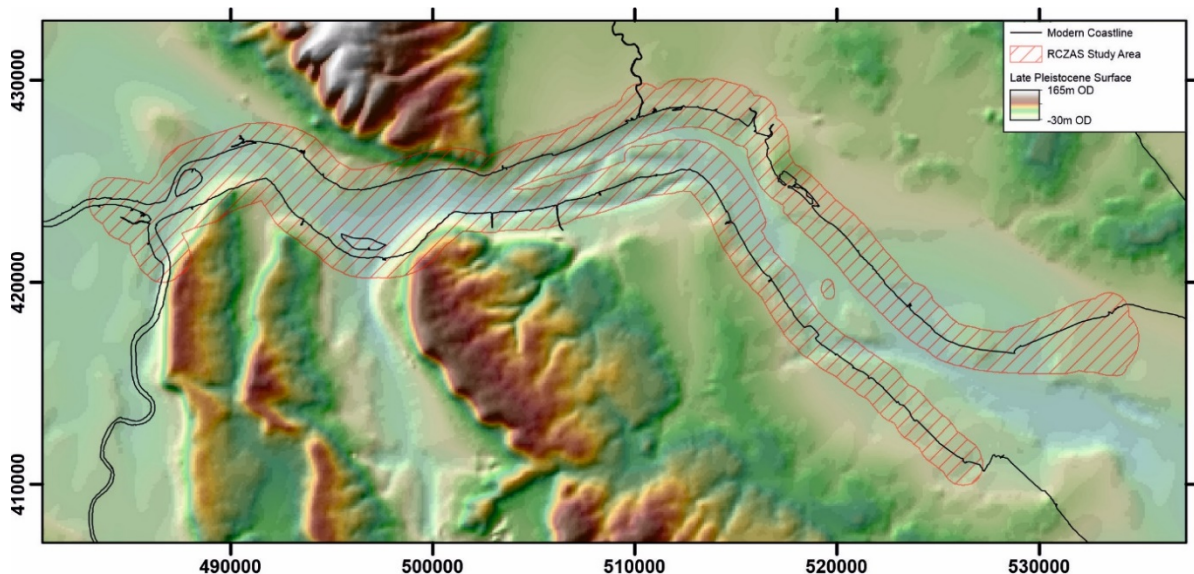


Figure 5.7 Modelled Late Pleistocene (post-15 ka) palaeotopography. Modelled based upon BGS Geindex data and models presented by Gaunt et al (1992), Gaunt (1994), Berridge and Pattison 1994 and Rees et al (2000). Contains British Geological Survey materials © UKRI 2018. Contains Ordnance Survey data © Crown copyright and database right 2020.

The Saltend Suite, overlying the Basal, Newland, Butterwick and Garthope Suites, is found in most parts of the Estuary. The base of this suite is a major erosional surface across the area. The suite comprises laminated muds and fine-grained sands and is readily differentiated from the Garthope Suite's poorly laminated muds. The sands and muds are interpreted as having been deposited on intertidal sandflats and mudflats respectively. Although some may have been deposited before 6000 cal BP, most are likely less than 4400 cal BP. Deposition of the Saltend Suite took place during a period of reducing rate of sea-level rise coupled with a wet climate and increased river discharge, resulting in increased channel erosion, migration and the deposition of sandflat and mudflat deposits.

The Sunk Island Suite occurs from the North Sea landwards as far as Goole. It comprises sands and muds, the former cross-stratified, while the muds are laminated with small shell fragments and only rooted near the modern surface. The laminated muds are interpreted as being deposited on mudflats, while the sands on sandflats or subtidal channel bars. Chemical analysis of these sediments shows a high lead (Pb) content. The lead is likely to be derived from mining in the Pennines that was then transported downstream in the rivers and suggests that the Sunk Island deposits may date from medieval times onwards.

The Skeffling Suite is visually indistinguishable from the Sunk Island Suite but contains elevated levels of several anthropogenic metals indicating deposition since the late eighteenth century, and likely to occur extensively over most parts of the channel of the estuary being deposited today. The final suite is the Spurn Suite that forms the modern spit of Spurn Point, to the east of the RCZAS survey area, and consists of an upward-fining sequence containing well-rounded gravels, sandy gravels and medium to very-coarse sands with shells.

5.5 Holocene Sea Level Change

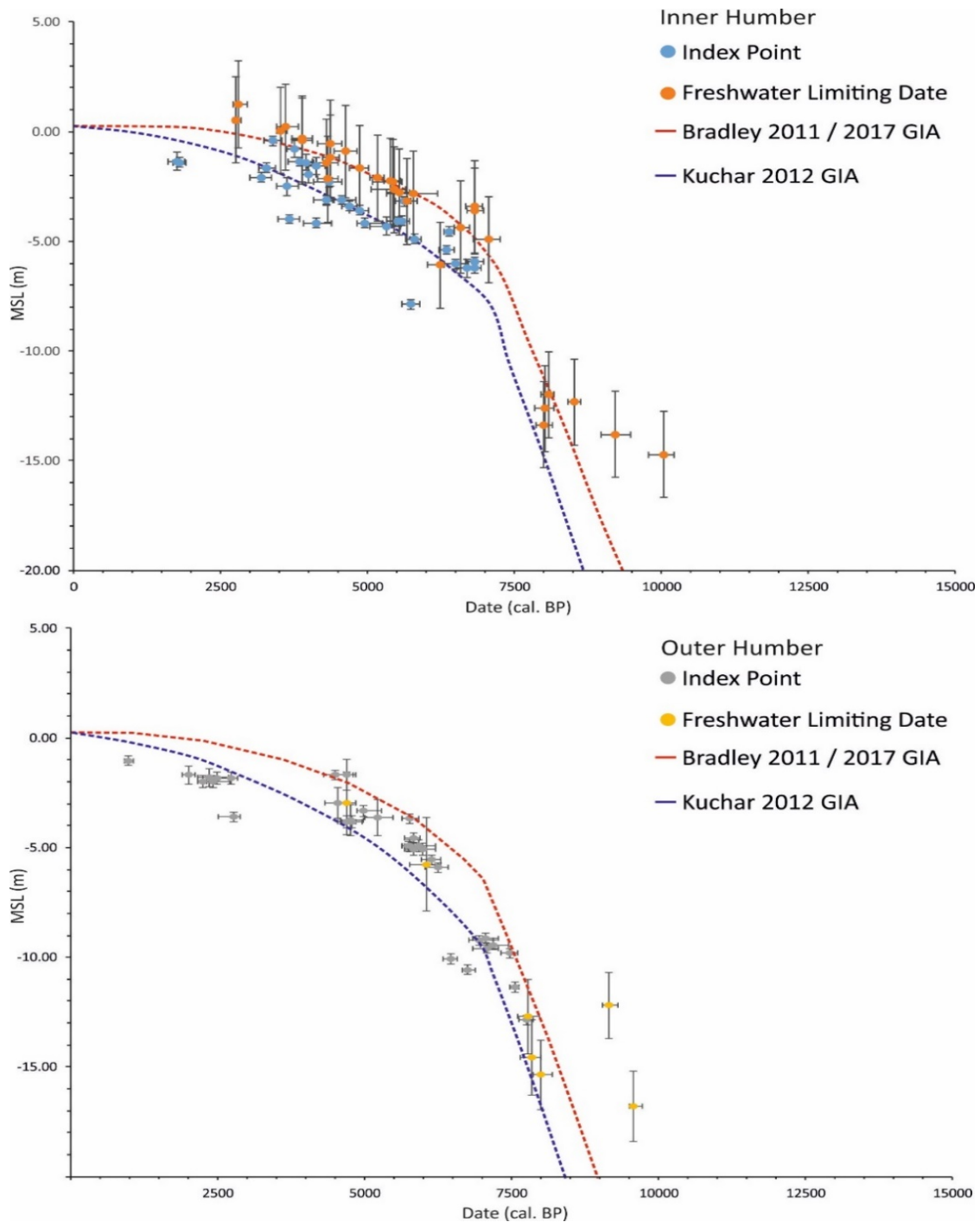


Figure 5.8 Age-elevation plot for Inner and Outer Humber Estuary of Sea-Level Index Points (SLIPs), limiting data and Relative Sea Level (RSL) predictions for two GIA Models (data from Shennan *et al* 2018).

The earliest investigations in the area seeking to establish regional sea level change were by Gaunt and Tooley (1974), collecting the oldest dates from basal peats at Market Place, Hull, and the Union Dock, Grimsby. Further work was undertaken in the area, although often focused on archaeological investigations, such as at Brigg in the Ancholme Valley and Hasholme in the Foulness Valley (Smith *et al* 1981; Millet and McGrail 1987; McGrail 1990), as well as the Humber Wetlands Project within the Keyingham and Roos Valleys (Thirtle Bridge, Halsham Carrs and Roos Drain), South Holderness, and the Ancholme

Valley (Rebourne, Brigg and South Ferriby) (Van de Noort and Ellis 1995; 1998). A comprehensive review of this data was undertaken by Dinnin and Lillie (1995) and Long *et al* (1998), who also presented new information from sites in Holderness (Kilnsea Warren), North Lincolnshire (Union Dock, Grimsby; Barrow Haven; Newton Marsh, Tetney), and the southern part of the Vale of York (Sandholme Lodge; East Clough). The subsequent LOEPS (Shennan *et al* 2000a) was conducted within the estuary, focused on collecting new data to refine the spatial and temporal gaps evident in the existing Relative Sea Level (RSL) record, collecting a wide range of Sea Level Index Points (SLIPs) along the estuary and adjacent offshore areas (Metcalf *et al* 2000; Shennan *et al* 2000b). Collectively, these studies have generated 103 SLIPs for the Inner and Outer Humber Estuary, enabling a well-constructed and consistent record of Holocene sea-level for the Inner and Outer Humber (Fig 5.8).

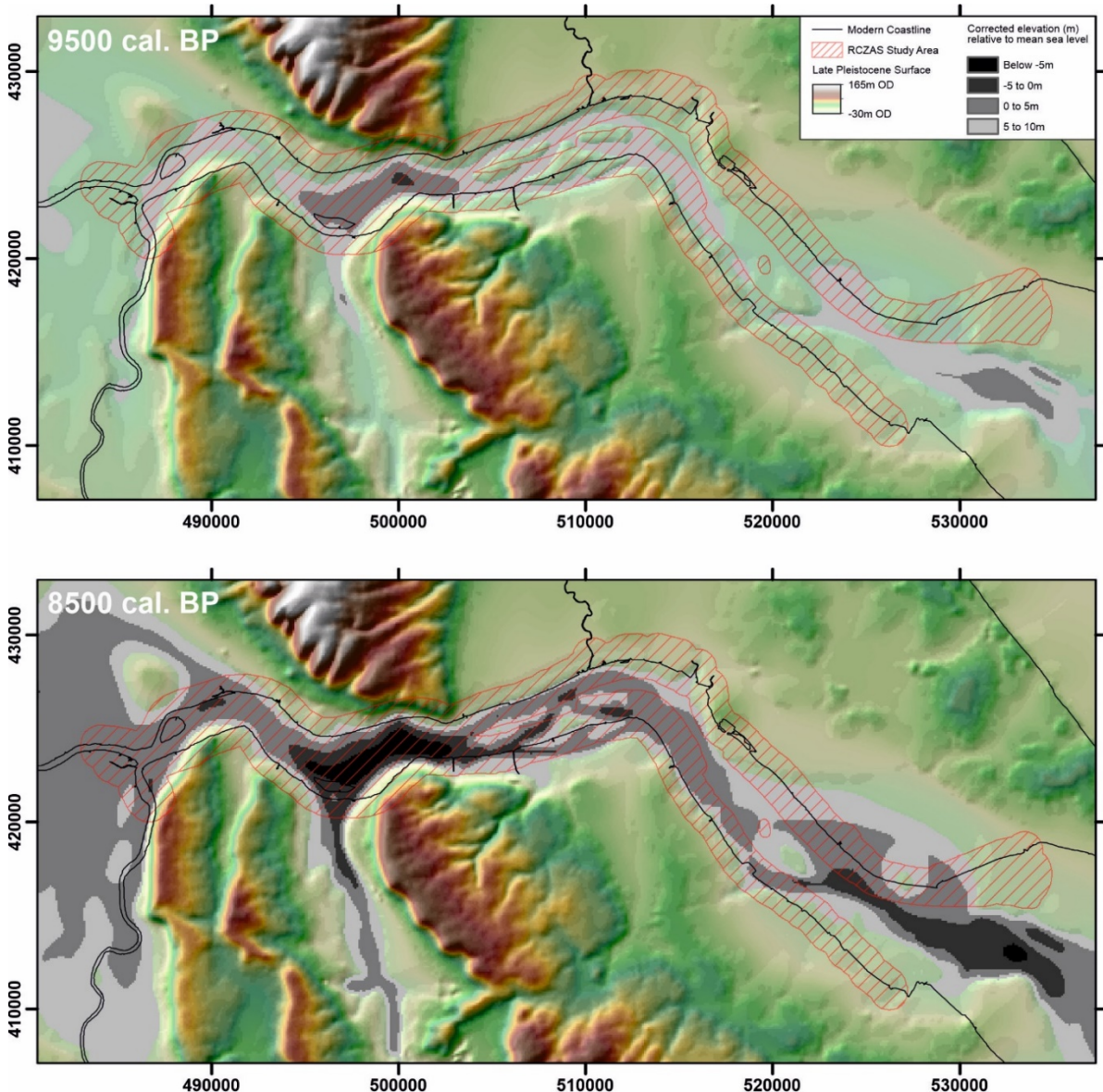


Figure 5.9 Palaeogeography reconstruction at 9.5 and 8.5 ka. Corrected elevation uses GIA model (see Sturt *et al* (2013) to correct Late Pleistocene Surface to estimate wetland extent and marine incursion into the Humber Estuary. Contains Ordnance Survey data © Crown copyright and database right 2019.

The data show that by c 8000 cal BP, estuarine conditions existed in the outer estuary with sea level about -17 m OD (Fig 5.9). The low sea level meant that during the Early Holocene the lower reaches of many rivers were fluvial systems with channels incised down to depths as low as -15m OD due to the steeper drainage gradient created by lower

sea levels. Relative sea level rose quickly between c 8000 and 6000 cal BP with many sites in the Outer and Middle estuary recording marine conditions (Gaunt and Tooley 1974; Long *et al* 1998; Metcalfe *et al* 2000). These changes affected the hydrology within the inner estuary, with impeded freshwater drainage causing ponding, waterlogging and paludification, the latter leading to the spread of alder (*Alnus glutinosa*) dominated fen carr communities in many rivers from c 8000 cal BP in the Humberhead Levels, as early as 9200 cal BP in the lower Trent (Bole Ings; Brayshay and Dinnin 1999) and c 7000 cal BP at Brigg in the Ancholme Valley (Neumann 1998). However, modelling of the Thorne and Hatfield Moors has suggested that the interrelationship between these landscape scale events of sea level change and peat spread are much more complex and not solely driven by rising base levels and paludification (Chapman and Gearey 2013). Local factors, such as microtopography, are important as they determine the layout of wetland systems (creeks, saltmarsh, carr woodland, etc) at a scale not possible to accurately model in a regional model.

Metcalfe *et al* (2000) attempted to utilise the SLIP data to generate palaeogeographic reconstructions of the Humber Estuary between 8–3ka cal BP. Rodriguez (2012) has highlighted problems with this approach, notably the absence of Glacio-Isostatic Adjustment (GIA) models, which has resulted in the Metcalfe *et al* (2000) model underestimating the extent and timing of Holocene flooding within the Inner Humber Estuary. However, Rees *et al* (2000) has highlighted that limited influence of marine conditions in the western parts of the estuary in the Early Holocene was affected by the presence of a morainic ridge near St Andrew's Dock, Hull, resulting in the Newland and Butterwick suite. This is visible as an expansion of wetland north of the Ancholme Valley unconnected to wetland expansion in the estuary mouth to the east (Figure 5.9 and 5.10).

To simulate the rate and extent of submersion within the RCZAS survey area, a GIA model has been applied against a Digital Surface Model (DSM) for the Inner Humber Estuary. The DSM is constructed from over 6000 BGS borehole logs along with surface elevation derived from EA Lidar and bathymetry and OS topographic mapping and presented in Figures 5.9–5.11 incl. To create this, the GIA model of Bradley *et al* (2011) was applied to the DSM for time periods from 9.5 to 5.5 ka, following the methodology of Sturt *et al* (2013). This readjusts the DSM elevation relative to the sea level for a given time interval and can therefore be used to estimate the position of MSL. From this, the position of the coastal margin and wetland areas can be inferred at a time period of interest. Please note, the model presented takes no account of the modelled changes in the palaeotidal range for the area, nor areas where sediment accumulation has taken place, such as the siltation along the estuary margins and tributary rivers.

After c 6000 cal BP (Fig 5.11), marine transgression progressed up into the lower valleys of the Inner Estuary and the rate of sea level rise began to slow (Kirby 1999; Metcalfe *et al* 2000). Peat formation is apparent at many sites as the accumulation of wood peats in backswamp floodplain environments kept pace with the rate of rising relative sea levels (Long *et al* 1998; Van de Noort and Ellis 1997, 1998, 2000; Neumann 1998; Brayshay and Dinnin 1999). An increased influence of estuarine expansion at sites in the lower Aire valley, west of Goole, is apparent between c 5000 and 2800 cal BP in the form of raised water levels associated with rising tide levels (Kirby 2001). Important changes in palaeotidal regime also occurred during the Early to Middle Holocene in the Humber and east coast area, with spring tidal range only 63 per cent of its present magnitude c 8000 cal BP (Plater *et al* 2000; Shennan *et al* 2000a; 2000b). Model predictions show that tidal range increased by 60 cm between c 8000 and 6000 cal BP, in response to variations in tidal prism and estuary configuration, with only minor changes occurring since (Shennan *et al* 2000b).

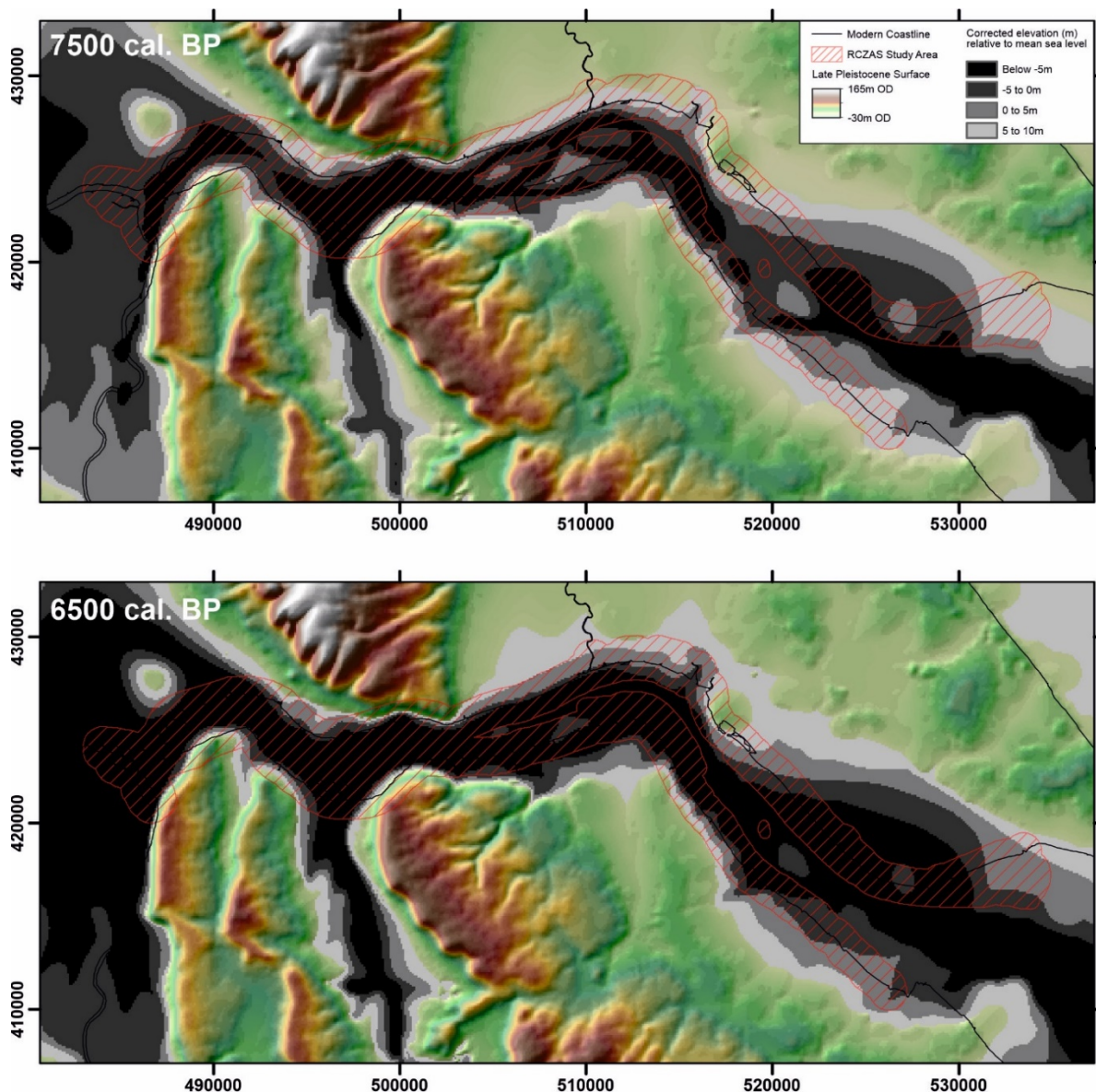


Figure 5.10 Palaeogeography reconstruction at 7.5 and 6.5 ka. Corrected elevation uses GIA model (see Sturt *et al* (2013) to correct Late Pleistocene Surface to estimate wetland extent and marine ingress into the Humber Estuary. Contains Ordnance Survey data © Crown copyright and database right 2019.

From c 4000 cal BP many sites were inundated as estuarine conditions expanded to their maximum extent (Smith 1958a; 1958b; Fletcher 1981; Smith *et al* 1981; Long *et al* 1998; Neumann 1998; Kirby 1999; Metcalfe *et al* 2000). This is illustrated by the discovery of Bronze Age boats and trackways buried within the estuarine alluvium (Wright and Churchill 1965; Crowther 1987; Buckland *et al* 1990; Long *et al* 1998; Fletcher *et al* 1999; Van de Noort and Ellis 1998). Fletcher (1981) suggested that marine conditions reached their maximum extent at c 2700 cal BP in the Ancholme valley when estuarine sediments were accumulating 22km inland at Waddingham Holmes. This expansion occurred during a period of positive sea-level between c 4000–1900 cal BP, followed by a phase of negative sea-level tendency (Long *et al* 1998). These changes coincide with widespread migration of the estuarine channel and formation of the Saltend Suite (Rees *et al* 2000; see Section 5.4). This may have been caused by increased runoff, caused by prevailing climate in conjunction with a decrease in the space available for sedimentation caused by a slowing rate of sea-level rise.

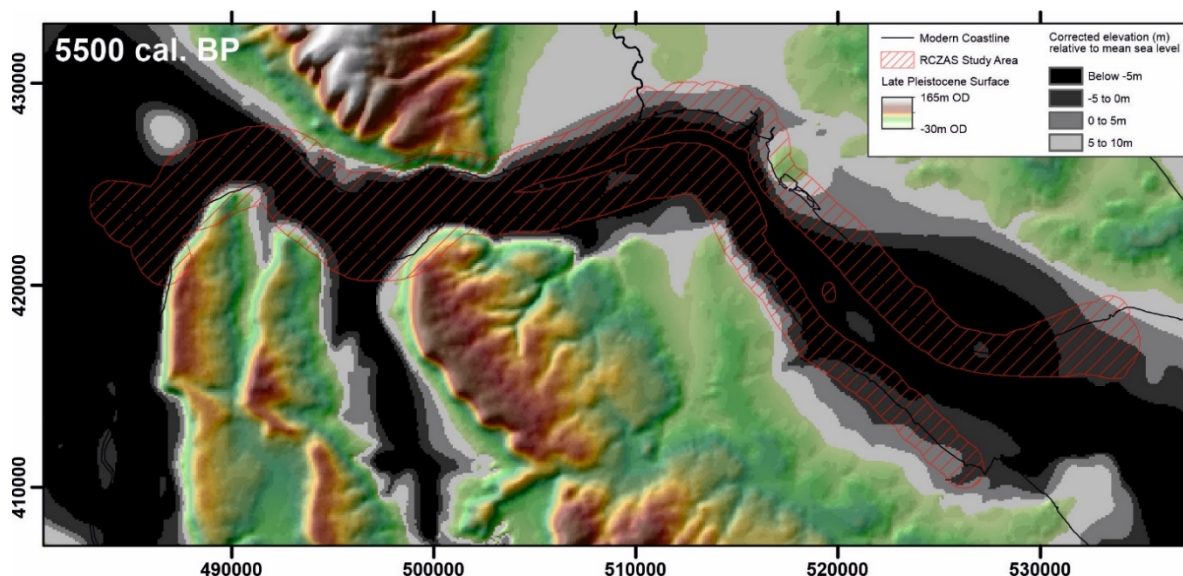


Figure 5.11 Palaeogeography reconstruction at 7.5 and 6.5 ka. Corrected elevation uses GIA model (see Sturt *et al* (2013) to correct Late Pleistocene Surface to estimate wetland extent and marine ingress into the Humber Estuary. Contains Ordnance Survey data © Crown copyright and database right 2019.

Evidence for a retraction of intertidal conditions and a period of shoreline advance dates from after c 3000 cal BP (Long *et al* 1998; Kirby 1999; Metcalfe *et al* 2000), with a number of coastal sites in the Humber (for example, Hasholme and Brigg) recording a replacement by freshwater conditions (Smith *et al* 1981; Jordan 1987). The development of surface peats in the Ancholme and Hull valley, and elsewhere in the estuary (for example, Barrow Haven) there is further evidence for estuarine contraction (Smith 1958a; Fletcher 1981; Dinnin and Lillie 1995; Long *et al* 1998). The maximum extent of estuarine conditions in southern Holderness is demonstrated by the relict storm beach between Keyingham and Patringham Haven, now 6km inland behind Sunk Island, which represents the former coastline c 3210-1960 BP (Fig 5.12; Berridge and Pattison 1994). Sheppard (1966) considers that estuarine alluvium of southern Holderness and the Hull valley was largely unexploited until the late early medieval period, though Didsbury (1988, 1990) suggests that later prehistoric activity on alleviated areas was occurring, and alluvial surfaces within the Hull valley were probably habitable in the Roman period. The work of Halkon and Innes (2005) has shown that the distribution of artefactual material in different periods is greatly affected by the changing extent of the wetland areas and estuarine edge and in the Hull Valley, Evans (2000) has shown that there was increased settlement activity in the Roman-Period period focussed on islands of glacial till forming relatively high-ground and on the edges of rivers. As Van de Noort (2004) suggests that while there is currently only limited evidence for early long-term settlement, the wetlands provided valuable resources that were seasonally exploited and that the creeks and waterways were valuable as routes for trading.

Studies of the area generally concur that environmental changes occurred during the late Roman period, resulting in a rise in sea levels and widespread flooding of low-lying wetland areas. Large parts of the Humber Estuary were abandoned during this time, although these were gradually re-occupied along some parts of the estuary from perhaps as early as the 9th century AD, increasing from around the 10th century onwards as a result of more active drainage and embankment schemes and settlement of islands of relatively higher ground (Sheppard 1966; Van de Noort 2004). Archaeological investigations as part of the Outstrays to Skeffling Realignment Scheme recording the buried traces of a flood defence bank considered to be 12th century in date (Howard *et al* 2017; Jackson 2019).

By the late medieval period, communities next to the salt marsh had developed, followed by land-claim using artificial embankments and drains for agriculture, with many of the

larger schemes undertaken by monasteries such as Meaux Abbey in the lower Hull valley and Thornton Abbey, near Goxhill, North Lincolnshire (Sheppard 1966; Van de Noort 2004). Exploitation of the saltmarshes was in the form of seasonal rough grazing of Ings (meadow/marsh) and in places, alongside smaller creeks, salt production.

During the 17th century the North Channel ran between Sunk Island and South Holderness, but landclaim around Sunk Island and Cherry Cobb Sands, coupled with an extension of Spurn Point, resulted in increased flooding at Keyingham and Hedon and silting up of the Keyingham Fleet in the 18th century. Ultimately to prevent this flooding, the Keyingham Drain Act of 1802 was implemented resulting in a diversion of this channel west of Sunk Island, but continued land-claim and sediment deposition ultimately led to end of the harbour and full connection of Sunk Island to the mainland (Fig 5.12).

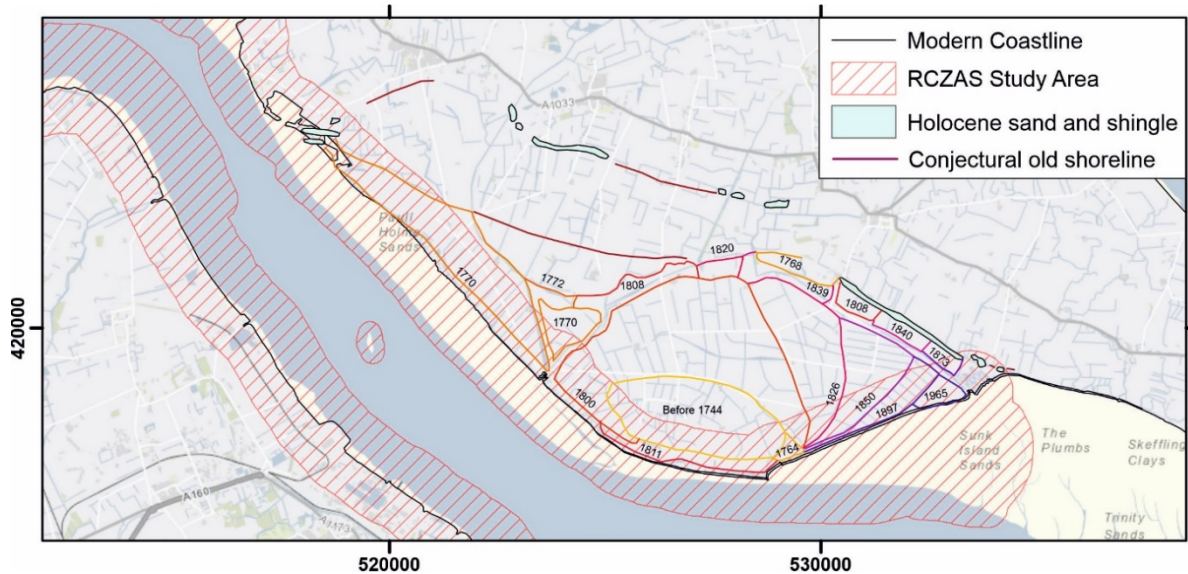


Figure 5.12 History of landclaim as defined by storm beaches, sea walls and old shorelines around Sunk Island (modified from Berridge and Pattison 1994). Contains Ordnance Survey data © Crown copyright and database right 2019.

Over the past c 300 years a process known as 'warping' has been undertaken in order to raise the level of the alluvial floodplain and improve drainage and agricultural quality. This is shown in Figure 5.5 which is derived from BGS mapping and shows large areas of warp deposits in the west of the study area, in the lower Trent and Ouse valleys. Evidence for warp deposits has been identified elsewhere within the project area, including the area of Broomfleet (Lillie and Geary 1999) and at Sunk Island (Howard *et al* 2017; Jackson 2019). In the west of the project area, Read's Island was created by warping and embankment in the 19th century.

Warping was achieved in one of two ways: dry-warping, involving the physical transporting of material and dumping in areas to raise the land surface; and the more extensive wet-warping where sediment-laden estuarine waters were fed into embanked areas along excavated channels or 'warping drains' to raise the land level over several cycles. The process of warping is discussed in more detail by Lillie (1998).

6 Previous archaeological and historical research

Dr Fiona Fleming and Peter Dudley

The following section has been sub-divided in terms of the boundaries of the Flood Areas as defined by the Humber Flood Risk Management Strategy (2008).

In terms of the Flamborough Head to Gibraltar Point SMP, Flood Areas 2 and 3 correspond with Policy Area K of the SMP. Policy Area L of the SMP corresponds with Flood Area 24.

6.1 Yorkshire

6.1.1 Yorkshire – Flood Area 2: Skeffling

Palaeolithic and Mesolithic

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events (Dinnin 1995; Dinnin and Lillie 1995).

Archaeological evaluation and borehole sampling as part of Outstrays to Skeffling Managed Realignment Scheme recorded organic sediments dating to the Mesolithic period. Analysis of the environmental evidence indicates open grassland, freshwater wetlands and salt marsh closer towards the estuary, with deciduous woodland and alder carr along the higher, drier, ground. Occasional breaching of the wetlands occurred periodically during this period, creating a mix of freshwater and brackish environments. A borehole in the vicinity of the Patrington Channel revealed a layer of coarse sand and gravel with small cobble inclusions, which were interpreted as a beach environment of Mesolithic date; possibly a sandy foreshore (Howard *et al* 2017; Jackson 2019).

Neolithic and Bronze Age

There is no evidence for Neolithic or Bronze Age activity in this part of the survey area. Evaluation as part of the Welwick to Skeffling Managed Realignment Scheme uncovered both estuarine and freshwater alluviums overlying the Mesolithic sediments and dated to the Neolithic and Bronze Age, indicative of rising sea levels (Howard *et al* 2017; Jackson 2019).

Iron Age and Romano-British

Wider evidence for Iron Age and Romano-British settlement activity in the local area suggests that this was predominantly situated on the higher ground north of the villages of Welwick, Weeton and Skeffling (outside the survey area), however, evidence of Iron Age and Romano-British settlement activity to the south of Weeton was uncovered during recent excavations as part of the Managed Realignment Scheme (Howard *et al* 2017; Jackson 2019).

Early medieval and medieval

Studies of wetlands archaeology generally concur that environmental changes occurred during the late Roman period, resulting in a rise in sea levels and widespread flooding of low-lying wetland areas. Large parts of the Humber Estuary were abandoned during this time, although these were gradually re-occupied along some parts of the estuary from perhaps as early as the 9th century, increasing from around the 10th century onwards as a result of more active drainage and embankment schemes (Sheppard 1966; Van de Noort 2004).

Archaeological evaluation and recording in advance of the Managed Realignment Scheme identified a potential early embankment and also recorded two areas of medieval occupation, evidence of stock enclosures and ditches associated with a field system (Howard *et al* 2017; Jackson 2019).

Pottery finds suggest a potential occupation site, with activity in the 10th/11th centuries, peaking in the late 12th to late 13th centuries. The boundaries of the associated field system were maintained in this area into the 14th century. It is not clear when they went out of use, but at some point before the mid-18th century, the narrow medieval linear fields underwent enclosure to create two larger fields.

During the 13th to 15th centuries there was once again serious loss of land along parts of the Humber Estuary as a result of flooding and many medieval settlements along the estuary edges were lost (Sheppard 1966). A general absence of late 14th/15th century pottery potentially indicates abandonment of the area by this time; within the project area this may have included the documented medieval villages of Orwithfleet and Penisthorpe (MHU2637).

The history of the drainage and landscape development in south Holderness was researched in the 1960s by June Sheppard (1966).

Post-medieval

Berridge and Pattison (1994) and Sheppard (1966) conclude that the medieval coastline of South Holderness may have extended to close to that of the present day but by 1650 this had receded, leaving a number of sand banks including Sunk Island and Cherry Cobb Sands. During the latter part of the 17th century there were more concerted efforts at drainage and reclamation, resulting in the channel separating Sunk Island from the (then) mainland becoming increasingly choked by silt. Sunk Island and Cherry Cobb Sands to the west were fully reclaimed again by the 19th century (see Fig 5.12). The methods of agricultural improvement included the building of further flood defence banks and the process of 'warping' (see Section 5.5 for further discussion).

Modern

The process of agricultural improvement continued, and the land created is of high grade for cultivation and agriculture. The flood defence banks have been maintained until recently but have now been breached with new ones created inland as part of the Managed Realignment Scheme.

6.1.2 Yorkshire – Flood Area 3: Sunk Island (Winestead Drain to Stone Creek)

Palaeolithic and Mesolithic

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events (Dinnin 1995; Dinnin and Lillie 1995).

Early medieval to post-medieval

The land area of Sunk Island developed through the natural accretion of river sediments into the medieval period. Further drying out of areas of salt marsh along the estuary edges were also actively encouraged during the 10th to 12th centuries by the embankment of some of the highest parts and during this period several small settlements, such as Frismersh (MHU2720) and East Somerle (MHU8954), were probably established close to the estuary edge (Sheppard 1966; East Riding of Yorkshire 2006;).

Sheppard (1966) gives a detailed summary of the development of Sunk Island. Up until the 13th century it probably remained an offshore island in the River Humber, before being lost to erosion and flooding between the 13th and 15th centuries. By the early part of the 16th century sandbanks developed and between the 17th and 19th centuries successive phases of enclosure, and reclamation increased its size rapidly (see also Berridge and Pattison 1994). By 1850 continued reclamation and silting up had resulted in the complete infilling of the North Channel and Sunk Island became part of the mainland.

The methods of agricultural improvement included the building of further flood defence banks and the process of 'warping'; the purposeful control of silt-rich estuarine water using sluice gates (Fig 4.2) to deposit sediment during the natural tide cycle to create 'made ground' above sea-level, reducing the liability to flooding (see Section 5.5 for further discussion).

The analysis of aerial photographs by the Yorkshire Coast and Humber Estuary RCZAS NMP has identified several areas of post-medieval ridge and furrow cultivation visible as cropmarks and earthworks (Deegan 2007).

Modern

The AI&M project recorded earthworks associated with Sunk Island Battery (MHU9587), situated near South Farm, one of two batteries on opposing banks of the Humber in World War One (WWI); the second being at Stallingborough. The project also recorded features associated with the World War Two (WWII); re-use of the Sunk Island Battery and features associated with the well-preserved Heavy Anti-Aircraft (HAA) battery (MHU4528), located on the east side of Stone Creek (Fleming and Royall 2019) (Fig 6.1). A survey of the battery was carried out by Dennison and Richardson (2013).



Figure 6.1 Sunk Island Battery – a Scheduled Monument (NHLE 1020187).

6.1.3 Yorkshire – Flood Area 4, Stone Creek to Paull Home Strays

Palaeolithic

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events (Dinnin 1995; Dinnin and Lillie 1995).

Mesolithic and Neolithic

Archaeological investigation in 2003, during groundworks associated with the Humber Estuary Tidal Defences Flood Alleviation Scheme at Paull Strays and Paull Holmes, recorded scatters of worked flint of Mesolithic and Neolithic date within the routes of two of the access roads, specifically where clay deposits were the thinnest and on high grounds of windblown sands (Tann and Field 2003).

Paull Holme was one of the sites investigated during the Humber Wetlands Project (Head *et al* 1995). The Holme is situated on an island of glacial till, which elevates it above the surrounding flood plain, formerly an area of tidal salt marsh (see Berridge and Pattison 1994 for explanation). Most of the finds recovered through fieldwalking were from this area of raised ground and included several flint assemblages of later prehistoric date, with a probable Mesolithic to Bronze Age date range (Head *et al* 1995).

Bronze Age

Archaeological monitoring of works to the flood defences at Paull Holme Strays produced a Bronze Age scraper and 11 Bronze Age flints (Tann and Field 2003).

Roman

Two Roman coins are recorded from Paull Holme (MHU18491) and the archaeological recording at the western end of the new embankment at Paull Holme Strays produced a fragment of Roman tile (*ibid*).

Early medieval and medieval

Cherry Cobb Sands probably developed as a sandbank during the early medieval period through the same accumulative processes as Sunk Island to the east. The area was lost to flooding between the 13th to 15th centuries when it began to develop once more, eventually becoming part of the mainland towards the end of the 18th century, hastened by embankment, reclamation and agricultural improvement. The landscape and geological development of the Holderness area has been researched by Sheppard (1966), Berridge and Pattison (1994) and revisited by the palaeoenvironmental survey of the Humber Wetlands Project (Dinnin 1995).

Paull Holme is recorded in the Domesday Book as 'Holme', where it formed part of the manor of Burstwick. The settlement may have been impacted by the stormy period of the 13th to 15th centuries, which may have resulted in significant loss of the surrounding salt marsh during this time (Head *et al* 1995). By the late 15th century Paull Holme was owned by the Holme family who had a moated manor built on the site, complete with a manor house (MHU2660; NHLE 1007875).

Paull Holme was investigated by the AI&M project (Fleming and Royall 2019), which mapped earthwork features associated with the moated manor and the extant north tower (MHU2660). Analysis suggests a possible shrunken settlement (MHU8515) to the east. Several areas of medieval ridge and furrow cultivation to the south of Paull Holme were also mapped, largely coinciding with the extent of the elevated glacial till.

Fieldwalking at Paull Holme as part of the Humber Wetlands Project recovered several sherds of medieval Humberware pottery, again predominantly from the area of glacial till (Head *et al* 1995).

Archaeological work associated with the Humber Estuary Tidal Defences Flood Alleviation Scheme also produced several findspots of medieval pottery, mostly of 14th to 16th century date, but with a 12th century jug sherd from the topsoil at the western end of the new embankment and another sherd of 12th century pottery from the bank material making up the existing embankment (Tann and Field 2003).

Modern

The improvement of the reclaimed land at Cherry Cobb Sands continued into the modern period; the agricultural land protected by flood defence banks which were regularly maintained and strengthened in the later 20th century, especially following the widespread flooding caused by the 1953 tidal surge.

The AI&M project recorded several military sites associated with the defence of Hull from early 1940s RAF aerial photographs (Fleming and Royall 2019). At the western extent of Flood Area 4 are the sites of an early 20th century See Saw Electric Light Emplacement (MHU20489) and Defensive Electric Light Emplacement (MHU18804), which formed part of the defences associated with Paull Point Battery (Paull Fort) (MHU2663) to the east. Both structures were inspected and surveyed as part of the Humber Estuary Tidal Defences Flood Alleviation Scheme (Tann and Field 2003). The Defensive Electric Light Emplacement forms part of the Paull Point Battery Scheduled Monument (NHLE 1020425).

Paull Holme Strays and Cherry Cobb Sands had a concentration of military sites during the WWII. The Strays were used for bombing decoys created to mimic Hull docks and the mouth of the River Hull; the earthworks and structures associated with these sites were mapped by the AI&M project (Fleming and Royall 2019) (Fig 6.2).

To the north east of the false River Hull there were additional decoy sites, comprising a permanent Starfish site (MHU18426) and a QF site (MHU 2670; 19147); both using oil

fired systems to simulate successful bombing raids on the city docklands and therefore encourage enemy aircraft to drop their bombs away from the intended target zone (see Council for British Archaeology 1996; Dobinson 1996, 2000). The success of these sites is apparent in the presence of a significant number of bomb craters visible on 1940s aerial photographs, and which were mapped during the AI&M project (Fleming and Royall 2019).



Figure 6.2 Aerial photograph of the WWII bombing decoys on Paull Holme Strays, including the false River Hull, decoy docks, a QF oil series site and a Starfish site. RAF/HLA/550 V 5125 27 May 42 © Historic England RAF Photography.

6.1.4 Yorkshire – Flood Area 5: Hull East (including Paull Village)

Mesolithic to Bronze Age

This coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Hull Valley was the subject of palaeoenvironmental and archaeological assessment as part of the Humber Wetlands Project (Dinnin 1995; Lillie and Gearey 2000).

An archaeological watching brief on a section of a gas pipeline on the eastern side of Rose Hill, Paull, recorded a layer of brown sandy clay sitting on top of an outcrop of glacial till from which a scatter of 102 pieces of late prehistoric flint were recovered. A further 22 flints were recovered from the west side of Rose Hill (Atkinson 1988).

Iron Age and Roman-British

Evidence for Iron Age activity along this part of the Humber Estuary is rare. An Iron Age settlement was excavated to the north of the project area on Saltshouse Road, Hull, in 1964. The settlement was located on an island of glacial till and the range of dateable finds indicates continued occupation into the Roman period (Evans 2000).

Evidence for Roman-period activity is generally more prolific within the Hull Valley, with a number of likely settlements situated along the river valleys and not always on the higher till islands. Their proximity to the rivers and areas of salt marsh indicate they may have used the land for grazing and small-scale industries, with the river playing an important role in their economy. A good overview of known Roman settlement in the Hull area up to 2000 is given in Evans' review of the archaeology of the area for the Humber Wetlands Project (2000).

A scatter of Roman findspots is recorded along the Humber edges, mainly in the form of coins and brooches identified as chance finds and by metal detectorists. It is unclear if these are *in situ* finds representative of activity or if these have been washed out and redeposited. Features recorded by archaeological excavation are similarly scant; at Poorhouse Lane, Marfleet Roman pottery was discovered but with no features identified (Jobling 2003a) and at Willerby Holiday Homes, Marfleet, evaluation revealed a ditch of uncertain date (Adamson and Atkinson 2008).

Early medieval and medieval

General reviews of the historical development of Hull and the lower Hull Valley during the medieval period are discussed by Evans (2000) as part of research during the Humber Wetlands Project (Van de Noort and Ellis 2000).

Currently the broader evidence suggests that there were periods of sea level rise and flooding from the late Roman period, that resulted in the abandonment of many of the Roman settlements along the lower lying parts of the Hull Valley and Humber Estuary (Van de Noort 2004).

There may not have been any concerted recolonisation of the area until the 9th century at the earliest and possibly not until the 10th or 11th centuries. The early settlements are located on islands of relatively high-ground, as at Marfleet, the place-name of which is derived from Old English, meaning 'pond' and 'estuary' or 'inlet'.

The drainage and reclamation of the Hull Valley area has been outlined in Sheppard's (1958) study, which includes discussion of the ongoing embankment of the Humber and the creation of habitable land out of former saltmarsh. The area contained several small formerly separate settlements including Marfleet and Paull.

Archaeological recording at St Giles Church, Marfleet, has recorded the remains of walls and features associated with the medieval church on the site; the site of the church siting on an island of relative high ground (Hamilton 2006; Jobling 2008 cited in EHU1841).

The medieval village of Paull (MHU9655) extended over a dispersed area west of the Grade I Listed St Andrew's Church, which was the subject of an archaeological watching brief in 2008 (Jobling 2009). The work revealed the foundations of the church and recorded a range of medieval and post-medieval finds but a geophysical survey in an area proposed for a new cemetery failed to identify any archaeological features (Webb 2011).

In the medieval period Hull developed as a strategic port and town (for a summary see Gurnham 2011 and Cornwall Archaeological Unit 2016a). Hull's economic and strategic importance and its position alongside a highly accessible waterway left it vulnerable to attack, and in response to a particular period of international tension in the 1540s, King Henry VIII ordered the construction of three blockhouses linked by curtain walls. The central and largest blockhouse was known as Hull Castle (MHU11690). Following considerable damage during the Civil War, the castle and southernmost blockhouse were remodelled to create The Citadel, a triangular artillery fort (MHU713).

David Evans of the Humber Archaeology Partnership has published an overview and research into Hull's medieval defences (2017; 2018). Much of the town's medieval walls were taken down in the late 18th/early 19th centuries as part of the development of Hull's docks.

The Citadel was partially demolished in 1864 and excavations on the site in the 1980s exposed some of the surviving below ground structures (Humber Archaeological Unit 1988). Further archaeological work in the area has revealed structural remains and occupation debris (George 2003; Humber Archaeology Unit 1988; Humber Field Archaeology 2002; Jobling 2015).

Post-medieval

The importance of the Humber Estuary as a trade and transport route increased during the post-medieval period, and the city and port of Hull developed exponentially in response – a PHS for Hull summarises its historical development (Cornwall Archaeological Unit 2016a).

The main area of industrial development comprised the expansion of Hull's docklands along the eastern side of the River Hull. The size and scale of the dock developments increased with the coming of the railways and the corresponding upturn in production and trade. The Grace's Guide website includes summaries on the historical development of several industrial sites in the area, including the Earle's Shipbuilding and Engineering Company. Parts of the historic dock structures and some structures associated with the former Earle's Shipyard were mapped by the AI&M project (Fleming and Royall 2019).

A watching brief at Clarence Street, Hull, recorded industrial activity dating to the 18th and 19th century expansion of Hull, in the form of a large waste pit (Jobling 2003b cited in EHU985). In addition, the former winding house associated with Victoria Dock has been the subject of historic building recording and a watching brief (Rawson 2018 cited EHU2788).

A significant number of wrecks in this part of the estuary were mapped by the AI&M project (Fleming and Royall 2019) and a recording survey of three 19th century wrecks at the former Earle's Shipyard was carried out by Humber Field Archaeology in December 2000 (Buglass 2001).

Modern

The strategic importance of Hull's docks and port-related industries has resulted in significant redevelopment and expansion, often over several successive phases. A watching brief on Hedon Road recorded several built features associated with the post-medieval development of the dock areas (Parry 2004 cited EHU1065). As part of redevelopment, The Clarence Flour Mill was demolished but recorded before works began (Rawson 2006).

Furthermore, the devastating bombing raids in WWII and the decline of the deep-sea trawling industry in the post-war period led to significant regeneration and redevelopment along the riverside areas. This has resulted in many historic dock areas and port-related buildings being redeveloped for use as office space, retail or modern residential units. The pressure for improved dock facilities has also resulted in several of the docks being infilled and redeveloped (CAU 2016a; Gurnham 2011).

World War One and World War Two

Paull Point Battery was constructed at Paull c 1856, probably on the site of earlier gun batteries dating back to 1542 and 1807 (MHU2663). Alterations to the landward side of the battery were carried out in WWI and gun emplacements and a range finder on the east side of the battery may also date to this time. During the WWII the battery was used as a submarine base and armament store (MHU19802; MHU18800). The AI&M project mapped features associated with Paull Battery (Fig 6.3), including the remains of structures associated with the submarine base and features associated with the 19th-century practice battery.



Figure 6.3 Paull Point Battery, a Defence Electric Light for the coastal artillery battery (MHU18804; NHLE 1020425).

During WWII, the Humber Estuary was a major target for enemy attack and there were a range of defensive military sites in and around Hull to deter both bombing and invasion. Sites included single and multiple gun and searchlight emplacements, anti-landing obstacles and barrage balloon sites. These sites were sometimes relatively short-lived but are visible on early 1940s aerial photographs (Fleming and Royall 2019). The barrage balloon sites formed two defensive lines: one along the Humber shore and another, moored on barges, along the estuary in front of the docks. The history and location of the barrage balloons manned by RAF Sutton Hull, responsible for the barrage balloon sites within Hull and its environs, were the topic of a book by L C Bacon (2002).

A HAA Battery (H7) was established to the northeast of Paull and retained after the war as a Nucleus Force Headquarters Battery (to defend the strategically important port facilities at Hull from high flying strategic bombers). The battery was surveyed by the Fortress Studies Group and RCHME in 1992, a study which also encompassed other military structures within Holderness (NRHE 912748).

6.1.5 Yorkshire – Flood Area 6: Hull West (Hull Barrier to Hessle Haven)

Palaeolithic and Mesolithic

This area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Hull Valley was also the subject of palaeoenvironmental and archaeological assessment as part of the Humber Wetlands Project (Dinnin 1995; Lillie and Gearey 2000).

Bronze Age and Iron Age

A good overview of Bronze Age and Iron Age archaeology in Hull up to 2000 is given in Evans' review of the archaeology of the area for the Humber Wetland Project (2000).

Early medieval and medieval

General reviews of the historical development of Hull and the lower Hull Valley during the medieval period are discussed by Evans (2000) as part of research during the Humber Wetlands Project (Van de Noort and Ellis 2000).

Currently the broader evidence suggests that there were periods of sea level rise and flooding from the late Roman period, that resulted in the abandonment of many of the Roman settlements along the lower lying parts of the Hull Valley and Humber Estuary (Van de Noort 2004).

There may not have been any concerted recolonisation of the area until the 9th century at the earliest and possibly not until the 10th or 11th centuries. Viking influence in the area is evidenced by the many Scandinavian-derived place-names (Evans 2000; Sheppard 1958), the etymology of which has been studied by the English Place-name Society (Smith 1970).

The drainage and reclamation of the Hull Valley area has been outlined in Sheppard's (1958) study, which includes discussion of the ongoing embankment of the Humber and the creation of habitable land out of former saltmarsh. The area contained several small formerly separate settlements including Hessle.

At Hessle, near to the site of the medieval hospital or alms-house (MHU824), an archaeological evaluation recorded medieval finds and features (EHU2646 citing Bruce 2004). However, most of the archaeological recording and research has focused on Hull, which was established in the 12th century as a small settlement and port for the export of wool by the Cistercian monks at Meaux Abbey (near Beverley). The port was built on low-lying land at Myton at the former confluence of the Hull and Humber Rivers (the original route of the River Hull was further to the west of its present course).

In the 13th century a new channel for the River Hull was cut to the east (near its current location). This used the line of an existing stream or inlet known as Sayers Creek.

By the end of the 13th century Hull was the third largest wool exporting port in England. In AD 1293 King Edward I bought Wyke upon Hull and the monks' land at Myton to develop the site as a royal port, re-naming it Kingston-upon-Hull. At this time Hull was known as 'Wyke upon Hull' – Wyke may derive from the Scandinavian word *vik*, meaning 'creek', or from the Old English *wic*, meaning 'trading settlement' (Gurnham 2011).

The early topography of Hull has been researched by Horrox (1978) using historic rental data (EHU3014) and by Armstrong (1978). Hull's Old Town was the target of extensive archaeological excavation, the results of which are published in the Hull Old Town Series by the East Riding Archaeology Society (Armstrong 1977; 1980; Ayers 1979; Armstrong and Ayers 1987; Evans 1993).

As Hull prospered and developed it was enclosed by defensive walls. Trial trenching at Hull College, Queens Gardens recorded evidence for the backlots of buildings associated with the original line of Lowgate (Market Gate) within the old town centre, and in two trenches, the remnants of the town wall (Mann 2008). Sections of the town wall have been revealed in other areas by an archaeological watching brief on Little Street, Old Town (EHU624 citing Tibbles 1998). Rescue archaeological recording by Ayers in 1976 was undertaken on Myton Gate during road improvements – the work recorded traces of the gate surviving as walls and buttresses (EHU3053). A watching brief at Little High Street recovered brick-built walling associated with the medieval town walls here (EHU3024); nearby the location of the wall was revealed in an earlier, separate watching brief undertaken in the 1980s (EHU180).

David Evans of the Humber Archaeology Partnership has published an overview and other research into Hull's medieval defences (2017; 2018). Much of the town's medieval walls were taken down in the late 18th/early 19th centuries as part of the development of Hull's docks.

A sequence of medieval buildings was recorded on the site of the medieval Wytelard burgage plot (Armstrong and Ayers 1987). Medieval deposits within the area of the Old Town have been revealed at Castle Street Hull (EHU2903 citing Humber Field Archaeology 1998) and at Blakfriargate, Hull, where an earlier watercourse (pre-14th century) was identified (Armstrong 1977).

Several excavations in the Old Town Area have recorded evidence for timber waterfront revetments including at Chapel Staithe Lane where three successive timber revetments on the west bank of the River Hull were revealed. The second phase revetment dated to

the early to mid-14th century and survived mostly extant, complete with posts, cross-beams, shutters, braces, and joists. Analysis established a dendrochronological curve for Hull and revealed considerable quantities of organic material and pottery (Ayers 1979). Similarly, archaeological recording undertaken at the Oriel Chambers, 27 High Street, revealed evidence for medieval timber waterfront revetments (Jobling and Rawson 2005).

At Wincolmllee on the edge of the River Hull, evaluation at 55 Union Street identified a sequence of layers, the lowest of which were considered to be medieval in date. Two fragments of wood recovered from the medieval layers were probably waste material from a ship repair yard (EHU2778 citing Humber Field Archaeology 2011).

The wealth and significance of Hull resulted in several religious foundations within the city. As yet, only limited archaeological evidence of these foundations has been recorded. Archaeological evaluation at Holy Trinity Church revealed late 14th to early 15th century deposits contemporary with the known construction date of the nave (Fraser 2005), and at Whitefriargate, walls potentially associated with the Carmelite friary were identified (Tibbles and Atkinson 1996). The publication of the results of archaeological excavation at Hull's Austin Friary in advance of the construction of the new Magistrates Court are in preparation (Marcus Jecock, pers comm).

There has been a considerable amount recorded in terms of multi-phase domestic and industrial evidence due to the high amount of archaeological recording work in the historic, medieval core of the city. A good example is at 5 Scale Lane, where building recording and excavation as part of restoration works revealed a wooden structure and wall footings dating to the 13th–14th centuries. Broadly contemporary occupation layers with evidence for leather working and a possible alluvial flood deposit were also found (Wood 1990).

Other notable sites for medieval deposits with phasing extending into the post-medieval period have been recorded in Old Town, for example at the seven phases of activity from the mid-15th century to the modern period at 36A–40 High Street, including phases of demolition and construction (Tibbles and Steedman 1994). A similar sequence was recorded by archaeological recording at Liberty Lane but with several phases dating to the 14th century: Phase 1, pre-14th century alluvium; Phase 2, early 14th century made-ground; Phase 3, 14th to 15th century structures and alterations (Duggan 2000).

Post-medieval

In the post-medieval period Hull continued to grow and flourish as a port. A brief history of this development is outlined in the PHS for Hull (Cornwall Archaeological Unit 2016a). There was a corresponding increase in the size of the town and its industry, in particular, from the late 18th century onwards, when a series of docks were created to improve the port (Fig 6.4).

Watching briefs on dock-related infrastructure include on former dock walls (Jobling 2006) and historic building recording (for example, Dawson 2018) including of the former Gilchrist's Smoking House, a Grade II listed smoke house dating to c 1890, before it was demolished (EHU1471 citing Dawson 2007). Evaluation trenching and archaeological recording at Hull Marina recorded 16th and 17th century waterfront embankments (George 2002).

Historic building recording has also been undertaken at Gordons Street, Gym, formerly part of the Chiltern Street Board School built in 1899 but now demolished (Dawson 2013) and the Grade II Listed City Chapel (Dawson 2010a). Dawson has also undertaken building recording of Albert Hall, Midland Street, Hull, a locally Listed Building (EHU2421 citing Dawson 2016).

It has been common for historic buildings to be demolished, as at land off Green Lane and Toogood Street, where the former Royal Victoria brewery (MHU20600) and other buildings were photographically recorded before being removed (EHU1727 citing Dawson 2010b). Likewise, a Georgian townhouse on Triptett Street was removed (EHU2043 citing Dawson 2013). An archaeological watching brief on Castle Street recorded early modern (17th to 18th centuries) demolition debris (Oxford Archaeology 2014).



Fig 6.4 The Hull Maritime Museum, formerly the Dock Offices to the north of Prince's Dock, built in 1871 and a Grade II Listed Building (NHLE 1219019).*

Groundworks in the historic core of Hull have a high potential to reveal remains of the city's post-medieval development, especially in the vicinity of the docks, e.g. at Castle Street, Hull (Oxford Archaeology North 2014, cited MHU23227).

Post-medieval development has sometimes removed traces of earlier features as at various recording projects at Sykes, Mason and Princess Streets where archaeological watching briefs (EHU561; EHU920) revealed no medieval features other than fragments of a late medieval flat roof tile (MHU19967).

At 55 Great Union Street, Wincolmllee, Hull, archaeological recording revealed a mortared surface and occupation layer and timbering which may have been contemporary with the nearby Henrician defences or the securing the edge of the river (MHU22736; Humber Field Archaeology 2011). The upper sequence of layers from Borehole 38, part of an archaeological survey at Castle Street, may relate to the infilling of the passage between Humber Dock and Prince's Dock and at 3.15m below OD, timber possibly associated with the construction of the docks (Oxford Archaeology 2014).

Adaptation and reclamation of the foreshore and intertidal area is a significant characteristic of Hull's post-medieval development as a port. Phases of early land reclamation were identified in the area of the Central Dry Dock, underlying the site of a 17th century South Battery (George 2007).

Modern

The locally-listed Lord Line Building at St Andrew's Dock has been covered by building recording to the equivalent of Level 3 as defined by Historic England (2016), undertaken by an architect as part of proposal for the adaptation of the historic buildings at St Andrew's Conservation Area (Jones 2019). In 2016, before being demolished the adjacent J Marr building, built in 1949, was covered by photographic recording to Level 2 as defined by Historic England (2016) (East Riding Archaeology). The former Central Fire Station off Worship Street, constructed in WWII, included a concrete-built air raid shelter – the feature recorded by photographic recording (Dawson 2016).

Buildings from the early 19th century have also been recorded prior to being demolished as at Osbourne Street, Myton streets and Waterhouse Lane, Hull (EHU2536 citing Dawson 2017).

6.1.6 Yorkshire – Flood Area 7: Hessle Frontage (Hessle Haven to Hessle Country Park Hotel)

Palaeolithic and Mesolithic

The area was included in the palaeoenvironmental and archaeological assessment as part of the Vale of York Humber Wetlands Project (Van de Noort and Ellis 1999).

A possible flint hand-axe was found on the foreshore close to Hessle Haven (MHU21855).

Neolithic and Bronze Age

An awl of later Neolithic or Early Bronze Age date was recorded during a watching brief at Ferriby High Road Pumping Station (Speed 2003).

Iron Age and Romano-British

A chalk-made pendant was found on the foreshore near Hessle Whelps (MHU13558). Fragments of Roman-period Terra Nigra pottery, a fine black slipped ware produced in northern Gaul from the late 1st century BC to 1st century AD, have been found to the east of Basket Pond (slightly outside the Flood Area) (MHU10229).

Post-medieval and modern

As a chalk outcrop, Hessle Cliff was a focus of extractive activity in the 18th and 19th centuries, with quarrying continuing and expanding into the 20th century. Activity included a lime kiln (MHU11646) and Cliff Mill (MHU5764); the mill a Grade II Listed building (NHLE 1161742) and Scheduled Monument (NHLE 1021074).

At the mouth of Hessle Haven, a late 19th century shipyard has now been demolished, the docks infilled as a landfill site, the area now a public park. The Vale of York NMP recorded several quarries and areas of ridge and furrow on the edge of the Flood Area (Kershaw 2001).

6.1.7 Yorkshire – Flood Area 8: North Ferriby

Palaeolithic, Mesolithic and Neolithic

A recent environmental study of the Foulness Valley between the Mesolithic and Iron Age periods by Halkon and Innes (2005) demonstrates that climatic changes and fluctuations in sea level during these periods influences the distribution of artefactual evidence in the Palaeolithic and subsequent periods.

Bronze Age

The three Bronze Age boats buried in the intertidal mudflats on the foreshore at North Ferriby are particularly famous. In the Bronze Age the foreshore here was at a similar level as it is found today and may have been a boat breaking and building site (MHU22618) or a long-lived landing point. The three boats vary in design but all incorporated wooden planks, hurdles and were of the sewn type (McGrail and Kently 1985) and have recently been dated to the Early Bronze Age (Van de Noort 2004). They are preserved in Hull Museum. Finds associated with the boats included pottery, baked clay sinker fragments and a probable dagger. The boats, and the high number of others found in the Humber basin, demonstrate that there was a complex network of waterborne trade in the area (Halkon and Innes 2005) and Van de Noort (2006) proposes that the development of sewn-plank boats enabled long-distance seaborne trade.

Iron Age and Romano-British

On the foreshore, there are several findspots of Romano-British and Iron Age pottery (MHU3675; MHU10230; MHU10226). Fragments of two sewn-plank boats suggest that the tradition of boat building continued in the area into the Iron Age (Van de Noort 2004, 85). At the western end of the Flood Area, Iron Age and Roman coins have been recovered (MHU17694; MHU17696), as has a Romano-British bronze fibula (MHU10225). Immediately to the west of the western tip of the Flood Area, in the area of the new training facility for Hull City FC at Red Cliff, geophysical survey identified a series of linear

anomalies indicating potential Romano-British ditches and enclosures (EHU2005 citing Harrison 2010).

Medieval, post-medieval and modern

The historic core of North Ferriby falls outside the Flood Area but is within the survey area; the history of the village is rapidly summarised in its Conservation Area appraisal (East Riding of Yorkshire 2006). The Parkfield area of the village was mainly developed in the early 20th century as a residential area of large houses in sizeable gardens, located close to Ferriby railway station, to enable easy commuting to and from Hull (East Riding of Yorkshire 2007).

6.1.8 Yorkshire - Flood Area 9: Brough

Mesolithic to Bronze Age

A recent environmental study of the Foulness Valley between the Mesolithic and Iron Age periods by Halkon and Innes (2005) demonstrates that climatic changes and fluctuations in sea level during these periods influences the distribution of artefactual evidence in the Palaeolithic and subsequent periods.

The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of 10 boreholes at Ellerker Sands but the survey assessed that there was restricted potential for palaeoenvironmental evidence (Lillie and Geary 1999).

However, At East Clough an intertidal exposure of alluvium and peat dates to the Bronze Age (EHU1644).

Iron Age and Romano-British

Archaeological interventions in small areas of Elloughton Ings, Brough aerodrome, Welton Ings and Melton Ings have not revealed any archaeological features (EHU747; EHU1095; EHU1439; EHU1632; EHU2049; EHU2494; EHU2840; EHU2739) although the area is known for its concentration of finds, especially on the foreshore in the vicinity of Red Cliff. Likewise, a watching brief undertaken on 51 Station Road, in the area known for Roman settlement revealed no archaeological finds or features (EHU1096).

Immediately to the west of the western tip of the Flood Area, in the area of the new training facility for Hull City FC at Red Cliff, geophysical survey identified a series of linear anomalies indicating potential Romano-British ditches and enclosures (EHU2005 citing Harrison 2010).

To the west of Willow Garth Industrial estate, an Iron Age/Romano-British settlement has been identified from aerial photographs (MHU21847). In 2014, members of the East Riding Archaeological Society and students from the University of Hull dug a trial trench across part of the site (the results are unpublished as yet). The AI&M project plotted rectilinear enclosures and a potential double-ditched trackway from aerial photographs (Fleming and Royall 2019).

Brough developed from a Roman settlement, only part of which lies within the Flood Area, but a majority of the area of the Roman settlement lies to the north, within the RCZAS study area. Archaeological excavation in the 1930s by Carder and then in the 1950/1960s by Wachter recorded a considerable number of buildings, structures and finds indicating a Roman-period settlement. Carder interpreted the settlement as a walled town but Wachter considered that it was a military site, perhaps a naval depot. It may have also been associated with a ferry crossing associated with the use of Ermine Street or an offshoot of it (MHU63). The finding of a 2nd century limestone dedication-slab incorporated in the masonry of an early 4th century building commemorated the dedication of a new *proscenium* (stage) of the theatre at vicus *Petuaria* by a junior magistrate *Marcus Ulpius Janarius*. This has led Brough to be associated with 'Petuaria', the only polis attributed by Ptolemy to the civitas of the Parisi, however, there has been dispute about this claim (MHU750).

There have been several watching briefs undertaken within Brough, a majority outside the Flood Area. Not all have revealed buried archaeology, but some have revealed further evidence of Roman occupation (Steedman 1997; Cool *et al* 2000) including outside the 'core' of the settlement as at Cave Road (Mackey 1997).

Early medieval and medieval

The broader evidence suggests that there were periods of sea level rise and flooding from the late Roman period resulting in the abandonment of many of the Roman settlements along the lower lying parts of the Hull Valley and Humber Estuary (Van de Noort 2004). There may not have been any concerted recolonisation of the area until the 9th century at the earliest, possibly not until the 10th or 11th centuries.

The Conservation Area appraisal for Brough includes a rapid summary of the historical development of the village which developed around a ferry crossing on the River Humber, mirroring the development of its Roman predecessor (East Riding of Yorkshire 2010).

Plans and maps from the 18th and 19th century show Brough as a small village surrounded by fields with lanes leading out to the coastal marshes or Ings used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks.

A small assemblage of later medieval/early post-medieval pottery was recovered during an evaluation by trial trenching on land adjacent to 8 Station Road, Brough, in 1999. At the same location a stone-built hard standing, possibly part of landing place, was recorded (Tibbles 2000).

Post-medieval

In the late 19th century, the coming of the railway accelerated the growth of the village now that people could commute in and out of Hull (East Riding of Yorkshire 2010). The haven was the focus for small-scale industrial activity including a brewery (MHU12231) and the River Humber continued as an important means of communication and transport. A watching brief at 66 Station Road, recorded a post-medieval cobbled surface (EHU1643 citing Jobling 2008; Fraser and Brigham 2013).

Modern

In the 20th century the growth of the village accelerated with the addition of residential terraces and villas and later, extensive estates. Much of the riverside industry ceased including the closure of the clay pits, the flooded remains of which now form Welton Water Park.

A significant development was the creation of Brough Airfield on Elloughton Ings. In 1916, the aviation pioneer Robert Blackburn established a factory at Brough for his Blackburn Aeroplane and Motor Company. During WWI the factory produced seaplanes for the allied forces and the Humber River was used to test them.

After the War, the factory produced torpedo bombers, seaplanes and patrol aircraft, many for use by the Fleet Air Arm. The factory also produced civil aircraft including the Bluebird which was made famous in the 1930s. At this time the aerodrome was also used as training school.

During WWII the company produced torpedo bombers and training aircraft as well as repairing American planes. Following the amalgamation with General Aircraft Limited in 1949 the aerodrome became the production hub of the Blackburn Beverley with production reaching its peak in 1953. At this time the runway was occasionally used a racetrack and in the late 20th century the factory produced the Buccaneer, Phantom, Harrier and Hawk planes, with production on the site downsizing to spare parts for the Hawk in the early 21st century. The airfield closed in the 1990s (BAE Systems, Brough webpage).

6.1.9 Yorkshire – Flood Area 10: Brough Haven to Weighton Lock

Mesolithic to Iron Age

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of eight boreholes at Faxfleet and a survey 19 boreholes close to Gilberdyle (Walling Fean) to the north of Broomfleet (and outside of the survey area) (Lillie and Geary 1999).

Peter Halkon has undertaken a long-standing survey of the Foulness Valley (2003). A more recent environmental study of the Foulness Valley between the Mesolithic and Iron Age periods demonstrates that climatic changes and fluctuations in sea level during these periods influences the distribution of artefactual evidence in this area. At this time, a large estuarine inlet extended to and included the area of Walling Fen but by the Bronze Age period this had developed into salt marsh (Halkon and Innes 2005).

Iron Age and Romano-British

A possible Iron Age settlement to the northwest of Weighton Lock has been plotted from aerial photographs (MHU2936) but was not recorded by the AI&M project (Fleming and Royal 2019).

Early medieval and medieval

The broader evidence suggests that there were periods of sea level rise and flooding from the late Roman period resulting in the abandonment of many of the Roman settlements along the lower lying parts of the Hull Valley and Humber Estuary (Van de Noort 2004). There may not have been any concerted recolonisation of the area until the 9th century at the earliest, possibly not until the 10th or 11th centuries.

In the 12th and 13th centuries new villages such as Blacktoft, Faxfleet and Broomfleet were founded on extensive alluvial plains with the enclosure and improvement of land surrounding each settlement (Van de Noort 2004, 135-136).

Faxfleet includes a moated site associated with the Templar Preceptory of Faxfleet; the earthworks are a Scheduled Monument (NHLE 1007737). An archaeological excavation close to this site was undertaken but recovered no artefacts or features (EHU1943). The AI&M project recorded a series of earthworks to the west of Faxfleet Lane which is potentially associated with the Templar preceptory (Fleming and Royall 2019).

In the area of Faxfleet several areas of ridge and furrow have been recorded from aerial photographs although the earthworks are now mostly now ploughed out (MHU22605-06). These features were also recorded by the AI&M project (Fleming and Royall 2019).

In the historic core of Faxfleet, a watching brief on a small extension to a Beeches Farm, recorded unstratified medieval and post-medieval pottery (EHU1708). A small watching brief at Oakleigh Cottage, Broomfleet, revealed no archaeological sites or features (EHU524).

Post-medieval

The history and archaeology of the deposition of warp deposits in the area is studied in the Humber Wetlands project report for the Vale of York – in places these deposits may mask archaeology from earlier periods (Lillie and Gearey 1999) (See Section 5.5 for further discussion).

The Market Weighton Canal, Blacktoft, extends 9.5 miles (15.3km) inland to Market Weighton, construction started in 1772 and was completed in 1782. Weighton Lock was built in 1773. The engineering achievements of John Grundy are celebrated in Skempton (1984).

Modern

A 3.5 miles (5.6km) stretch of the canal closest to Market Weighton was abandoned in 1900 and the right of navigation through Weighton lock was lost in 1971. However, in 2002 the lock was made passable and the canal can now be navigated to the junction with the River Foulness. The canal now forms a major part of the flood defences of the area. In 2013, a watching brief undertaken during trenching works to locate services to the south west of the lock recorded large fragments of chalk and building materials (EHU2096 citing Dawson 2013).

6.1.10 Yorkshire – Flood Area 11: Weighton Lock to Boothferry Bridge

Palaeolithic and Mesolithic

Peter Halkon has undertaken a long-standing survey of the Foulness Valley (2003). A more recent environmental study of the Foulness Valley between the Mesolithic and Iron Age periods demonstrates that climatic changes and fluctuations in sea level during these

periods influences the distribution of artefactual evidence in this area. At times, the area formed part of a creek which extended to and included Walling Fen (Halkon and Innes 2005).

The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of 10 boreholes at Ellerker Sands but there was limited potential for palaeoenvironmental evidence (Lillie and Geary 1999).

Iron Age and Romano-British

Brough developed from a Roman settlement; the focus of the settlement is located to the east in Flood Area 9, however, contemporary settlement has been identified in this Flood area, in close proximity to the Haven and to the road leading to Ermine Street (MHU63; MHU19793), for example, see MHU17783, to the west of the Cave Road, where finds of coins, pottery and a tessellated pavement suggest further occupation (MHU17783; MHU2945).

A watching brief at 17 Cave Road did not identify any buried structural remains but recovered several sherds of Roman pottery (Duggan 2001).

Evaluation on land adjacent to 8 Station Road recorded a gravel deposit, suggested as the remains of a landing place for the Roman settlement at Brough. At the same site, 12 fragments of Romano-British pottery were found, including a fragment of early 4th century Romano-Saxon ware, redeposited within later layers (MHU20612). Ground penetrating radar in this area has possibly located the former channel of Brough Haven (EHU1351).

In the late 1960s, a Romano-British settlement, interpreted as the remains of a port, was excavated 150m to the north east of Weighton Lock, following the discovery of Romano-British finds from the foreshore. Along with traces of a possible roundhouse, finds included masses of Romano-British and imported pottery, beehive and disc querns, lead pig, and a dragonesque brooch (MHU158).

Early medieval and medieval

The broader evidence suggests that there were periods of sea level rise and flooding from the late Roman period, that resulted in the abandonment of many of the Roman settlements along the lower lying parts of the Hull Valley and Humber. There may not have been any concerted recolonisation of the area until the 9th century at the earliest, possibly not until the 10th or 11th centuries, on islands of relatively high ground or alongside river banks (Van de Noort 2004). In the 12th and 13th centuries new villages such as Blacktoft, Faxfleet and Broomfleet were founded on extensive alluvial plains with the enclosure and improvement of land surrounding each settlement (Van de Noort 2004, 135-136).



Figure 6.5 The medieval flood defence bank (MHU173) near Broomfleet.

Three flood banks converge on Broomfleet in the western part of the Flood Area (Fig 6.5), the furthest inland of the three, is considered to be late medieval in date (Allison 1976). This feature survives as a sizeable earthwork and extends from Broomfleet in an arc towards Brough Haven (passing outside the survey area) and to the north of Brantingham Sands (MHU173). Several areas of ridge and furrow associated with this bank have been recorded from aerial photographs although the earthworks are now mostly now ploughed out (MHU22607) and were recorded by the AI&M project (Fleming and Royall 2019).

A medieval fishery was located to the east of Weighton Lock, at the entry of the Frisdyke (now Weighton Canal). Records suggest it prospered well into the 16th century but that it went out of use after it was purchased in 1794. A building associated with the fishery survived into the 19th century and a nearby clay pit, known as 'Fish House Close' preserves the association with fishery (MHU149).

Post-medieval

The western side of Brough Haven was the focus for small-scale industrial activity in the form of a coal yard (MHU12230) and the River Humber continued as an important means of communication and transport. But in the late 19th century the coming of the railway reduced the river trade.

At Ellerker Sands the railway cut across a low-lying landscape of relatively recently enclosed and reclaimed land, with fields defined by rectilinear drainage ditches and low hedges and bordered by a flood defence bank which enabled the reclamation and improvement of the area. Allison (1976) suggests that the bank extends via Crabley Farm (formerly Cave Sands Farm) in the direction of Broomfleet and dates to the post-medieval period.

The history and archaeology of the deposition of warp deposits in the area is studied in the Humber Wetlands project report for the Vale of York – in places these deposits may mask archaeology from earlier periods (Lillie and Gearey 1999; see Section 5.5 of this report for further discussion).

Until the mid-19th century, Broomfleet Island lay in the River Humber, separated from the mainland by a narrow channel and the 1856 OS map shows a small area of enclosed

land, protected by a flood defence bank. The riverine edge of the mainland is also protected by the flood bank, potentially 17th century in date (MHU175).

The landscape and geological development of the area has been researched by Sheppard (1966) and Berridge and Pattison (1994) and revisited by the Humber Wetlands Project (Van de Noort and Ellis 1999). Earthworks preserving traces of this phase of reclamation and improvement were recorded from aerial photographs by the AI&M project (Fleming and Royall 2019).

Weighton Lock was built in 1773 by John Grundy as part of the construction of the Market Weighton Canal, Blacktoft; the canal extends 9.5 mile (15.3km) inland to Market Weighton, construction started in 1772 and was completed in 1782 (Skempton 1984).

Modern

A 3.5miles (5.6km) stretch of the canal closest to Market Weighton was abandoned in 1900 and the right of navigation through Weighton lock was lost in 1971. However, in 2002 the lock was made passable and the canal can now be navigated to the junction with the River Foulness. The canal now forms a major part of the flood defences of the area.

6.2 Yorkshire/Lincolnshire

6.2.1 Yorkshire/Lincolnshire – Flood Area 13: Goole Fields and Crowle

Palaeolithic and Mesolithic

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of 24 boreholes (Lillie 1998a). Fieldwork undertaken by the project included fieldwalking and small-scale excavation resulting in the retrieval of several flint artefacts and assemblages (Fenwick *et al* 1998).

The area falls within the study area for the Mapping the Palaeochannels of the Trent Valley, with several palaeochannels plotted by the project, some of which may date to the Palaeolithic or Mesolithic and the post-glacial evolution of the landscape following the gradual drainage of the Lake Humber and later waterlogging caused by the rise in sea-levels (Malone and Stein 2017).

Romano-British

Fieldwalking in the area of Adlingfleet has recovered fragments of Romano-British pottery including greyware, Neve valley coated ware and Samian ware (MLS22447). Romano-British pottery has also been identified to the south-east of Adlingfleet, where in 1995 and 1996, geophysical survey and small-scale excavation was undertaken, identifying a series of amorphous anomalies (EHU1145 and EHU1146 citing Ancient Monuments Laboratory 1999; Fenwick *et al* 1998).

Early medieval and medieval

Large areas of ridge and furrow in the fields surrounding Ousefleet and Adlingfleet have been recorded from the analysis of aerial photographs (MHU22605–6). As part of the AI&M project, further areas of ridge and furrow in the area were also plotted using a combination of aerial photographs and Lidar imagery (Fleming and Royall 2019). Analysis of recent aerial photographs suggest that these features have been largely ploughed out.

Post-medieval

In the 18th century flood defence banks were built for the reclamation and improvement of the wet ground (Robinson 2001).

Agricultural improvement in the area was aided by the redirection of the River Don in the 17th century under a scheme designed by Dutch engineer, Cornelius Vermuyden. The Don originally flowed into the Trent near Adlingfleet, but Vermuyden canalised the channel and redirected it to flow into the River Ouse near Goole, to the west of Twin Rivers.

The Island Farm place-name preserves the fact that this was once an island in the River Trent (MLS22444). The farm buildings there date to the 19th century and were built at a time when the area was extensively enclosed, drained and improved. Island Farm has been rapidly studied as part of the Greater Lincolnshire Farmstead project (Partington *et al* 2015).

Modern

Intensive agricultural improvement continued into the 20th century with the construction of a flood defence bank to protect the newly reclaimed and improved land. In 1953 the area, like many other parts of the Humber Estuary and east coast of England, was affected by coastal flooding and subsequently, the flood defences were updated in the latter part of the century (MLS22444).

6.3 Lincolnshire

6.3.1 Lincolnshire – Flood Area 16: Alkborough

Palaeolithic and Mesolithic

This low-lying area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of 24 boreholes, including at Trent Falls on the west bank of the Trent (Lillie 1998a).

On Alkborough Flats, in advance of the managed-realignment scheme of the flood defences, the team from the Wetland Archaeology and Environments Research Centre (WAERC) undertook a borehole survey of 30 boreholes with pollen and radiocarbon analysis completed (ELS2195 citing Fenwick *et al* 2004).

The Flats formed part of the study area for the Mapping the Palaeochannels of the Trent Valley, with several palaeochannels plotted, some of which may date to the Palaeolithic or Mesolithic periods and the post-glacial evolution of the landscape following the gradual drainage of the Lake Humber and later waterlogging caused by the rise in sea-levels (Malone and Stein 2017).

Neolithic and Bronze-Age

A flint assemblage was recovered during trial-trenching and fieldwalking in the area of Countess Close, Alkborough, potentially containing tools dating from the Late Mesolithic to Early Neolithic and from the later Neolithic and Bronze Age. The finds suggest a local source of flint and the location an ideal place to explore the resources of the lower-lying areas next to the River Humber (MLS20129 citing Bradley *et al* 2004).

In 1921, near to Walcot Hall, a chance findspot made in a tree-bole suggested the site of a Bronze Age burial or occupation (MLS4621).

A programme of fieldwalking organised by the North Lincolnshire Museum in a field to the north of Whitton Road, Alkborough, has recorded a sherd of Neolithic pottery and a concentration of Bronze Age pottery suggesting a possible occupation site (MLS20444).

Romano-British

On the limestone scarp of high ground above the flats (and therefore just outside the Flood Area), to north of Whitton Road, metal detecting, fieldwalking and interpretation of aerial photographs has identified a Romano-British settlement site, the evidence for which is mainly from finds of pottery, coins and domestic tools and debris (MLS13173; MLS15520). As part of the AI&M project, an enclosure (MLS26474) and other ditched features (possibly a trackway; MLS26475) on the site were plotted from aerial photographs held in the NRHE and HER (Fleming and Royall 2019).

Trial trenching, topographical and geophysical survey at Countess Close has confirmed the presence of a Romano-British settlement, first suggested by chance finds and later, by field walking (MLS19316; Noel 2003). Further Romano-British finds have been found in the area of Walcot including the Walcot Jar (MLS53).

A walk-over survey of the Devil's Causeway concluded that the feature is a natural outcrop rather than a man-made structure (ELS2550 citing Jobling 2005).

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

Fabric at the base of the tower of the church of St John the Baptist at Alkborough potentially dates to the Late Saxon period. The Conservation Area appraisal for Alkborough contains a rapid summary of the village's history (Lyman 2004b).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the 18th century this increased dramatically with Parliamentary Enclosure. The current flood defence wall along this part of the Humber dates from the 19th century enclosure and improvement (Russell and Russell 1987; Robinson 2001). The buildings at Flats Farm dated to the 19th and early 20th century and were associated with the management and grazing of Alkborough Flats: the farm buildings were recorded before being demolished as part of the managed realignment scheme in 2004/2005 (ELS2548 citing Atkinson 2005). A watching brief in the south west corner of the flats identified a boundary ditch associated with the enclosure and improvement of the flats, as well as rock armour associated with historic flood defences (ELS3205 citing Atkinson 2009).

Modern

During WWII, the Flats were used for bombing practice – a watching brief undertaken as part of the managed realignment scheme recorded several practice bombs (ELS3320 citing Atkinson 2006b).

6.3.2 Lincolnshire – Flood Area 17: Whitton to Winteringham

Palaeolithic and Mesolithic

The fieldwork undertaken by the Humber Wetlands Project included fieldwalking and small-scale excavation and several flint artefacts were recorded in this area (Fenwick *et al* 1998). Fieldwork on the foreshore survey carried out by WAERC in 2001 recorded the remains of a buried forest at Whitton Ness, the undated deposit containing tree stumps in a peat layer (MLS21593).

A geological borehole at Whitton Ness recorded a peat deposit described as, 'Brownish black to black peat with wood fragments' (British Geological Survey Borehole record viewer, SE92SW55 — WHITTON NESS HMB 13).

Neolithic and Bronze Age

Fieldwalking to the south of Whitton, undertaken as part of the South Humber Bank Wildlife and People Project (SHWAP) recorded sherds of prehistoric pottery including some of Bronze Age date (MLS20733).

Iron Age and Romano-British

Settlement at Winteringham and Winterton is considered to have its origins in the Roman period. At Winteringham, an archaeological watching brief on land adjacent to 22 Silver Street recovered a number of fragments of pottery, including Roman grey ware (Underhill 2003). Archaeological test pitting undertaken at the Old Vicarage, Whitton, revealed a Roman period midden containing animal bone pottery, brick and tile fragments and an iron nail (MLS20013, Test Pit 13). Further fragments of Roman pottery including Grey Wares, Shelly Ware and Samian, were recovered in trenching to the west of the church (MLS20017). Metal detecting in the fields to the south of Ings Lane, Whitton, has recorded large amounts of Roman Pottery (MLS19416), and chance finds in the nearby area suggest extensive Romano-British settlement (MLS2140).

Medieval and early medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

A Late Saxon cemetery, off Chapel Lane at Whitton, was investigated in 1987, 2001 and 2012. The cemetery extended beyond that of the present enclosed churchyard and an outer boundary ditch was recorded, to the east of which no burials were identified (MLS15616). The project at Whitton was led by the University of Sheffield, who also dug test pits in the area surrounding the cemetery, revealing large amounts of Late Saxon, medieval and post-medieval pottery (Hadley 2001; 2004).

Rex and Eleanor Russell's research in Lincolnshire has shown that many villages in the area were located on higher ground away from the flood plain and were surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974).

At Winteringham, traces of ridge and furrow were recorded by an archaeological watching brief on land off Ferry Lane, (Allen *et al* 2009) and at the Old Rectory, West End, a medieval pit and a probable medieval ditch were recorded. Artefacts, including a medieval pot sherd, post-medieval tile and animal bone were recovered (Wood 2012).

The area was extensively field walked by the Humber Wetlands Project (Chapman *et al* 1998).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001).

Analysis of aerial photographs held as part of the NRHE and the North Lincolnshire HER has identified several ditches and field boundaries in the area (MLS26506; MLS26523, MLS26542; Fleming and Royall 2019). These features are undated but could be associated with the enclosure and improvement of the low-lying ground, the process of which included the construction of new farm complexes as at Marsh Farm, a U-plan farm dating to the 19th century (MLS25089). Marsh Farm has been rapidly studied as part of the Greater Lincolnshire Farmstead project (Partington *et al* 2015).

The village of Winteringham includes a high concentration of historic buildings, many of which are Listed. Historic building recording has been undertaken on 19th century barns at 16 Silver Street (Clay 2007) and in two separate sites off Ferry Lane (Allen *et al* 2009; Allen and Clay 2009), the latter also including a watching brief on the site. There have been several watching briefs on land off Ferry Lane, Winteringham, but many have yielded no significant results (Clay 2010b; Rawson 2003; Adamson 2018).

Modern

For the most part, the rural character of the area continued much as before with the exception being the further development and improvement of the flood defences.

6.3.3 Lincolnshire – Flood Area 18: Winteringham Ings and Flood Area 19: South Ferriby

Palaeolithic and Mesolithic

This low-lying coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence, including a borehole survey in the area of South Ferriby Sluice (Neuman 1998).

An assemblage of 84 pieces of struck flint were found on land off Horkstow Road, South Ferriby. Analysis suggests that these were a mixture of Mesolithic and Neolithic and Bronze Age tools (MLS20489; Clay 2006).

A buried soil to the west of Ferriby Sluice has been identified by recent archaeological monitoring of geotechnical investigation test pits (Wessex Archaeology 2019).

A series of three geological boreholes at Sluice Lane, Ancholme Valley, recorded a peat deposit between 7m to 8m below ground level, lying beneath a thick deposit of warp (British Geological Survey Borehole record viewer, SE92SE15/A-C – SOUTH FERRIBY. A1077).

Neolithic and Bronze Age

A fragment of an Early Bronze Age Collared Urn (c 1800 BC), suggesting a nearby burial, was retrieved from the spoil heap on the new school site, Horkstow Road, South Ferriby. The site also revealed limited but potential evidence for Neolithic activity (MLS20490; Clay 2006).

On the foreshore, in the area of Leggott's Quarry (just outside the Flood Area), Bronze Age metalwork has been discovered including two fragments of a dagger, a tip of a spear, and a palstave (MLS21573; MLS22040; MLS425).

Close to the site Old Winteringham (see below), near to East Field Farm, geophysical survey in advance of quarrying identified the traces of a field system and settlement which when excavated dated to the Late Bronze Age. The work revealed evidence for two four-post structures and a ditched field system used in two phases. Iron Age pottery finds was also recovered from the same site (MLS21589; GSB 1996; Rowlandson 2005).

Iron Age and Romano-British

There is evidence for considerable Romano-British and Late Iron Age settlement activity in this area, being positioned at the head of Ermine Street where it struck the southern edge of the Humber Estuary, having followed the chalk ridge from Lincoln.

A section of Roman road or causeway eroding out of the foreshore at South Ferriby, was recorded by the Humber Wetlands project (Chapman *et al* 1998), the route of the road was also noted in a subsequent geophysical survey of the football field to the south and a watching brief on work to the flood defences (MLS16777 citing Lindsey Archaeological Services 1999).

At Horkstow Road, South Ferriby, geophysical survey, archaeological evaluation and excavation as part of new school revealed the remains of a Late Iron Age cemetery and Romano-British settlement and the foundations of a potential Romano-Celtic temple, with pottery finds suggesting a 3rd to 4th century date (Masters 2003; Clay 2004; 2006; MLS20457; MLS20559).

The recent archaeological evaluation of trial trenches and test pits, guided by an earlier geophysical survey by Headland Archaeology, in advance of a proposed Flood Alleviation scheme at South Ferriby (and the mouth of the Ancholme navigation) recorded a pit and ditch of possible Romano-British date (Wessex Archaeology 2019).

To the north east of South Ferriby, close to the foreshore and located on the chalk of the Lincolnshire Wolds, is the South Cliff Iron Age and Romano-British settlement site (MLS1661). The site has mainly been confirmed by finds discovered over the past 120 years eroding out of the cliff including human bones and pottery recorded by the PAS (MLS26109). The AI&M project plotted rectilinear enclosures and double-ditched trackways from aerial photographs, with evidence for further settlement plotted to the south west of Leggott's Quay (Fleming and Royall 2019).

At the western end of the Flood Area, at Winteringham Ings, lies the extensive Roman settlement of Old Winteringham, a Scheduled Monument (NHLE 1005243; MLS2068;). In the 17th century, the antiquary William Stukeley described the site and the wealth of finds that had been revealed there by ploughing. In the late 1950s structures and finds were revealed by trenching works cut for a sewage pipeline and in the 1960s, a small part of the site was excavated by Ian Stead. Published in 1976 the results confirmed a Roman period settlement, a road leading to the Humber and a possible embarkation point

to Brough, Yorkshire. Analysis of aerial photographs, and a programme of field walking and metal detecting, with further geophysical survey and archaeological evaluation at East Field Farm, has confirmed that the site spreads across approximately 70 acres and includes Iron Age activity (GSB 1996; Lindsey Archaeological Services 1998; Rowe 2008a; Parker *et al* 2012; Fleming and Royall 2019). The Humber Wetland Project provides a good summary of the investigations up to 1998 (Chapman *et al* 1998).

Nearby, to the north of Composition Lane, evidence for a Late Iron Age settlement and trading post (MLS2224) was initially identified from cropmarks on aerial photographs. Features associated with the site have also been plotted by the AI&M project (Fleming and Royall 2019). Further development-led investigations of the settlement have been undertaken in the form of desk-based assessment (Gardener 2006), geophysical survey (Bunn 2007), strip, map and sample recording (Tann 2010) and two tranches of evaluation trenching (Rowe 2008b; Parker 2012). This work also revealed evidence for 1st century AD activity.

At Winteringham Waterworks, to the east of Composition Lane and to the north of Old Winteringham, geophysical survey and archaeological evaluation trenching followed by excavation revealed a number of features from the Late Iron Age to the 2nd century AD, at which time the site appears to have been abandoned due to flooding (Pre-Construct Archaeology 2004; Young 2007 cited in Event record ref ELS2936).

Further archaeological work has also been undertaken in advance of quarry activity at East Field farm revealing further extensive evidence of Romano-British settlement.

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

Metal detecting has revealed two 9th century Anglo-Saxon metalwork finds to the east of the church at South Ferriby (MLS21736).

Rex and Eleanor Russell's research in Lincolnshire has shown that many villages in the area were located on higher ground on the edge of the floodplain and surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974). A ditch of possible post-medieval date was revealed in Trench 1 of a recent archaeological evaluation undertaken at South Ferriby (Wessex Archaeology 2019).

Analysis of aerial photographs held as part of the NRHE and the North East Lincolnshire HER has identified ditches, field boundaries and a palaeochannel to the south west of the CEMEX plant (MLS20788; Fleming and Royall 2019). These features are undated but could include medieval field boundaries. The area was extensively field walked by the Humber Wetlands Project (Chapman *et al* 1998).

Post-medieval

The wreck of the Mary Maria, a three-masted wooden vessel was investigated by the Humber Foreshore Industrial Archaeological Survey, including a survey of its surviving structure (Clay 2010a; 2011; MLS21496).

South Ferriby Hall, a Grade II Listed Building and an early 19th century country house incorporating probable 17th century fabric, has been investigated by a detailed historic building record (MLS5144; Carey 2010). In South Ferriby, historical research has been undertaken on Simon's Cottage, a mid-19th century terraced cottage (MLS21468). Although a watching brief in the grounds of Humber Lodge, Post Office Lane, South Ferriby, revealed no evidence for late prehistoric activity, it did record a possible post-medieval linear ditch which pre-dated the late 19th century buildings recorded on historic maps (Clay 2008c).

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001). Traces of an early flood defence bank, of probable 19th century date, has been recorded by aerial photographs by the AI&M project (Fleming and Royall 2019).

In the 17th century, the River Ancholme was redirected and canalised. The former route of the river was recorded in a recent archaeological evaluation (Trench 4; Wessex Archaeology 2019). A watching brief conducted on limited ground disturbance in the area of a new laboratory at the EA's South Ferriby depot (to the south east of the sluice) revealed little, other than evidence of post-1800 deposits (Jarvis 1997 cited in ELS3099).

Geophysical survey in advance of emergency repairs to tidal defences to the north of Sluice Road, Ferriby, produced limited results but included potential extraction pits and a probable demolished structure (Johnson 1997).

Modern

For the most part, the rural character of the area continued much as before with the exception being the further development and improvement of the flood defences in the latter part of the century, following the flood event of 1953.

The Defence of Britain project undertook field visits in the area, including to WWII pillbox at the entrance to the CEMEX factory (MLS21174; Defence of Britain Archive, Archaeology Data Service webpage).

6.3.4 Lincolnshire – Flood Area 20: Barton Cliff to Barton Haven

Palaeolithic to Bronze Age

A geological borehole near Blyth's tile works, Barton, recorded a 1m thick peat deposit at 6.20m below ground level (British Geological Survey Borehole record viewer, TA02SW97 – HUMBER BRIDGE APPROACH ROADS 10).

A geophysical survey and watching brief at Far Ings were undertaken during the excavation of geotechnical trial trenches in advance of the proposed laying down of a number of reed beds. A remnant buried turf layer of undetermined date was noted below the alluvium in several of the trenches (Armour-Chelu 2000).

In 2002, geophysical survey, evaluation trenching and a borehole survey as part of the managed realignment of sea defences at Chowder Ness identified two undated ditches and possible Bronze Age alluvial deposits (Bradley 2002). Further evaluation trenching revealed very little (Tibbles 2003). In 2005, an archaeological watching brief at the eastern end of the managed realignment site recorded a Romano-British brooch (MLS21657) (Atkinson 2006a).

Romano-British

In the early 1970s Geoffrey Bryant of Barton undertook an excavation at Poor Farm (also known as Blue Coat Charity Farm) of a chalk-built walled building and recovered roof tiles, considered to be 3rd or 4th century in date (unpublished; MLS427). Fieldwalking in the area had recorded large amounts of Romano-British pottery and metalwork. Analysis of the ceramic finds by Ian Rowlandson (2011) confirmed that the majority date to between the later 2nd and 3rd century with some dating to the 4th century. A limited number of Iron Age finds supporting a longer settlement history of the site. In 2010, as part of the SHWAP, a geophysical survey was undertaken, confirming the site of multiple square enclosures, traces of a field system and trackway (West Yorkshire Archaeology Service 2010).

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

The low-lying land in this area, fell within the open fields and coastal marshland surrounding Barton. Rex and Eleanor Russell's research in Lincolnshire has shown that many villages in the area were surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974).

The site of a possible medieval oratory or chapel at St Chad's Well has been suggested by the finding of fragments of dressed stone, leadwork and coloured glass in 1807. The site is included in studies of medieval wells and chapels in Lincolnshire (MLS468; Owen 1975).

The watching brief undertaken at Chowder Ness in 2005 recorded two medieval finds including a buckle and ceramic disc (MLS21658; Atkinson 2006a).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground. From the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001).

The area was noted for its numerous brick and tile works in the 19th and early 20th centuries (Coulam 1991; Coulam and Watkinson 2001; Bryant and Land 2007, all cited in Clay 2010a). The works often included jetties projecting into the river to allow seaborne trade of the products. Several of the extractive pits and jetties, as well as other post-medieval field boundaries, were plotted from aerial photographs held as part of the NRHE has been undertaken for the area (Fleming and Royall 2019).

The area contains the William Blyth Ings tile and pottery works, the last traditionally operated tile works in the region. The works, and other industrial sites in the area, were investigated by the Humber Foreshore Industrial Archaeological Survey, including historic building recording of 16 structures on the site, of which four are Grade II Listed Buildings (Clay 2010a, 2011; NHLE 1390935, 1391189–90). Stage 2 of the Survey undertook survey and recording of the remains of the brickworks at Ness End (MLS22110), the embanked loading bays on the foreshore at Far Ings (MLS26399) and on or near the chalk of the Lincolnshire Wolds, the Adament cement works (MLS21964) and the jetty at Leggott's Quarry (MLS20049) (Clay 2011).

The Grade II Listed tower at Hewson's Mill, Barton (NHLE 1039878) has been covered by a building survey as part of conversion of this 19th century windmill (Allen Archaeology 2017); the area adjacent to the mill, and off Dam Road, has also covered by desk-based assessment and archaeological evaluation which revealed three pits of post-medieval date (Clay 2008a, 2008b).

Modern

As the 20th century progressed, a majority of the brick and tile works closed leaving redundant buildings and clay pits. Several of the large pits flooded, providing important habitat for birds and managed as part of the Far Ings nature reserve.

6.3.5 Lincolnshire – Flood Area 21: Barton Haven to Barrow Haven

Palaeolithic and Mesolithic

This coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence (Lillie and Gearey 2001).

An archaeological watching brief at the Fleetgate pumping station, to the south of the junction between Waterside and Malkiln Roads, Barton, recorded a peat deposit which contained animal and plant remains. Tentative comparison with ten peat samples taken in a 1991 borehole survey of this area suggested that the peat deposits could date to the Late Mesolithic period (Schofield *et al* 2002 cited in MLS21237).

Geological borehole surveys in the area have also identified buried layers which could yield palaeoenvironmental evidence including in the area of the Water's Edge at Barton, where several narrow bands of fibrous peat were identified (British Geological Survey Borehole record viewer, TA02SW67 – BRITAG SITE 3).

Bronze Age

Fieldwalking as part of the archaeological survey of the Lincolnshire Marsh undertaken by the Humber Wetlands Project recorded flint finds in the area considered to be Bronze Age in date (Fenwick *et al* 2001b).

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

Barton has its origins in the early medieval period, with evidence for Anglo-Saxon occupation in the area of St Peter's church, contains building fabric dating to the 9th and 10th centuries. Evidence for Romano-British settlement has also been found in this area (Clay 2008b). Once a thriving port, Barton was the major coastal settlement in North Lincolnshire, mostly due to its importance as a port – the Haven at this time was located to the north of Fleetgate and railway station. The early history of the town is summarised in the Conservation Area Appraisal for the town (Lyman 2004a) and in a pamphlet published by the Workers' Education Association (Bryant 1994).

At this time, a large part of the low-lying but productive land in the vicinity of Barton, was in the control of Bardney Abbey (located in south Lincolnshire). As with other settlements in the area, and typical of the time, Rex and Eleanor Russell's research has demonstrated that Barton was surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing. Where the open fields met the marshes they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974; Clarke *nd*).

The success of Barton was hampered by the development of Hull as the main port on the Humber Estuary in the later medieval period, but it continued to be a significant town and market in north Lincolnshire.

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001).

The area was noted for its numerous brick and tiles works in the 19th and early 20th centuries (Coulam 1991; Clapson 2005; Bryant and Land 2007, all cited in Clay 2010). The works often included jetties projecting into the river to allow seaborne trade of the products. Several of the extractive pits (Fig 6.6) and jetties, as well as other post-medieval field boundaries, were plotted from aerial photographs by the AI&M project (Fleming and Royall 2019).

Due to silting, the haven at Barton gradually moved northwards to its present location but the Humber continued to be the main artery for trade. In the 19th century the town developed towards the estuary with a mixture of terraced residential properties and industrial activity in the form of rope making, tile works, boat building, whiting (derived from chalk) and candle making. The industrial archaeology of the area has been investigated by the Humber Foreshore Industrial Archaeological Survey (Clay 2010, 2011), and a timber structure of probable post-medieval date was recorded during the construction of a new pumping station at Fleetgate (MLS21236).



Figure 6.6 A flooded post-medieval clay pit at Barton, now used as fishing lake.

Modern

As the 20th century progressed, traditional industrial activity located close to the haven reduced leaving considerable areas of derelict land. This area was re-developed and archaeological and historic building recording work has been undertaken during the conservation and conversion of the Ropewalk (Brett 2004) and at Pasture Wharf, the surviving chimney of the Hoe Hill brick works where recording included an archaeological watching brief (Clay and Piirainen 2011).

In 1953 Barton Haven, like many other parts of the Humber Estuary and east coast of England, was particularly affected by coastal flooding and subsequently flood defences were built in the latter part of the century.

6.3.6 Lincolnshire – Flood Area 22: Barrow Haven to East Halton Skitter

Palaeolithic and Mesolithic

This coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence including a survey of 11 boreholes (Lillie and Gearey 2001).

Geological borehole surveys in the area have identified these buried layers including at New Holland and Neatgangs Farm (British Geological Survey Borehole record viewer, TA02SE13 — NR RAILWAY JUNC NEW HOLLAND; GOXHILL SHIPYARD LINC; TA12NW342; GOXHILL SHIPYARD).

A borehole transect survey undertaken on land near East Halton Skitter in advance of a gas pipeline identified a large palaeochannel and peat deposits suggesting the area has a complex hydrological history and evidence of the post-glacial estuarine environment (Oxford Archaeology North 2017).

Neolithic and Bronze Age

The Humber Wetlands Project undertook extensive fieldwalking in this area, recording several flint artefacts (Fenwick *et al* 2001b).

To the east of New Holland, the Humber Wetlands Project recorded a Bronze Age fish trap (MLS19722; Fenwick *et al* 2001b).

An unpublished borehole auger survey in the area to the south of East Halton Skitter was undertaken by WAERC in 2000, in advance of the Humber Link Pipeline project. The survey identified a peat deposit which has been interpreted, by inference with similar deposits in the area, as being of Bronze Age date (MLS21153).

Iron Age and Romano-British

Geophysical survey, evaluation and excavation in advance and during the construction of a gas pipeline to the north and west of East Halton Skitter has revealed extensive activity, occupation debris and field systems dating to the Roman period. A number of circular and rectangular features defined by shallow gullies identified near to a network of small palaeochannels have been interpreted as evidence for contemporary salt-making activity (Oxford Archaeology North 2017).

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

The settlements of Goxhill and Barrow, just outside the survey area, have their origins in the medieval period. They were located on the ridges of higher ground as the coastal margins were still marshland prone to flooding. Rex and Eleanor Russell's research in Lincolnshire has shown that many villages in the area were located on the higher ground on the edge of the floodplain and surrounded by open fields with lanes leading out to the coastal marshes which were used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974; Clarke nd).

Next to the tidal inlets salterns or salt production sites were often built and earthwork and documentary evidence for medieval salterns has been identified in the area of Halton Marshes (Healy 2001).

A large part of the low-lying marshland in the area came under the control of Thornton Abbey in the early 13th century (to the west of the survey area; Fenwick *et al* 2001a). The abbey undertook reclamation and enclosure, and the history of the Abbey is summarised in a report published by English Heritage (Oswald *et al* 2010).

Documentary sources show that Barrow came under the influence of Thornton Abbey. Founded on the site of an Anglo-Saxon monastery, Barrow was an important manor by Domesday. Furthermore, the motte and bailey castle near to Barrow Haven (NHLE 1007749) (Fig 6.7) also suggests the presence of an important estate, the site potentially being a landing point for a ferry across the Humber. It was excavated by Varley in 1964 and later surveyed by the Humber Archaeology Partnership (Fenwick *et al* 2001a). The history of Barrow is rapidly summarised in its conservation area appraisal (Lyman 2005).



Figure 6.7 Barrow castle survives as earthworks, some of which are visible from the public road.

At Hogcote, north east of Goxhill, is the site of a former moated site, ploughed out in the 1960s but also plotted from aerial photographs by the AI&M project (Fenwick *et al* 2001a; Fleming and Royall 2019).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th and 19th centuries (Russell and Russell 1987; Robinson 2001).

A surviving windmill tower at Barrow Haven is a conspicuous landmark – the building has been recorded by Pevsner’s analysis of historic buildings for Lincolnshire and in a local study of surviving windmills (Pevsner *et al* 1989; Jager 2007).

The area was noted for its numerous brickworks which developed from the later 19th century. The works often included jetties projecting into the river to allow seaborne trade of the products. Several of the extractive pits and jetties, as well as other post-medieval field boundaries, were plotted from aerial photographs by the AI&M project (Fleming and Royall 2019).

In the 19th century, the coming of the railways had a considerable impact on the trade, economy and landscape of the area. New Holland was developed as a London and North East Railway train-ferry terminal linking passengers to and from Victoria Pier, Hull. A new village developed around the road leading to the pier, hotel and train station, and with planned terraced housing, a non-conformist chapel and a national school built to serve the community.

Modern

Through the 20th century, a majority of the brickworks closed down, the exception being the new tile manufactory at Goxhill. For the most part, the rural character of the area continued much as before with the exception being the further development and improvement of the flood defences in the latter part of the century. At Barrow Haven, a HAA battery was built in WWI as part of the network of defences to protect the Humber

Estuary and Hull; the site noted by Dobinson's 1996 study of 20th century fortifications in England.

6.3.7 Lincolnshire – Flood Area 23: Halton and Killingholme Marshes

Palaeolithic and Mesolithic

This coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive survey and analysis of this evidence in the broader area (Lillie and Gearey 2001).

This potential has been confirmed at Marsh Farm, Killingholme Marshes where a Phase 1 palaeoenvironmental survey in advance of proposed development was able to identify the potential coastline in the later prehistoric period and potential deposits suitable for further assessment and analysis (Allen Archaeology 2013; 2016). Additional survey in the area by the University of Durham has recorded a peat deposit radiocarbon dated to the Late Mesolithic period and provided valuable evidence for modelling past sea-levels (MLS22851).

The results of the Humber Wetlands Project, together with the other data and events in the North Lincolnshire HER, are included in the desk-based assessment for the large-scale development of the Able Humber Ports Facility (Cottam and Cox 2011).

Neolithic and Bronze Age

Fieldwalking undertaken by the Humber Wetlands Project recorded several flint artefacts potentially dating to the Neolithic and Bronze Age (Fenwick *et al* 2001b).

Iron Age and Romano-British

The large-scale development, and proposed development, of various port facilities and pipelines has resulted in several archaeological recording projects in the area. These have often incorporated geophysical survey, evaluation trenching and excavation. At North and South Killingholme, as part of the construction of the Able Logistics and Able Marine Energy Park, two Iron Age enclosures and a single roundhouse were identified. As part of the same scheme, a Late Iron Age/Romano-British settlement comprising of an unenclosed roundhouse and boundary ditches was also revealed, yielding evidence for salt-making (Allen Archaeology 2019).

Further evidence for a Romano-British field system and activity was found during archaeological recording as part of the construction of the Able Vehicle and Redistribution Storage Facility (Jordan 2006).

In the north of the area, at Halton Marshes, evaluation trenches as part of the Humber Link Pipeline project, identified Late Iron Age and Romano-British activity, including a large and significant collection of Romano-British pottery (Neal *et al* 2000).

Medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

The settlements of North Killingholme, South Killingholme and East Halton have their origins in the medieval period. They were located on the ridges of higher ground as the coastal margins were still marshland prone to flooding. Rex and Eleanor Russell's research has shown that each village was surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974; Clarke *nd*).

Salterns or salt production sites were often built next to the tidal inlets and earthwork and documentary evidence for medieval salterns has been identified in this area (Healy 2001).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground. From the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001).

Several brickworks were developed in the area in the later 19th century. The works often included jetties projecting into the river to allow seaborne trade of the products. Several of the extractive pits and jetties, as well as other post-medieval field boundaries, were plotted from aerial photographs held as part of the NRHE has been undertaken for the area (Fleming and Royall 2019).

Modern

The modern history of this Flood Area is dominated by the development of the Humber Sea Terminal at North Killingholme as deep-water port (Cornwall Archaeological Unit 2016b).

North Killingholme played an important role in the defence of the Humber Estuary and east coast of England in WWI, its various sites recorded by the Defence of Britain project (Defence of Britain Archive, ADS webpage). The AI&M project plotted the Royal Naval tank farm first developed in 1912 (MLS15395), and as part of WWI war effort, the sea plane base, airfield and jetty (MLS21205) (Fig 6.8) and gun battery (MLS26130). The gun battery (now demolished) was subject to photographic recording and a watching brief (Humberside Archaeology Unit 1995; 1999 cited in Fenwick *et al* 2001a).



Fig 6.8 The modern sea defence wall sitting on the earlier bank to the north of North Killingholme Haven with the remains of the WWI sea plane jetty in the intertidal area. (Photograph taken by CAU in 2015).

6.3.8 Lincolnshire – Flood Area 24: Immingham to West Grimsby.

Palaeolithic and Mesolithic

This coastal area contains palaeoenvironmental evidence in the form of organic-rich deposits which have the potential to inform our understanding of past sea levels, vegetation cover and flood events. The Humber Wetlands Project undertook extensive

survey and analysis of this evidence, including a borehole survey at Cress Cottage, to the north of Healing but outside the RCZAS survey area (Lillie and Gearey 2001).

A geological borehole in the area of Woad Farm recorded a peat deposit with 'occasional stem/trunk fragments recognisable' (and at Immingham Dock, a peat deposit with fragments of alder (wood) and common reed was radiocarbon dated to the later Mesolithic period (MNL3099) and a submerged forest deposit yielded deer antlers (MNL845).

Flint scatters on the edge of the intertidal zone have been identified at Pyewype and further to the north-west, near Old Fleet drain (MNL2088; PAS NLM-43B48C).

Romano-British

In the area of Old Fleet Drain, as part of the construction of the Stallingborough power station, archaeological field walking, evaluation and excavation revealed a Romano-British settlement site and field system, with a later phase of occupation dating to the 6th to 8th centuries, perhaps representing resettlement of the site (MNL1463 citing Naomi Field Archaeological Consultancy 2011).

A possible enclosure and ditched-features identified from aerial photographs at Pyewype could date to the Late Iron Age or Romano-British periods (MNL4303). A comprehensive assessment and interpretation of aerial photographs held by the NRHE has been undertaken for the area by the AI&M project (Fleming and Royall 2019).

Early medieval and medieval

The Angles and Frisians and later, the Vikings, had a considerable impact on the region in the early medieval period, including the place-names of the area; the history and development of which has been studied by the English Place-Name Society (Cameron 1991; Cameron *et al* 2001).

The settlements of Immingham and Stallingborough have their origins in the medieval period. They were located on the ridges of higher ground as the coastal margins were still marshland prone to flooding. Rex and Eleanor Russell's research in Lincolnshire has shown that many villages in the area were surrounded by open fields with lanes leading out to the coastal marshes used for seasonal rough grazing and at the estuary edge, to the havens, typically small inlets or creeks. Where the open fields met the marshes, they were sometimes enclosed by a sea defence bank (Russell and Russell 1987; Russell 1974).

Salterns or salt production sites were often built next to the tidal inlets. Evidence for medieval salterns has been identified in the vicinity of Stallingborough (Healy 2001).

By the 12th century, Grimsby had developed into an important fishing and trading port and a further haven at Pyewype on the former course of the River Freshney is recorded although its exact location is uncertain (Brigham *et al* 2008). By the 15th and 16th centuries the haven at Grimsby had silted up so severely that the port and town entered a long period of decline. The port history of Grimsby has been studied by David Kaye (1981), and in 2015, a rapid PHS, outlining its historical development and heritage significance was completed (Cornwall Archaeological Unit 2016c).

Post-medieval

Further sea defence banks were built for the reclamation and improvement of the wet ground and from the late 18th century this increased dramatically with Parliamentary Enclosure. The current sea defence wall along this part of the Humber dates from the late 18th century enclosure (Russell and Russell 1987; Robinson 2001).

The Humber remained a nationally important artery for maritime trade, the volume of which increased dramatically with the Industrial Revolution and the further growth of Hull as a port. Correspondingly, the infrastructure to defend the ports and to ensure the safe navigation of the river increased, for example at Stallingborough Haven where a Napoleonic coastal battery was built as a partner fort to Fort Paull on the north bank of the Humber. A desk-based assessment of the battery was carried out as part of proposed remediation works to secure the adjacent landfill site (Entec 2011).

In the late 18th century, an Act of Parliament granted powers to widen and deepen the harbour at Grimsby. In the mid-19th century, the antecedent of Alexandra Dock was completed and later in the century, under the impetus of newly formed railway companies, Grimsby developed into the first truly modern dock in Britain with integrated docks, railways and the means for rapid unloading by the systematic and extensive use of hydraulic power. Hugh Winfield, former HER officer for North East Lincolnshire, summarised the development of the dock in a draft, unpublished document (2014).

Modern

The modern history of this Flood Area is dominated by the development and expansion of Immingham as a deep-water port. The significance and history of the port is described in Crossland and Turner's *'Immingham – A History of the Deep Water Port'* (2012). Due to its national significance and the fluctuations in trade and industry, port-side development is subject to frequent changes, as outlined in the PHS for Immingham (Cornwall Archaeological Unit 2016b).

The western end of Alexandra dock, Grimsby falls within the RCZAS survey area. As with Immingham, a PHS was completed in 2016 for the port (Cornwall Archaeological Unit 2016a; Fig 6.9).

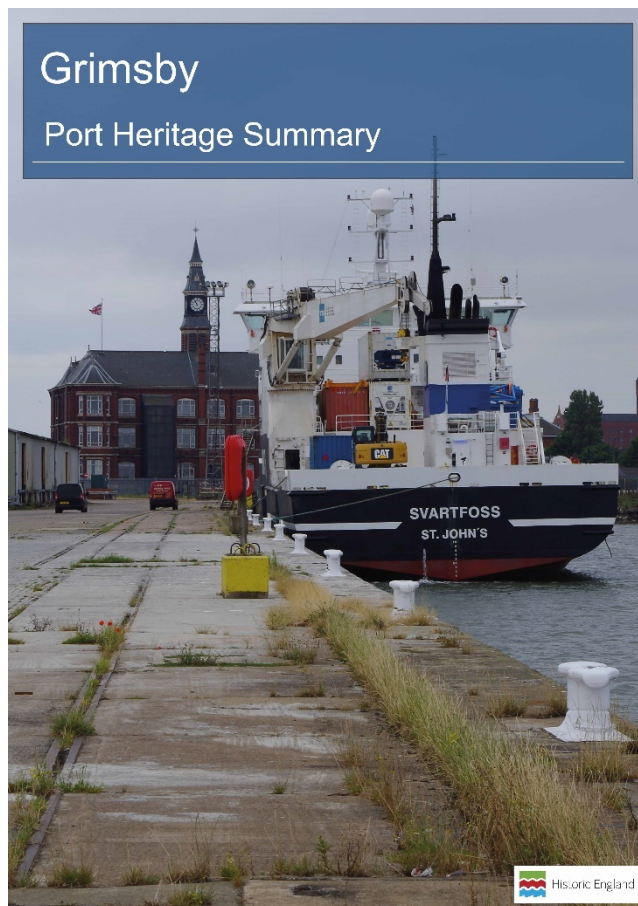


Figure 6.9 The front cover of the Port Heritage Summary for Grimsby.

Two of the buildings associated with 20th century port-related development at Immingham and Pyewype have been recorded before being demolished. This includes a brief photographic record of a former fertiliser bagging factory built in the 1980s at Immingham (Unknown 2015) and at Pyewype, an historic building record of the United Fish Industries building (Davy 2003).

Immingham Dock played an important role in the defence of the Humber Estuary and east coast of England in WWI and WWII (Cornwall Archaeological Unit 2016b). The early history of the RAF in Lincolnshire, and at Immingham Dock, has been summarised by Terry Hancock (2001).

7 Assessment of historic sources

7.1 Historic maps and estate plans

The estuary was mapped from the early 17th century; the earliest example inspected by the project was the 1622 Plan of the Winteringham Estate, which illustrates the former location of a landing point below the village, much closer to the settlement than the present Haven (Fig 7.1).



Figure 7.1 Winteringham Haven as shown in 1622 when a landing place was located at the bottom of Low Burgage lane (arrowed) (MISC/DON 1789/1. Image courtesy of Lincolnshire Archives).

William Palmer's Map of Sunk Island and the north Humber coast shows the area of Cherry Cobb Sands and Sunk Island before the extensive reclamation schemes undertaken from the late 18th century (Fig 7.2). Other estate plans mainly dating from the 18th and 19th centuries also provide accurate detail for specific locations, a good example is the 1876 plan for flood defences on the Walcot Estate at Alkborough and the Devil's Causeway which enabled the accurate dating of jetties, several of which are still extant (Lincolnshire Archives: 10-NOTT/1/4.). The plan also records further infrastructure associated with the use of the river, for example, the now demolished Whitton Pier (MLS26489) for which the plan shows further details associated with its construction and use.

Enclosure plans and Tithe maps, mainly dating from the late 18th to the mid-19th centuries, were available for a number of areas. In Lincolnshire, many of these have been studied and reproduced in Rex Russell's series of books about the former open field systems in the area (Russell 1974; Russell and Russell 1987).



Figure 7.2 William Palmer's 1723 map of Sunk Island and Humber North Coast Early charts of Sunk Island more closely defined the changing extent of the island and includes early jetties and quays as at Thorneycroft, and Old Sands Bridge, near Cherry Cobb Sands. (Reproduced by kind permission of the Burton Constable Foundation, courtesy of the East Riding Archives: ERALS DDCC/155/3).

The project utilised four epochs of historic 1:10560 and 1:2500 Ordnance Survey (OS) mapping; the coverage and publication dates varying across the survey area (Table 7.1).

2500	First edition	Second edition	Third edition	Fourth edition
Yorkshire	1888 – 1893	1906 - 1911	1927 - 1928	
Lincolnshire	1886 – 1888	1907 - 1908		1932 - 1933
10560	First edition	Second edition	Third edition	Fourth edition
Yorkshire	1854 – 1856	1891 - 1894	1907 - 1911	1926 - 1953
Lincolnshire	1889 – 1892	1908 - 1911	1930 - 1933	1932 - 1953

Table 7.1 OS map editions and publication date ranges for each county.

The first and second edition 1:2500 OS maps covered the entire survey area while the third and fourth revisions covered less extensive areas, mainly urban centres, in particular Hull west to Brough, and on the Lincolnshire side, around Barrow and between Immingham and Grimsby. The early date of the first edition 1:10560 map for Yorkshire was particularly useful in areas of the coastal margin where the rate and extent of successive port development increased dramatically in the late 19th century.

Due to their extensive coverage and standard conventions these sources were the initial evidence used to build the GIS database for the addition of new records and amending and updating existing ones. In this way they were extremely useful as a starting point and consistent baseline to undertake further analysis.

7.2 Admiralty charts

Historic charts from the UK Hydrographic Office (UKHO), Taunton, were assessed as part of this project. It should be noted that the main purpose of charts is for the safe navigation of ships and shipping at sea, with the earlier charts' coordinates fixed via

triangulation and transects at sea creating an inaccuracy factor. Carr (1962) points out that charts prior to the late 18th century should be treated with the 'greatest reserve' and that even up to the mid-19th century much of the detail on historic maps and charts is inaccurate.

Appendix 5 shows the Admiralty charts inspected as part of this project. On the whole, the charts added extra detail in the form of small-scale features, often in specific locations, rather than widespread across the entire estuary, for example, the small short-lived coastal batteries (for example, Stallingborough Haven, Lincolnshire), small quays and jetties, and ferry crossings (for example, Goxhill Haven). Booms and dolphins that protected the anchorages and navigable channel of the outer estuary between Stallingborough Haven and Sunk Island during WWI were recorded on Admiralty charts and added by the project to the relevant HERs (Fig 7.3).

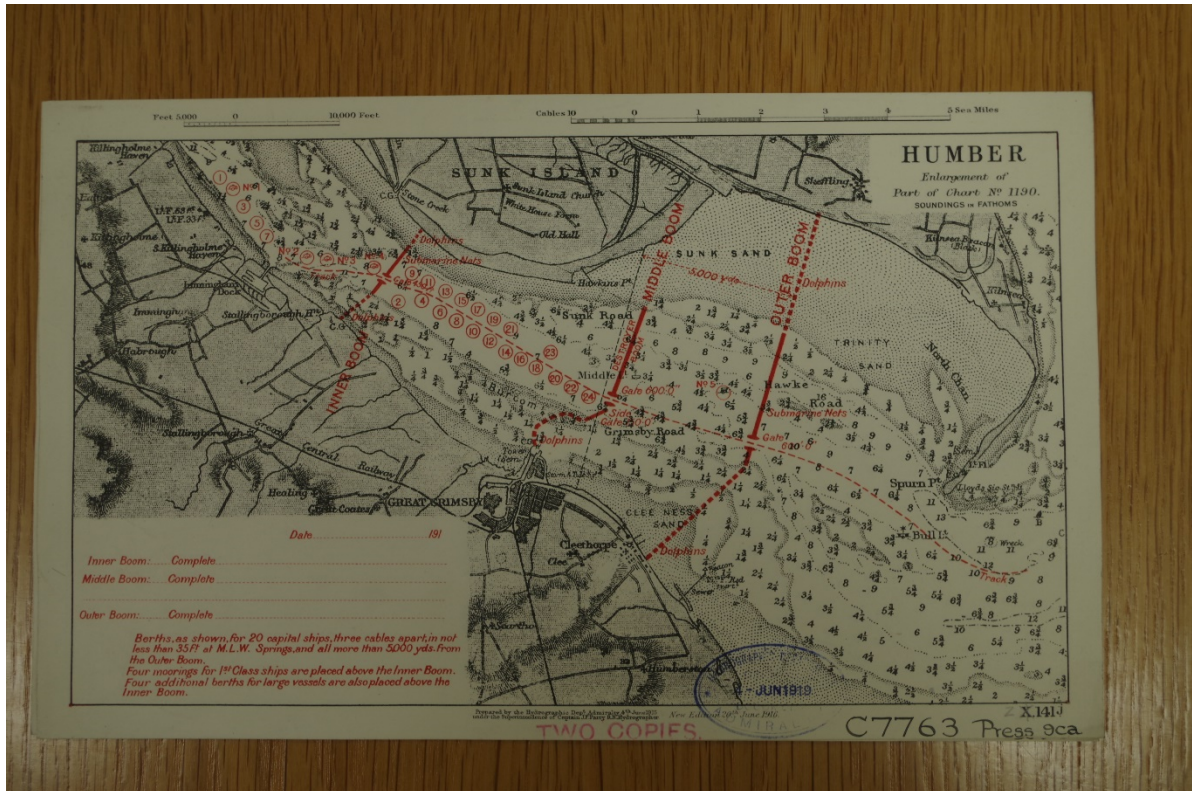


Figure 7.3 WWI submarine and warship defences to create a safe anchorage and navigable channel in the middle of the estuary (United Kingdom Hydrographic Office CC7763).

8 Assessment of data sets

8.1 HER

Sites and Monuments, Events and HLC layers were provided by the three HERs in the survey area: North East Lincolnshire Council, North Lincolnshire Council and Humber HER (East Riding of Yorkshire and Kingston-Upon-Hull). All three datasets were outputted from HBSMR database to GIS layers with a corresponding table of descriptive detail in html or pdf format. All three HERs form comprehensive datasets and while each one had its differences in terms of the coverage of sites there was generally a good level of spatial accuracy and descriptive detail. However, there were areas where improvement was made, in the main, on the edge of the estuary on both sides of the Humber by plotting further jetties and sea defences recorded on historic plans and charts.

A total of 36 new sites were added to the Humber HER in the area west of Brough Haven. This area had been flagged up at an early stage by the Humber HER team as an area where the density of sites could be enhanced.

8.2 NRHE and NHLE data

Point, line and polygon data for monuments and events was provided from Historic England's National Record of the Historic Environment (NRHE) and National Heritage List (NHLE). The NRHE dataset bolstered the evidence base but often had little further information compared to the HER data, especially for landward records. Where the NRHE was particularly useful was in providing further detail below MHW and in particular, for wrecks (see below Section 8.4).

Data on designated sites was consulted via the NHLE pages of the HE website. The NHLE data for designated sites such as Scheduled Monuments and Listed Buildings was useful because of the detailed information contained in the supporting descriptions, however, for a majority of sites this had already been incorporated into the relevant HER.

8.3 Aerial Investigation: AI&M/NMP data

The survey area is covered by several aerial investigation projects; the principal being the Aerial Investigation and Mapping (AI&M) component of the Phase 1 DBA for the Inner Humber (Fleming and Royall 2019), with additional National Mapping Programme (NMP) investigation undertaken for the Vale of York (Kershaw 2001), the Yorkshire Wolds (Stoertz 1997) and the Yorkshire Coast and [Outer] Humber Estuary (Deegan 2007).

The AI&M project recorded all archaeological features visible on aerial photographs and Lidar imagery as cropmarks, soilmarks, parchmarks or earthworks and some structures. The earliest sites recognised on aerial photographs usually date from the Neolithic onwards and therefore, AI&M projects record all archaeological features visible on aerial photographs with a date range from the Neolithic to the 20th century.

The more recently undertaken mapping includes analysis of widely available digital datasets including Google Earth vertical digital aerial photography and EA Lidar imagery, whereas the earlier NMP projects for the Vale of York and Yorkshire Wolds undertook analysis of aerial photographs only.

8.4 Wrecks

When dealing with shipwrecks it is very important to take into account historical variations in UK wreck recording. Many vessels will have been lost with no record being made. This is particularly and very obviously true of later prehistoric and Roman losses and there are no documented wreck sites. Medieval records, particularly prior to the 13th century, are also unusual. Systematic loss recording only commenced in the 18th century with Lloyd's List, although it cannot be relied upon as a comprehensive record until well into the 19th century, and then only for larger vessels (Wessex Archaeology 2008, 23).

The NRHE dataset records wrecks as point data and records a total of 102 wrecks within the survey area. The dataset also includes considerable descriptive information outlining the way by which the vessel was lost. The HERs contained fewer records.

Spatial accuracy in relation to wreck data is a problem and after filtering, only 31 wrecks were entered into the final project GIS database. While the NRHE data includes a precision field to better understand and capture this variability, this project shows that it could be improved by assessing it against current websites and survey work presented online, for example, by The Wrecks Site EU website.

8.5 Portable Antiquities Scheme

The high-level PAS data was downloaded as an Excel spreadsheet, and converted to a shapefile into the project GIS, where sites falling within the survey area were selected as a separate dataset totalling 3,127 records. A cautionary approach to the data was taken in revealing the *precise* location of finds, resulting in only 32 sites, mainly lithic scatters, taken forward to the GIS database. Additionally, a rapid visual appraisal by the project suggested a good concurrence of PAS finds in the general areas of sites, monuments and buildings already within the HER.

8.6 Receiver of Wreck

Information on 'wreck' (wreckage or artefacts exposed or washed up on the foreshore) declared to the Receiver of Wreck up to and including 2011 is already in the NRHE.

8.7 Lidar

Detailed assessment and analysis of different visualisations generated from existing EA Lidar data for the majority of the DBA survey area was undertaken by the AI&M component of this survey (Fleming and Royall 2019, see appendix 1). There were three exception areas where previous NMP surveys had not had access to Lidar data and where the DBA survey area was not covered by the survey's AI&M component. These were:

1. in the area surrounding the Humber bridge, corresponding within the chalk of the Yorkshire Wolds (Stoertz 1997);
2. the low-lying area east of South Farm, Sunk Island, corresponding within the area of the Yorkshire Coast and [outer] Humber Estuary RCZAS NMP mapping (Deegan 2007); and
3. the eastern edge of the survey area at Pyewype and the edge of Grimsby, corresponding within the area of the Yorkshire Coast and [outer] Humber Estuary RCZAS NMP mapping (Deegan 2007).

The 1m and 2m resolution DTM Lidar data from the EA was available for these areas. It was rapidly inspected for the project area; however, it was not manipulated into any visualisations which benefit the identification of archaeological features, unlike those inspected as part of a full AI&M project (Fleming and Royall 2019, section 3.3).

The area at Pyewype and on the edge of Grimsby is predominantly developed land and built up and therefore the potential for Lidar data to reveal previously unrecorded archaeology in this area was limited.

8.8 Borehole data

There are hundreds of geological borehole logs available for the survey area from the British Geological Survey (BGS) Borehole record viewer webpage. A high percentage of the associated logs are available as scans of paper records or as pdf documents which can be viewed online.

These logs are described from a geotechnical viewpoint rather than a palaeoenvironmental or geoarchaeological perspective, so therefore lack some of the detail normally required for heritage purposes. They can, however, provide evidence of deposits that have the potential to yield palaeoenvironmental information. For example, at Woad Farm, Great Coates, North East Lincolnshire, where a geological borehole taken in 1993 in the area of Woad Farm recorded a peat deposit approximately 0.7m thick at an estimated depth of 5.10m below ground level. It is described as a, 'firm to spongy black fibrous peat with occasional stem/trunk fragments recognisable' (TA21SW238 – WOAD FARM GRIMSBY 10; British Geological Survey Borehole record viewer website).

9 Assessment of Results

9.1 Overview of results: new and enhanced data

Overall, the project added, updated or amended 685 records. The tables in Appendix 4 show the new sites created for each Historic Environment Record (558 for Humber; 100 for North Lincolnshire and 15 for North East Lincolnshire). The following sections provide an overview of the new sites added.

9.1.1 Prehistoric and Romano-British

Sixty-four new prehistoric and Romano-British records were added to HERs by the project (Fig 9.1). A majority of these new records were findspots identified by the Humber Wetlands Project but not previously uploaded to the Humber HER. An important source of new information was the PAS database with finds predominantly in the form of coins discovered by detectorists and lithic scatters. Notable concentrations of these records were added in the area of Paull, East Riding of Yorkshire. Fewer new records from the PAS database were added to the North Lincolnshire and North East Lincolnshire HERs as they had a high level of existing records in this respect and the PAS data added little in terms of coverage and date of finds.

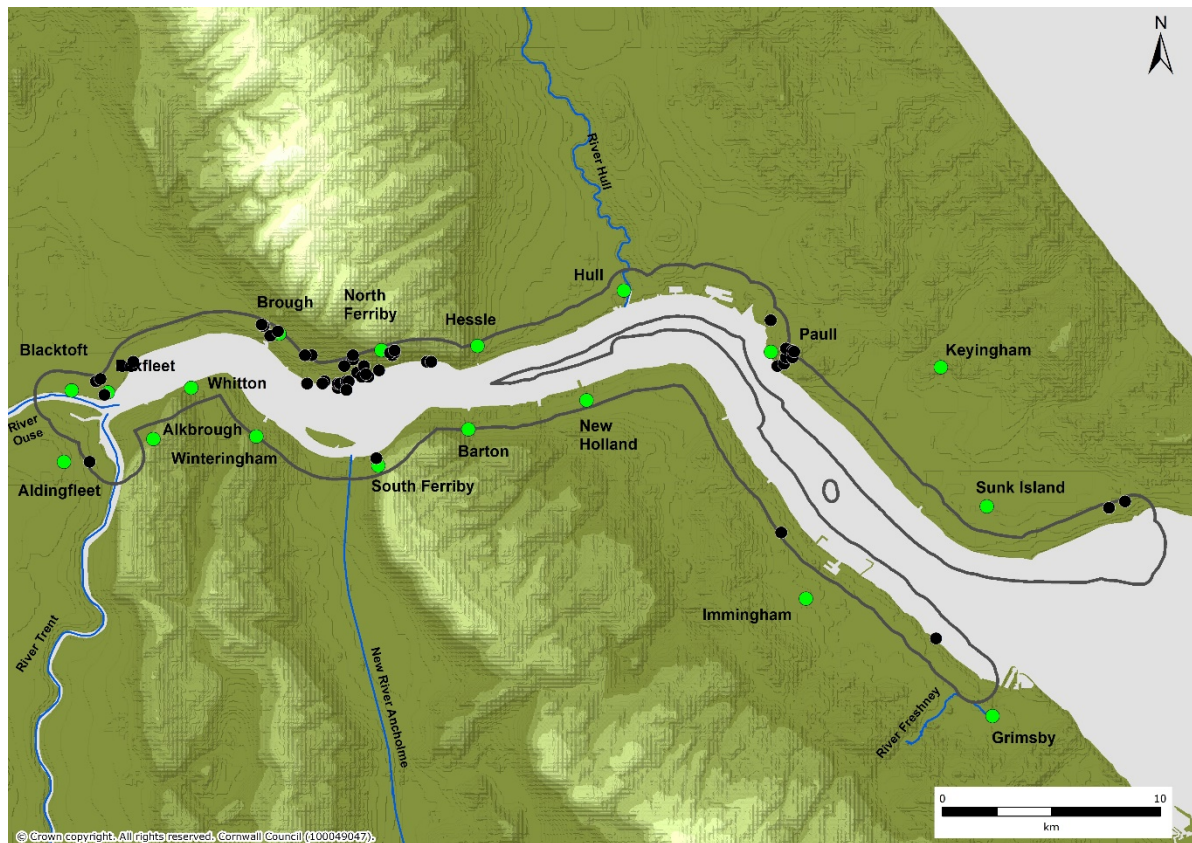


Figure 9.1 Map showing the new prehistoric and Romano-British records (black dots) added by the project.

More recently, palaeoenvironmental survey has been undertaken by Allen Archaeology in advance of development at the Able Humber port (Allen Archaeology 2013, 2016) and by York Archaeological Trust as part of the Skeffling to Welwick Managed Realignment Scheme (Howard *et al* 2017; Jackson 2019). Both identified buried land surfaces and deposits providing significant information on the post-glacial development of the estuary including evidence for palaeochannels – with two records for these added to the relevant HERs.

Eleven of the records were for flint scatters, with ten of the records located within the Humber HER, at two locations, Paull and Melton. The remaining record was for a flint

scatter found in the intertidal area near Oldfleet drain, North East Lincolnshire, originally recorded in the PAS database.

9.1.2 Early medieval and medieval

The project created only 29 new records dating to the early medieval and medieval periods as each HER had extensive records for these periods and rapid research yielded limited further information (Fig 9.2).

A majority (23) of the sites added were findspots of pottery identified by the Humber Wetlands Project and the PAS database.

Archaeological excavation undertaken as part of the Outstrays to Skeffling Managed Realignment Scheme has revealed evidence for activity on the low-lying coastal marshes, possibly associated with seasonal rough grazing; two records were added to the Humber HER.

An archaeological watching brief undertaken by Wessex Archaeology near Ferriby Sluice, North Lincolnshire, revealed buried evidence of the former channel of the River Ancholme, prior to its canalisation in the 18th century (see Section 6.3.3 for more information).

At Winteringham, analysis of the 1622 survey of the manor shows an earlier landing point approximately 500m inland of the present Haven – the site was potentially in use during the medieval period (see Fig 7.1).

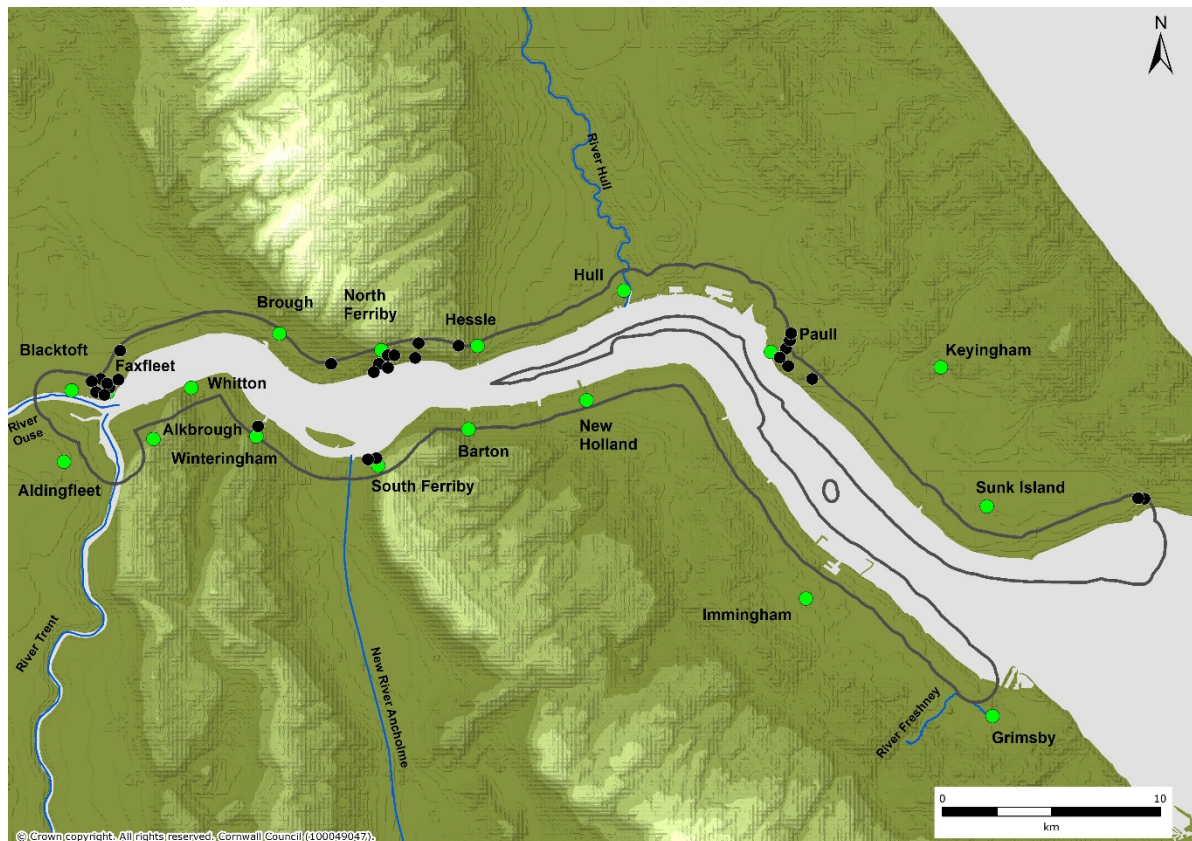


Figure 9.2 Map showing the new early medieval and medieval records (black dots) added by the project.

9.1.3 Post-medieval

Two hundred and fifty new records dating to the post-medieval period were added across the survey area (Fig 9.3).

This included a wide range of monument types, the most common of which were jetties, groynes, flood and sea defences, wharfs, landing points and landing stages with, in total, 116 sites added – reflecting the strong maritime character of the estuary. The data was predominantly derived from analysis of historic maps, plans and surveys and had a wide coverage across the survey area (Fig 9.4).

In terms of the location of the jetties and wharfs, there is a strong relationship with brick and tile works and extractive industries, for which the project added records for a further six brickyard-related records, a chalk pit, a clay pit, an extractive pit, four gravel pits and three quarries (Fig 9.5).

In terms of post-medieval wrecks, nine new records were added with eight sourced from the NRHE database but with an additional wreck added near South Ferriby Cliff from a 1906 chart of the Upper Humber surveyed by the Humber Conservancy Board (Fig 9.6).

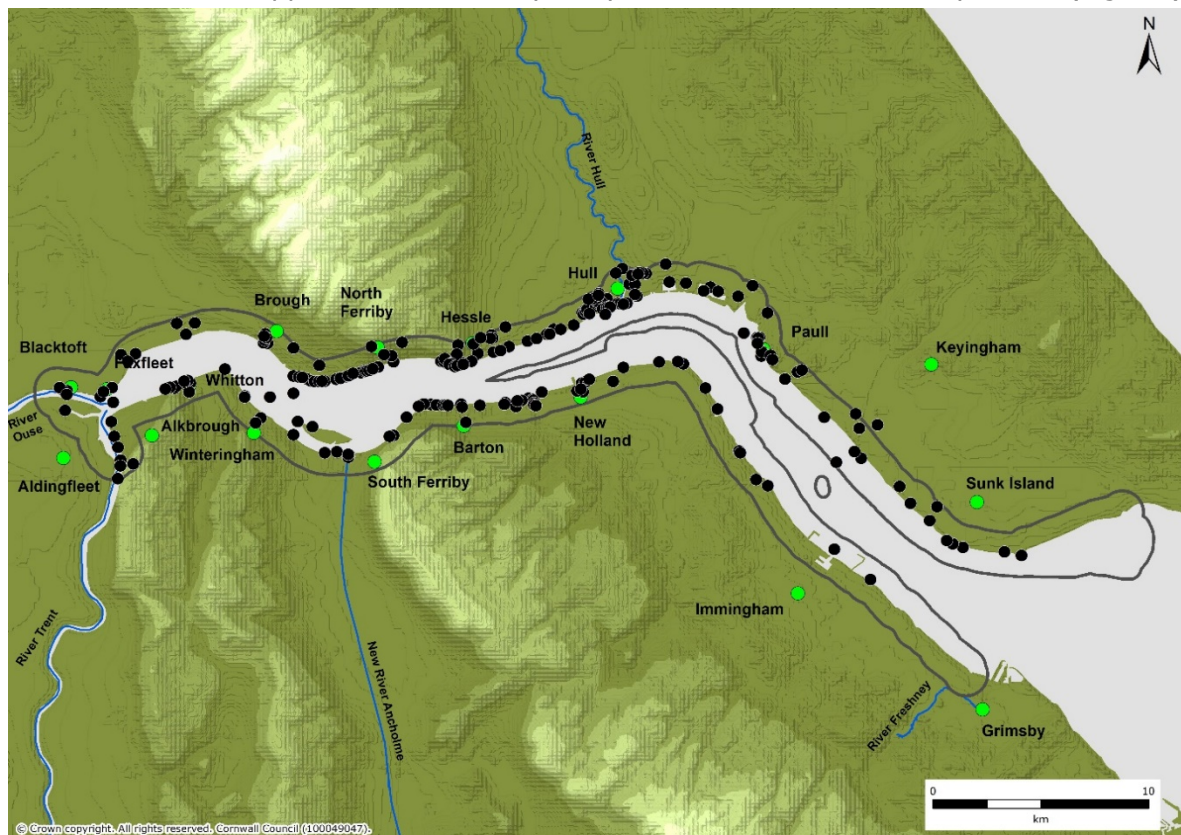


Figure 9.3 Map showing the new post-medieval records (black dots) added by the project.

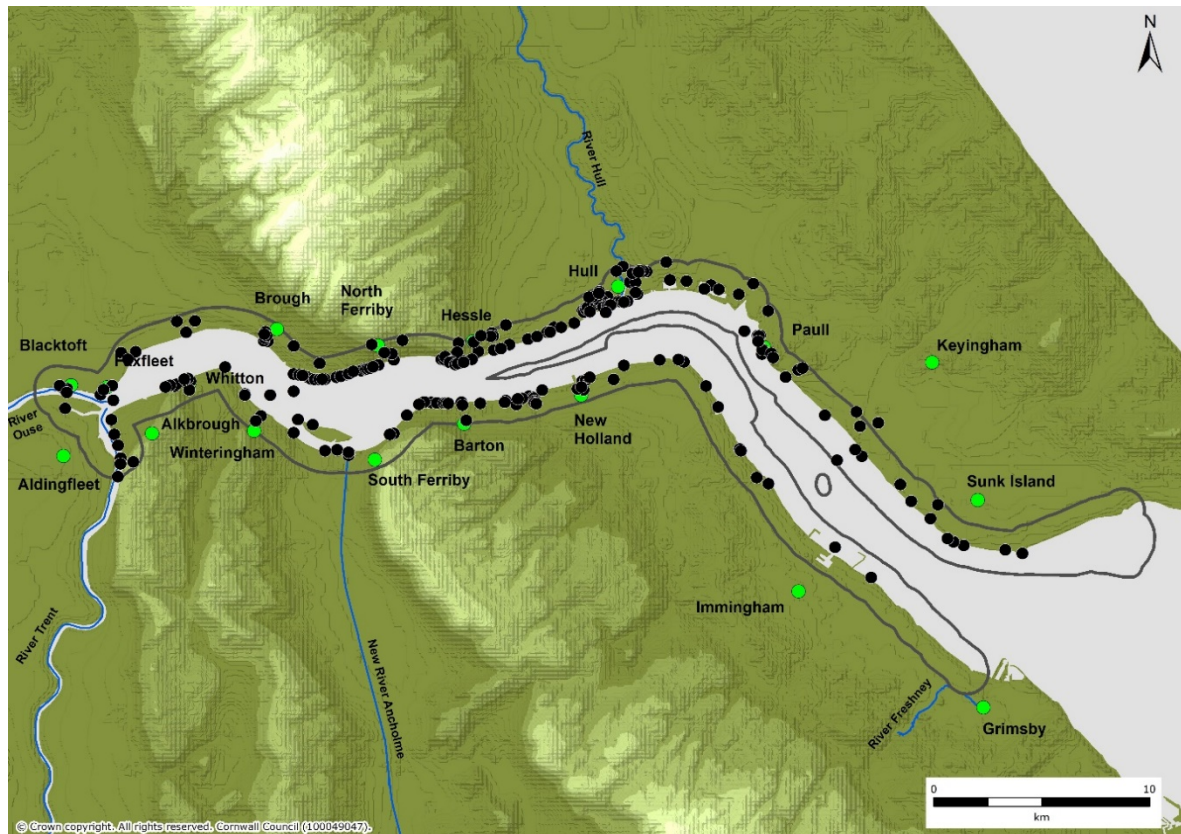


Figure 9.4 Map show the new records for post-medieval jetties, groynes, flood and sea defences, wharfs, landing points and landing stages (black dots) added by the project.

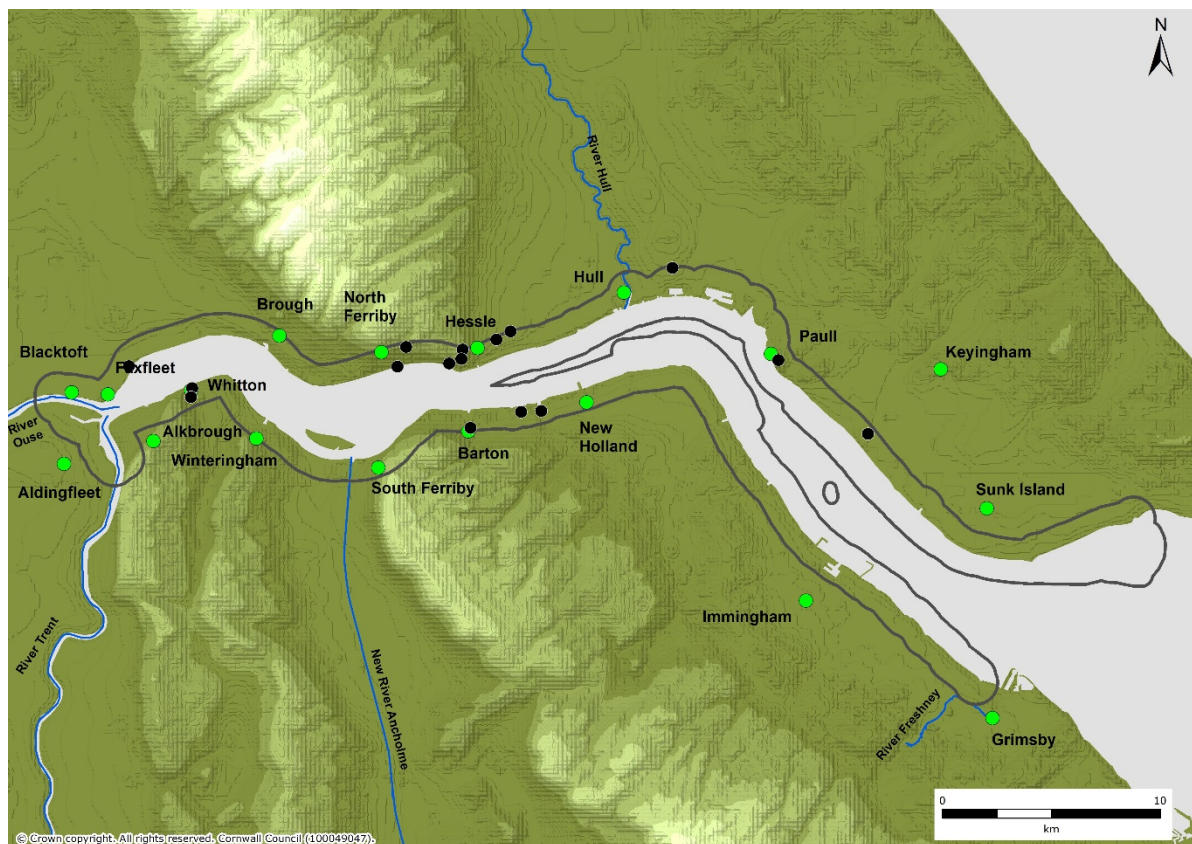


Figure 9.5 Map showing the new records for post-medieval brickyards, chalk and gravel pits and quarries (black dots) added by the project.

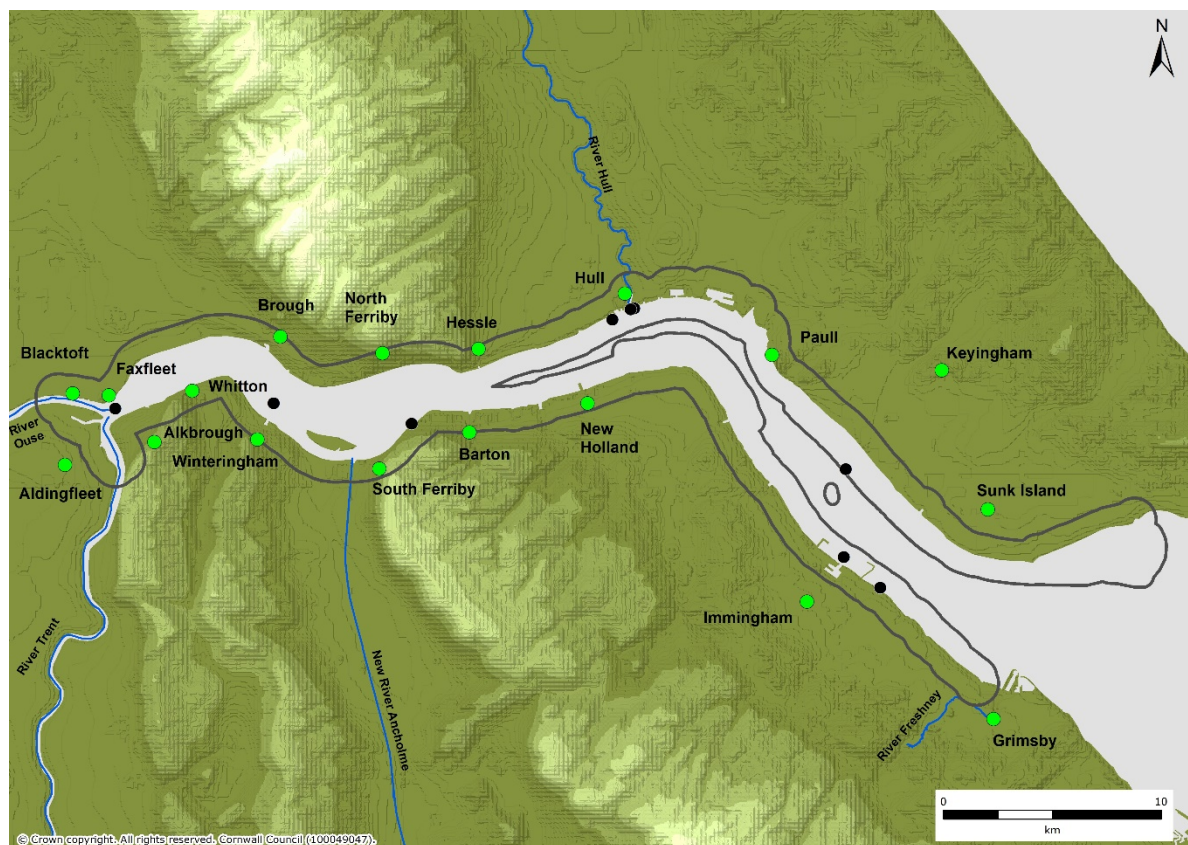


Figure 9.6 Map showing the new records for post-medieval wrecks (black dots) added by the project.

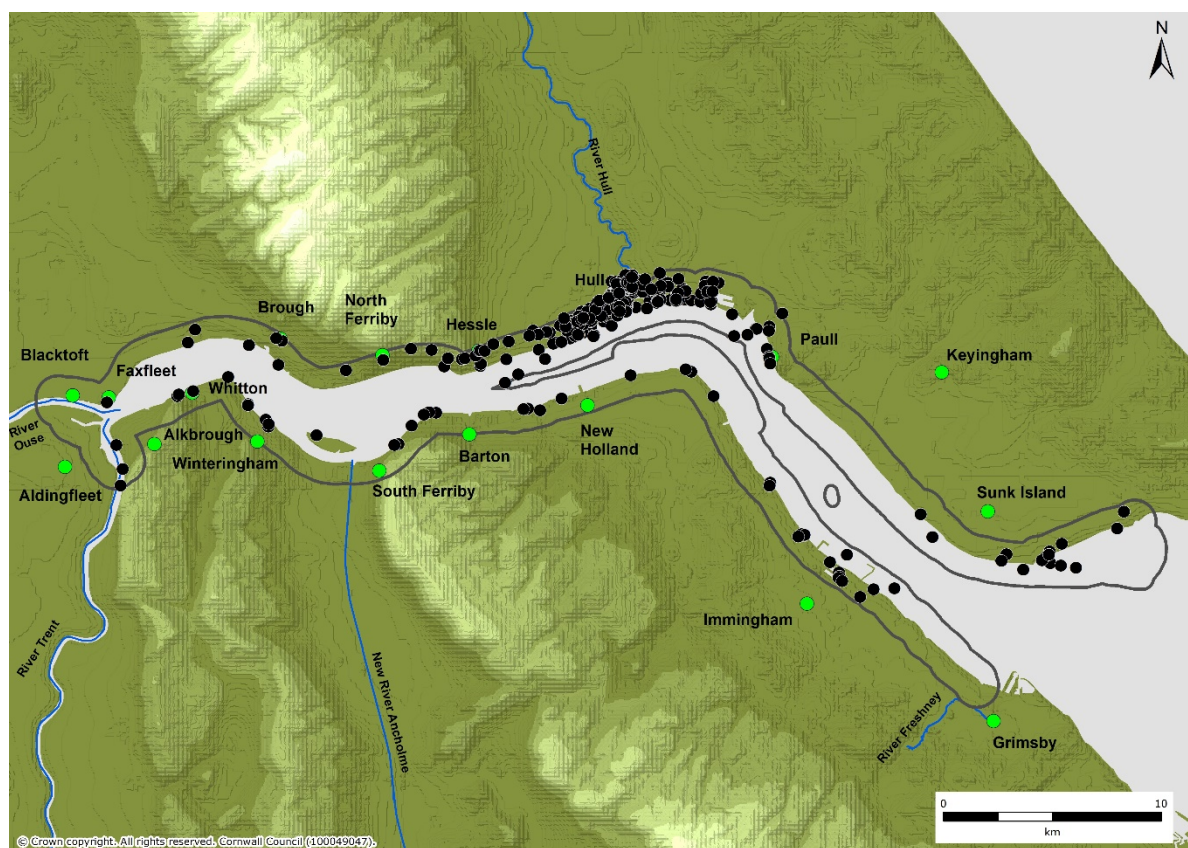


Figure 9.7 Map showing the new records of modern date (black dots) added by the project.

9.1.4 Modern

Monuments and buildings dating to the modern period form the majority of the data recorded by the project, with 328 new records added across the survey area (Fig 9.7).

A majority of these records are recorded for documentary sources, mainly historic OS maps and to a lesser extent, historic charts.

As with the post-medieval period, there were a high number of features related to the maritime use of the area, in the form of jetties, groynes, flood and sea defences, wharfs, landing points and landing stages (Fig 9.8).

In Hull, public houses recorded on historic maps were mapped, resulting in 93 records added to the Humber HER. A majority of the records were 'site of', most of the pubs having been destroyed in the widespread bombing of the city and portside areas in WWII (Fig 9.9).

Due to the widespread assimilation of the Defence of Britain project's sites into the HERs only a single modern military site was added by the project – a record for a searchlight battery at Crabley Farm, Broomfleet.

Twenty-three modern wrecks were added, a majority of which were in the River Humber, off Hull (Fig 9.10). Two of the wrecks were recorded from data provided by the Citizen project.

Five WWI records were added by the project. This included three sites of submarine and destroyer defences recorded from a chart held by the UKHO (Fig 7.3) and two HAA batteries; one at Marfleet, Hull and the other at Hessle.

In relation to WWII, 11 records were added covering a variety of monument types including bomb craters, air raid shelters, barrage balloon site, observation posts and wrecks; all the sites from information derived from the NRHE (Fig 9.11).

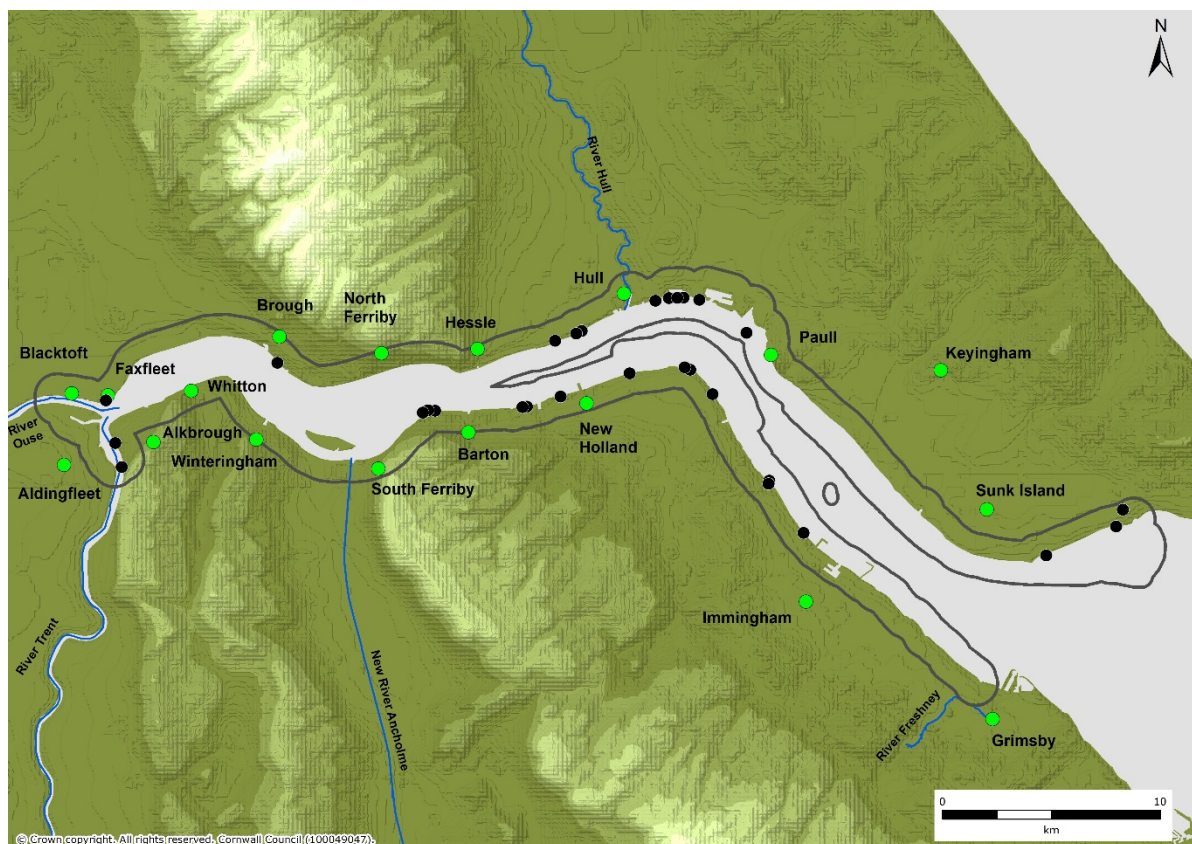


Figure 9.8 Map showing the new records for modern jetties, groynes, flood and sea defences, wharfs, landing points and landing stages added by the project.



Figure 9.9 Map showing the new records for modern public houses (black dots) added by the project.

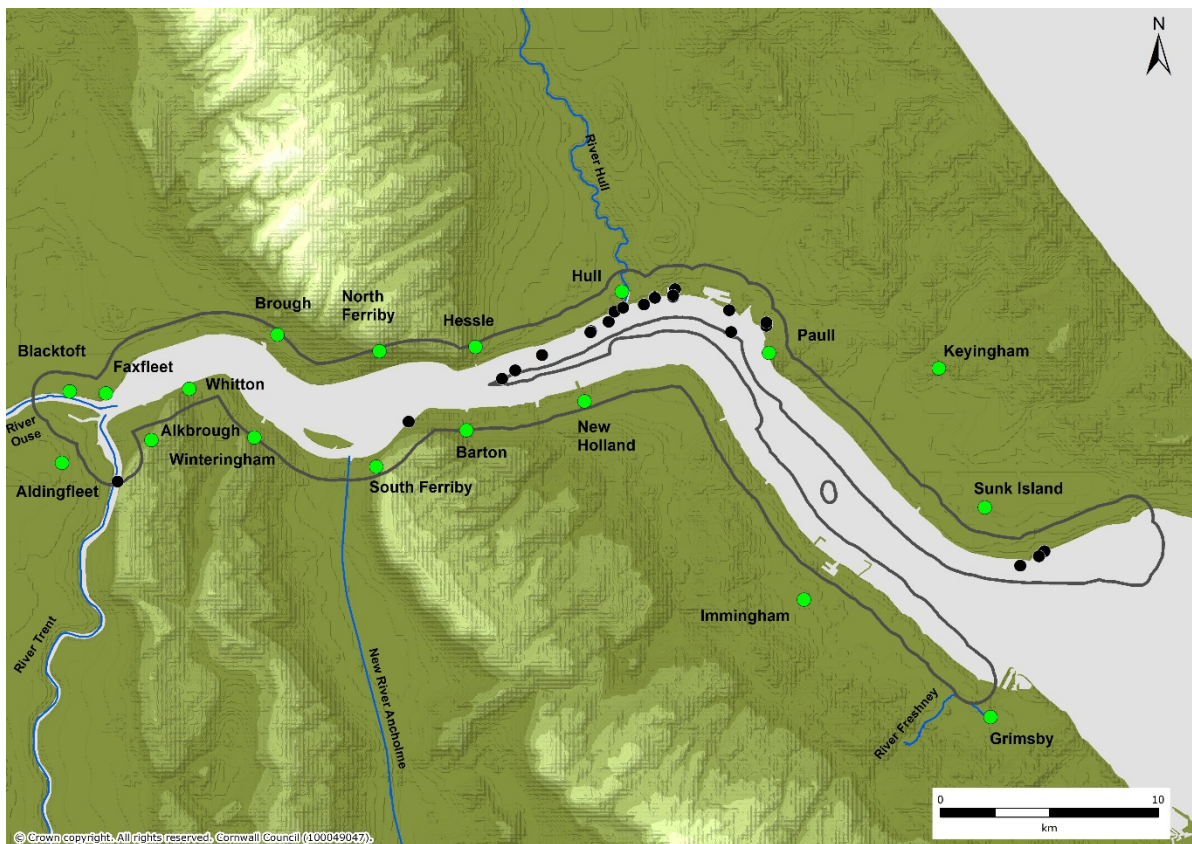


Figure 9.10 Map showing the new records for modern wrecks (black dots) added by the project.

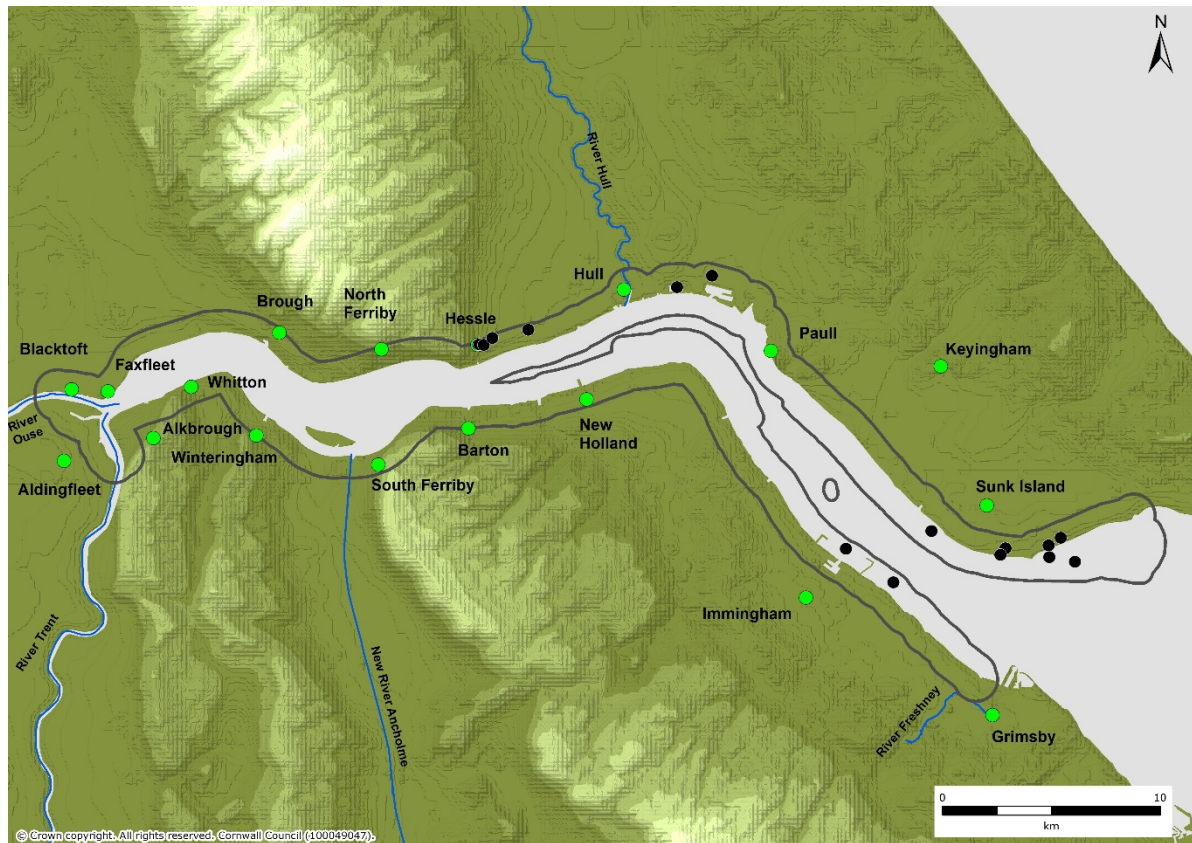


Figure 9.11 Map showing the WWI and WWII records (black dots) added by the project.

9.1.5 Uncertain

Records for 26 monuments of uncertain date were added by the project. These cover a wide range of monument types but are predominantly associated with buried land surfaces. Fifteen records were added from the BGS borehole data survey viewer, in the form of peat deposits identified by geological boreholes, complementing the extensive palaeoenvironmental borehole survey records in the area, a majority of the latter having been undertaken by the Humber Wetlands Project and WAERC over 20 years ago.

10 Assessments of threats to coastal heritage

The EA's Humber Flood Risk Management Strategy (2008) does not take into account the flood risk to individual heritage assets or indeed the historic environment in general, whereas the SMP for Flamborough Head to Gibraltar Point does consider the implications of different coastal-change scenarios on selected heritage assets, but only those that are designated (Scott Wilson 2010; see Section 4 of this RCZAS report for a wider discussion of the different strategies and management plans for the Inner Humber).

Threats to the coastal historic environment resource can be characterised in two ways:

- coastal change through natural processes, flood events and rising sea-levels; and
- anthropogenic threats such as coastal/flood defence schemes, infrastructure works, development, compensatory measures for habitat loss as a result of natural or anthropogenic change, increased visitor pressure and vandalism due to improved coastal access.

The threats posed by human-led development and changes to land use are largely controlled by the planning system. This allows opportunities for consultee and public scrutiny and the mitigation of potential adverse effects via conditions being placed on each application upon the granting of permission. Processes, such as storm events or rising sea levels, however, bypass these ordered procedures and, in these circumstances, mitigation cannot always be expected to take place as it is often reactive.

The following section is an overview of the management issues identified in each Flood Area.

10.1 Yorkshire

10.1.1 Yorkshire – Flood Area 2: Skeffling

In 2008, the EA considered that minor repairs were expected to the existing flood defences every few years, but a major improvement was required in the next two decades. As the area contains a relatively small number of properties at risk it is possible that this support will be withdrawn, however, the agricultural land is of a high grade (typically Grade 2) and the landowners may wish to protect it. At this stage, however, it is difficult to predict what will happen and if a managed re-alignment takes place, where new defences will be located. It is also possible that the existing defences will be maintained but with minimal or no public financial support.

There are no designated heritage assets at immediate threat, and although the risk could be considered as slight, severe storm surges and flood events such as those experienced in the winter of 2013–2014 demonstrate that if defences are breached, extensive flooding will occur. The risk may be expected to increase as a result of increased frequency of storm events and rising sea levels, and major flood events could lead to unplanned naturally-led realignment.

The archaeological evaluation and recording undertaken as part of the Outstrays to Skeffling Managed Realignment Scheme has demonstrated the archaeological potential of the area (Howard *et al* 2017; Jackson 2019). If further realignment schemes are required, whether publicly or privately funded, it is likely that these will go through the planning system and therefore, there will be future opportunities for archaeological mitigation.

10.1.2 Yorkshire – Flood Area 3: Sunk Island (Winestead Drain to Stone Creek)

This Flood Area contains scattered farms and high-grade agricultural land (Grade 2 although the interior of Sunk Island is Grade 1). Although this and the neighbouring area of Stone Creek to Paull Holme Strays (Flood Area 4) are separated by Keyingham Drain, flooding in one can affect the other.

Major improvements are likely to be needed to the flood defences in the next 10 to 20 years. Currently, the banks in this part of the estuary are mostly owned by the Crown Estate. It will become increasingly expensive to maintain the existing defences in the

future as sea levels rise and at some point the owners may decide it is not worthwhile carrying on. If maintenance is withdrawn from the existing defences, it is likely that new banks will be built to protect the villages at the edge of the floodplain.

At this stage it is difficult to predict what will happen and if a managed re-alignment takes place, where new defences will be located.

With these potential risks in mind, it is possible that the Scheduled gun battery at Stone Creek (NHLE 1020187; MHU4528) and the Grade II Listed South Farm farmhouse (NHLE 1083467; MHU 7503) will come under increasing risk of flooding.

In terms of close proximity to the existing flood defence bank, and therefore at greatest risk of a major flooding event, there are several non-designated heritage assets, including the site of East Somerle village (MHU8954) and a possible enclosure near Old Hall, Sunk Island (MHU19476).

The archaeological evaluation and recording undertaken as part of the Outstrays to Skeffling Managed Realignment Scheme has demonstrated the archaeological potential of the area (Howard *et al* 2017; Jackson 2019). If further realignment schemes are required, whether publicly or privately funded, it is likely that these will go through the planning system and therefore, there will be future opportunities for archaeological mitigation. Minor changes to privately-owned defences are likely to require an EA licence, and there is a possibility that there will be limited heritage input into mitigating the effects of the schemes on heritage assets.

10.1.3 Yorkshire – Flood Area 4: Stone Creek to Paull Holme Strays



Figure 10. 1 Looking to the Managed Realignment Scheme and Yorkshire Wildlife Trust Reserve at Paull Holme Strays with the River Humber on the right.

This Flood Area contains scattered farms and Grade 2 agricultural land, drained to the estuary by a system of ditches leading to Keyingham Drain. Although this and the neighbouring area of Sunk Island (Flood Area 3) are separated by Keyingham Drain, flooding in one can affect the other.

In 2008, it was anticipated that major improvements to the flood defences would be required in 40 or 50 years. Although there is uncertainty about the rate at which sea levels will rise and defences deteriorate, it is likely that maintenance will be withdrawn

from the existing defences at some point before 2058, and new banks constructed further inland to protect the villages at the inland edge of the floodplain.

The EA has identified a site to the north west of Stone Creek (Keyingham) as suitable for wildlife habitat creation to compensate for loss of habitat elsewhere in the estuary due to development. At this stage, the exact extent of the managed realignment area has not been published.

The archaeological evaluation and recording undertaken as part of the Outstrays to Skeffling Managed Realignment Scheme has demonstrated the archaeological potential of the coastal margin. If further realignment schemes are required in this Flood Area, whether publicly or privately funded, it is likely that these will go through the planning system and therefore, there will be future opportunities for archaeological mitigation.

In terms of close proximity to the existing flood defence bank, and therefore at greatest risk of a major flooding event, are the non-designated heritage assets including a pill box to the west of Stone Creek (MHU18822), the former Stone Creek public house (MHU11801), and in the vicinity of Paull Holme Strays (Fig 10.1), WWII bombing decoys (MHU19147; MHU2670).

Located behind the realigned flood defence bank, a major flooding event could threaten the lower lying parts of the Scheduled Paull Holme Tower and Moated site (NHLE 1007875).

In future, the Scheduled Thorney Crofts bombing decoy range (NHLE 1020022) located on the estuary side of the flood defence bank, is likely to experience increased rates of coastal erosion.

10.1.4 Yorkshire – Flood Area 5: Hull East (including Paull Village) and Flood Area 6: Hull West (Hull Barrier to Hesse Haven)

Most of the properties at risk from flooding are in Hull, although there is a significant number in Paull.

Overall, the existing estuary flood defences in this Flood Area are considered in good condition but in several places, they are currently being upgraded as part of The Humber: Hull Frontage scheme. The Scheme will protect the designated and non-designated heritage assets in the area, substantially reducing the risk of flooding and coastal erosion to them.

Seven kilometres of flood defences along the edge of the estuary including at St Andrew's Quay Retail Park, Victoria Pier and Victoria Dock Village are being upgraded, with work on the scheme scheduled to be completed by March 2021. The flood defences in the River Hull have also recently been repaired and upgraded, which together with the Hull Tidal Surge Barrier, currently provide a one in 200-year protection, meaning that the defences reduce the risk of flooding to a 0.5 per cent chance in any one year (see Fig 10.2).

The EA are also monitoring the defensive wall at Paull and in particular how to manage the large volumes of spray from waves that can occur during severe storms.

Due to the number of residential properties, and nationally important industrial and port-related activity the EA anticipates that the defences will need to be improved as sea levels rise.

The current flood defence improvements have been completed in the area of St Andrew's Dock. Further works in the future are likely to require the heightening of defences. It is also possible that the cost of contributing to the flood defences will limit the options for the re-development of the remaining part of St Andrew's Dock (the Conservation Area; see Section 11.2.5 for more discussion).

Strengthening of flood defences in future has the potential to have an impact on the setting of several designated monuments and directly affect designated quays and docks (Fig 10.3). However, the benefits of improving flood defences are potentially significant as they will protect the historic core of Hull which has a high concentration of Listed Buildings, several Conservation Areas and a number of Scheduled Monuments.



Figure 10.2 Flood defence improvements on the River Hull at Citadel Wharf, Hull in 2019.

Severe storm surges and flood events such as those experienced in the winter of 2013–14 demonstrate that if defences are breached, extensive flooding will occur. This may be expected to increase as a result of increased frequency of storm events and rising sea levels. However, the coastal edge of these two Flood Areas is hard-engineered and designed to defend the high number of residential properties and industrial areas and port-related infrastructure.

It is possible in the longer-term the Grade II Listed swing bridge and lock to the Humber Dock (NHLE 1197718) will require strengthening and upgrading.

If further flood defence improvement schemes are required, they are likely to go through the planning system and therefore, there will be future opportunities for archaeological mitigation.

Coastal erosion is a threat to parts of the Paull Point coastal battery, resulting in its inclusion on HE's 2020 HAR register (see Section 11.2.4 for a further fieldwork opportunity as part of a Phase Two RCZAS project).

10.1.5 Yorkshire – Flood Area 7: Hessle Frontage (Hessle Haven to Hessle Country Park Hotel)

The existing flood defences are considered to be in a poor condition and to provide a low standard of protection. The shoreline is being worn away by tides and waves in places, which in time will threaten some of the defences. The EA expect that the maintenance of these defences in the future will become increasingly expensive and other ways of managing the flood risk may need to be considered.

Close to the foreshore of the Hessle Country Park is the Scheduled and Grade II Listed Cliff tower mill and whiting works (NHLE 1021074; NHLE 1161742). It is possible that in future that this designated heritage assets will come under increasing threat of coastal erosion and flooding.

10.1.6 Yorkshire - Flood Area 8: North Ferriby

The area is mainly residential, although there is some farmland and the old Church Lane landfill site at its eastern end. The edge of this site is being eroded by tides and waves,

which could release contaminants into the estuary. Part of the main railway to Hull is on the edge of the area but is considered to be above the level of flood risk.

At present the EA are continuing to maintain the defences along the edge of the estuary but as sea levels rise a managed realignment or withdrawal may be considered.

No designated heritage assets are currently under risk but higher rates of coastal erosion in the area of North Ferriby could reveal further later prehistoric finds – the area already has a high concentration of findspots (for example, the North Ferriby boats, see Section 6.1.7).

4.1.1 Yorkshire – Flood Area 9: Brough

This Flood Area is sub-divided in two sub-areas: 9a, Brough (Welton Water) and 9b, Brough (BAE Works).

Most of the properties are residential and are located in Brough, at the western end of the area, which also contains an important factory and airfield owned by BAE. The eastern end (Welton Water) contains old gravel/clay extraction pits, which are now used for recreation (fishing and sailing), nature conservation and the Brickyard Lane landfill site (see Section 2.2.5 for further description). Although not a flood defence issue, the landfill site is being eroded by waves and tides, which could release contaminants into the estuary. The EA are reviewing the risk of allowing the erosion of the landfill site to continue but any work needed as a result will be separate from the flood defence strategy.

The existing flood defences at the western end have been improved but in 2008, the EA considered that work was needed to improve the condition of the remaining defences.

In 2008, the EA envisaged that it would continue to protect Brough and the BAE factory by building a new bank from the end of the defences across the airfield to high ground behind Welton Water.

However, the justification for maintaining the defences at the eastern end of the area cannot, the EA considers, be justified as they protect very few properties. Although the EA may not be able to carry on maintaining the existing defences, others may be able to obtain the approvals needed to do so while complying with the relevant regulations.

While there are no designated heritage assets at immediate threat, there are a high number of non-designated heritage assets at risk of being exposed by continuing erosion at Redcliff. The area has a high concentration of Bronze Age, Iron Age and Romano-British finds (MHU16383; MHU960).

4.1.1 Yorkshire – Flood Area 10: Brough Haven to Weighton Lock

In 2008, the EA noted that the existing flood defences between Brough Haven and Crabley Farm had been improved but that the remaining defences were not owned by the EA but managed by others and were in a fair to poor condition; many were too narrow and difficult to maintain and in need of improvement within the next 15 to 20 years.

As part of the 2100+ Strategy, the EA are considering the possibility of keeping some lengths of the defences lower than others, so that certain areas will be flooded in a managed way to minimise damage during a major event. This Area, as with Flood Areas 11 and 13, is being considered for altering the height of some of the flood defences.

There are no designated heritage assets within the area, other than the Scheduled Lock and Grade II Listed Sluice at Weighton Lock (NHLE 1005217; NHLE 1031829 respectively). It is possible that in the longer-term that the lock and sluice may require upgrading and strengthening. If further major flood defence improvement schemes are required here, they will probably go through the planning system and therefore, there will be future opportunities for archaeological mitigation. Minor changes to privately-owned defences are likely to require an EA licence, and there is a possibility that there will be limited heritage input into mitigating the effects of the schemes on heritage assets.

In close proximity to Brough Haven are a small cluster of non-designated heritage sites, however, other than a findspot of Roman coins (MHU1339) these are predominantly the site of industrial buildings and yards dating to the 19th and 20th centuries. Away from the Haven there are only a few non-designated heritage assets at risk of flooding and those that are at risk are of local significance, mostly being associated with the enclosure

and improvement of this low-lying area (for example, MHU22607) although the surviving medieval flood bank (MHU175) is an interesting and relatively rare survival.

10.1.7 Yorkshire – Flood Area 11: Weighton Lock to Boothferry Bridge

Within the RCZAS survey area, this Flood Area contains the villages of Faxfleet and Blacktoft, together with many scattered residential properties and farmsteads, within an area of Grade 2 agricultural land. The Weighton Canal and its corresponding designated sluice and lock gates (see below) form an important component of the flood defences of the area, helping to manage water levels and drainage in the surrounding low-lying land. The EA's 2008 Flood Strategy considered the defences were generally in a reasonable condition, providing an appropriate standard of protection. However, they highlight that the banks of the River Ouse are being eroded in a number of places and there is concern about the defences in some places, including a stretch to the west of Blacktoft that will need to be improved within the next 15 years. This area contains few identified heritage assets other than the former site of ridge and furrow recorded as cropmarks from aerial photographs (MHU22605).

This Flood Area, as with Flood Areas 10 and 13, is being considered for altering the height of some of the flood defences (see Flood Area 10 for fuller explanation) (Fig 10.3).



Figure 10.3 A modern navigation beacon built in top of the flood defence bank near Faxfleet, East Riding of Yorkshire.

In the longer-term the strengthening of defences could require the updating of Weighton Lock; the sluice is a Grade II Listed Building (NHLE 1031829) and the lock, a Scheduled Monument (NHLE 1005217). Weighton Lock forms an important part of the flood defences in the area and it is possible that in future, the defences here will need to be strengthened (see Section 11.2.4 for a fieldwork opportunity as part of a Phase Two RCZAS project). If further major flood defence improvement schemes are required here, they are likely to go through the planning system and therefore, there will be future opportunities for archaeological mitigation.

Severe storm surges and flood events such as those experienced in the winter of 2013–14 demonstrate that if defences are breached, extensive flooding could occur. This may be expected to increase as a result of increased frequency of storm events and rising sea

levels. If a major flooding event occurred it is possible that the designated heritage assets of the Scheduled earthwork site of a moat (and earlier monastic farm) at Hall Garths (NHLE 1007737) and the Grade II Listed 18th century house at Faxfleet (NHLE 1352656) could be at risk – a risk that is likely to increase in the future. Likewise, at Blacktoft, the Grade II Wesleyan Chapel (NHLE 1083333) and Church of Holy Trinity (NHLE 1346686) could be risk of a major flooding event.

10.1.8 Yorkshire - Flood Area 13: Goole Fields and Crowle

Flood Area 13 covers the land lying between the Rivers Ouse and Trent. A number of villages including Adlingfleet lie just outside the RCZAS survey area, but the survey area itself consists entirely of Grade 2 agricultural land, and a small number of dispersed farms. The Area has recently been affected by serious flooding, due to high flows in the River Don, as occurred in the Winter of 2019–2020.

In 2008, the EA considered that the defences were generally in a reasonable condition, providing an adequate standard of protection although in places, the riverbanks are being worn away and may require localised repair.

This Area, as with Flood Areas 10 and 11, is being considered for altering the height of some of the flood defences (see Flood Area 10 for fuller explanation).

No designated heritage assets lie within the area of the RCZAS project. On the landward side, in close proximity to the current flood defence banks, are several non-designated heritage assets in the area including early medieval and medieval finds near the mouth of the old River Don (MHU17798) and extensive areas of medieval ridge and furrow (MHU22605–06).

10.2 Lincolnshire

10.2.1 Lincolnshire – Flood Area 16: Alkborough

The existing flood defences at Alkborough Flats were modified by the EA in 2006 so that just under half the area will flood on most high tides while the remainder will be available to store water during extreme events. In 2008, the EA considered that the defences were in good condition and were expected to last for at least 30 years before any major improvements were needed.

The Flats are now managed by the RSPB as a nature reserve, with a managed breach in the flood defences providing about 170ha of intertidal habitat to replace the losses caused by flood defence works and sea level rise. The remainder of the area provides marshy rough grazing and reedbed habitats.

The EA aims to maintain the existing defences and the new structures, so the scheme continues to provide flood defence benefits by lowering water levels during extreme events. It is possible, but entirely speculation, that if sea levels rise and there is a greater potential risk of flooding, that the area of intertidal habitat may need to be expanded and further openings made in the existing defences.

There are no designated heritage assets within the area of the Flats, but the area has archaeological potential in terms of palaeoenvironmental evidence (see Section 6.3.1).

10.2.2 Lincolnshire - Flood Area 17: Whitton to Winteringham

Most of the properties at risk are in the villages of Whitton and Winteringham, at the edge of the floodplain. The rest of the area is Grade 2 agricultural land containing scattered farms and a high-voltage power line. The land is principally drained through a system of channels to an outfall at Winteringham Haven.

The existing flood defences were considered to be in good condition by the EA in 2008 except at Whitton Ness where there was a risk that they could be eroded. Maintenance support is likely to be withdrawn, leading to landowners having to maintain the defences.

If the defences are withdrawn from active management, there is likely to be an increased risk of flooding. Due to the topography and geology this could be relatively limited in extent and there are no designated heritage assets at risk in this Flood Area, other than perhaps the Old Vicarage at Whitton (NHLE 1241772).

Severe storm surges and flood events such as those experienced in the winter of 2013–2014 demonstrate that if defences are breached, extensive flooding could occur. This may be expected to increase as a result of increased frequency of storm events, rising sea levels and periods of heavy rainfall. If a major flooding event occurred, it is possible that a limited number of non-designated heritage assets will be at increased risk, however, most of the identified sites are of local significance associated with the post-medieval agricultural use of the area. Nonetheless, as Section 6.3.3 demonstrates, the area surrounding the site of Old Winteringham has high archaeological potential (see Section 11.2.5 for a research opportunity here).

10.2.3 Lincolnshire – Flood Area 18: Winteringham Ings and Flood Area 19: South Ferriby

Flood Area 18 includes the Ancholme Valley, and extends beyond the survey area, southwards up the river valley to Brigg. South Ferriby forms Flood Area 19 and is a large village, nestled at the foot of the Lincolnshire Wolds, on the edge of the flood plain. The two adjacent Flood Areas are separated by the River Ancholme and flooding in one can affect the other.



Figure 10.4 Looking across the South Channel to the eastern edge of Read’s Island from the flood defence bank near South Ferriby CEMEX plant. The area experiences high rates of coastal erosion and the flood defences here have recently been upgraded.

In 2008, it was noted by the EA that strong tidal currents that flow along the channel between the shore in and around Read’s Island are damaging the existing flood defences and the A1077 behind them (Fig 10.4). The EA’s South Ferriby and Winteringham Ings Sea Defence Improvements scheme was started in 2019 to reduce the risk of erosion with the construction of new defences (largely on the footprint of the old defences).

However, both Flood Areas are at risk of flooding from high flows in the River Ancholme and therefore the Scheduled South Ferriby sluice (NHLE 1005244) could be vulnerable to future flooding events. Severe storm surges and flood events such as those experienced in the winter of 2013–2014 are expected to increase as a result of increased frequency

of storm events and rising sea levels, and therefore, the sluice may require further upgrading and strengthening.

With the increased risk of flooding in the future if a major event breached the existing defences it is possible that the eastern part of the Scheduled area of Old Winteringham Romano-British settlement (NHLE 1005243) could be affected, as it lies in close proximity to the flood defences and is low-lying (see Sections 11.2.4 for a fieldwork opportunity as part of a Phase Two RCZAS project). At South Ferriby, the Grade II Listed South Ferriby Hall (NHLE 1215058), is also located in close proximity to the existing flood defence bank. The area has a high number of non-designated heritage assets in close proximity to the existing flood defences. These include a range of monument and evidence types and as Section 6.3.3 outlines the area has a high archaeological potential for the Romano-British period and for palaeoenvironmental evidence, including the history of the development of (and eventual re-routing) of the River Ancholme (see Section 11.2.6 for a fieldwork opportunity).

10.2.4 Lincolnshire – Flood Area 20: Barton Cliff to Barton Haven

This Flood Area is sub-divided into units; Flood Area 20a (Barton Cliff to Humber Bridge) and Flood Area 20b (Humber Bridge to Barton Haven).

In 2008 the EA considered that the existing estuary defences were in good condition and would not require major improvement for more than 20 years. The EA is continuing to maintain all the existing defences but as there are very few properties at the western end of the area (Flood Area 20a), it is likely that the defences here will be withdrawn and potentially, a secondary shorter defence built near the Humber Bridge to further protect Barton-upon-Humber. This option is under review as part of the 2100+ strategy.

This would protect the William Blyth tile yard (Grade II Listed Buildings: NHLE 1390935; NHLE 1391189-91) and the scatter of Grade II Listed Buildings in Barton (NHLE 1045862; NHLE 1083041; NHLE 1039878; NHLE 1045883; NHLE 1346818), but the area is vulnerable to flood damage if defences are over-topped.

Behind the protection of the flood defences, are several sites of former tile and brick works (all non-designated heritage assets). Most survive as flooded pits and earthworks and form important habitat for birds. On the estuary side of the existing flood defence bank are the remains of former jetties associated with the brickworks. With the expected rise in sea levels and major flood events it is possible that these non-designated heritage assets will come under increasing risk of coastal erosion and flooding damage, including the Adamant cement works and a Romano-British settlement near Leggott's Quarry (see Sections 11.2.2 and 11.2.6 for further fieldwork and outreach opportunities as part of a Phase Two RCZAS project).

10.2.5 Lincolnshire – Flood Area 21: Barton Haven to Barrow Haven

Most of the properties at risk are in Barton with a few near Barrow Haven. In 2008, the EA stated that the existing flood defences required major improvement in about 20 years, with maintenance and improvement expected to continue in the longer-term as sea levels rise.

In Barton, the Grade II Listed Ropewalk (NHLE 1346819) could be at risk due to its close proximity to Barrow Haven and the estuary edge if a major flooding event occurred, breaching the existing flood defences. This increased risk is also likely to apply to the Grade II Listed Buildings at the former William Blyth Hoe Hill site (NHLE 1390936; NHLE 1391192-94). Although entirely speculation, a major event could also impact upon the Scheduled HAA gun site, 220m east of West Marsh Cottage, to the south west of Barrow Haven (NHLE 1020024). With the expected rise in sea levels and major flood events it is possible that these designated heritage assets will come under increasing risk of flooding although the upkeep and improvement of the existing flood defences will reduce the risk (see Sections 11.2.2 and 11.2.6 for further fieldwork and outreach opportunities as part of a Phase Two RCZAS project).

Behind the protection of the flood defences, are several sites of former tile and brick works (all non-designated heritage assets). Most survive as flooded pits and earthworks.

On the estuary side of the existing flood defence bank are the remains of former jetties associated with the brickworks. With the expected rise in sea levels and major flood events it is possible that these non-designated heritage assets will come under increasing risk of coastal erosion and flooding damage.

10.2.6 Lincolnshire – Flood Area 22: Barrow Haven to East Halton Skitter

Most of the property at risk is located in the villages of Barrow and New Holland (most of which lie outside the RCZAS study area), and on the edge of the floodplain at Goxhill.

In 2008, the EA identified a suitable site for creating new intertidal habitat at East Marsh, north of East Halton Skitter, Goxhill. However, the site's development depends on whether the existing defences continue to be maintained. A decision is unlikely to be made until after 2040. This could be combined with the construction of a secondary line of new defences to protect the areas of denser settlement at Goxhill, Barrow and New Holland.

At New Holland, close to the port, the Flood Area contains two Grade II Listed Buildings; the Lincoln House Hotel and Manchester Square (NHLE 1103700; NHLE 1346853 respectively) (Fig 10.5). Forming part of the settlement of New Holland, the Listed Buildings will be protected by the flood defences which will be maintained and upgraded (as outlined above).



Figure 10.5 The Grade II Lincoln House Hotel, now dock offices, at New Holland, North Lincolnshire.

Behind the protection of the flood defences, are several sites of former tile and brick works (all non-designated heritage assets). Most survive as flooded pits and earthworks. On the estuary side of the existing flood defence bank are the remains of former jetties associated with the brickworks. With the expected rise in sea levels and major flood events it is possible that these non-designated heritage assets will come under increasing risk of coastal erosion and flooding damage (see Sections 11.2.2 and 11.2.6 for fieldwork and outreach opportunities as part of a Phase Two RCZAS project).

The increased risk of coastal erosion may also reveal further findspots and sites of past activity. The existing HER data for the coastline between Goxhill Haven and East Halton Skitter shows a high number of sites located in the intertidal area and foreshore including

a findspot of a hand axe (MLS19306), a possible fish trap (MLS22549), a possible wreck (MLS26204) and closer to East Halton Skitter, a scatter of Romano-British, medieval and post-medieval pottery sherds (MLS1591) and, potentially, an Iron Age figurine (MLS17785). Section 11.2.6 outlines an opportunity for further fieldwork here as part of a Phase Two RCZAS project.

The Flood Area is large and contains several areas where archaeological assessment, evaluation and excavation has shown a high archaeological potential, for example, inland of East Halton Skitter where archaeological excavation has revealed finds and features associated with Bronze Age and Romano-British activity (see Section 6.3.6).

10.2.7 Lincolnshire – Flood Area 23: Halton and Killingholme Marshes

This Flood Area is sub-divided into two units; Flood Area 23a (Halton Marshes) and Flood Area 23b (Killingholme Marshes).

The Halton Marshes Flood Area includes farmland and dispersed settlement in the form of single farmsteads but near to Killingholme Marshes, the area becomes increasingly dominated by large-scale port infrastructure in the form of the Humber Sea Terminal.

The foreshore is being worn away, resulting in the existing flood defences along the whole frontage, particularly at Halton Marshes, being extremely vulnerable in the short-term and in 2008, the EA considered that improvement was needed in the next 10 to 20 years.

Both Areas lie within the proposed South Humber Bank development site which has been allocated for port-related industry or commercial activities. Due to the regional and national strategic importance of this land for port-related development it is likely that the flood defences will be maintained and strengthened, or perhaps, as part of development, realigned to protect commercial activity.

While the strengthening of the defences may affect the setting of the Grade II Listed High and Low lighthouses at Killingholme (NHLE 1103706; NHLE 1215093) and Killingholme North Low Lighthouse (NHLE 1103707), the works will ensure that these designated heritage assets are at a lower risk of flooding in future.

Due to the demand for port-related development in this Flood Area there has been considerable amount of archaeological recording of non-designated heritage assets (see Section 6.3.8 for details) – sites that predominantly survive as buried archaeology including palaeoenvironmental evidence. The existing data suggests that parts of the Flood Area have a high archaeological potential for later prehistoric settlement, especially in the area to the south west of East Halton Skitter (Romano-British settlement; MLS20086); Killingholme Marshes (undated cropmark enclosures, MLS20082 and MLS21156) and in the area of Station Road (multi-phase sites; MLS21567; MLS21568; MLS20789).

10.2.8 Lincolnshire – Flood Area 24: Immingham to West Grimsby.

Most of the residential properties at risk are in the towns of Immingham and Grimsby, although there are some in Stallingborough and Healing (all these settlements, however, are outside the RCZAS survey area).

A large part of the Flood Area lies within the proposed South Humber Bank development site and has been allocated for estuary related activities. It already contains major industrial and commercial facilities, including wharves, storage areas, petrochemical and power plants (Fig 10.6). The area also contains important road and rail links and high voltage power lines, while most undeveloped land is used for agriculture.

The existing flood defences generally provide a good standard of protection. However, in 2008 the EA noted that the foreshore was being eroded, weakening the flood defences.

Following the devastating 2013 tidal surge which threatened the Port of Immingham, a programme of improving the flood defences has been put in place.

There are no designated heritage assets in this Flood Area and many of the non-designated heritage sites recorded in the North Lincolnshire HER have been destroyed in advance of modern port and industrial development. There is undeveloped land in the Area where potential buried archaeology has been identified as cropmarks from analysis

of aerial photographs by the AI&M project (Fleming and Royall 2019) including to the north of Old Fleet Drain where there are possible later prehistoric ring-ditches and to the south of Kiln Lane, a possible cropmark enclosure site. The flood defences here will be maintained and upgraded, however, a major flood event could affect these areas, if the defences are breached.

Close to Immingham Dock, in the intertidal area, the AI&M component has also identified features which are the possible remains of fish traps although further research is needed to confirm this interpretation.

The increased risk of coastal erosion and the likelihood of more intense and prolonged storm events as sea levels rise and climate change intensifies may reveal further findspots. In the intertidal area close to where the Old Fleet Drain empties into the Humber, and to the west of the mouth of the River Freshney, Pyewyke, are a flint scatter (recorded by this RCZAS project from PAS data) and artefact scatter (MNL2088), with finds eroding out of the coastal edge. It is possible that as the potential for coastal erosion and coastal squeeze increases that further finds at these locations will be revealed and as Section 11.2.6 outlines, there is an opportunity in this area for a field walking project conducted by volunteers).



Fig 10.6 Looking to the Port of Immingham from the modern sea defence wall to the north of where Stallingborough Haven was once located. (Photograph taken by CAU in 2015).

10.3 The Flamborough Head to Gibraltar Point SMP 2

The two Policy Areas that fall within the survey area are:

1. SMP Policy Unit K, Easington Road to Stone Creek (north bank of the River Humber, Yorkshire); and
2. SMP Policy Unit L, East Immingham to Cleethorpes (south bank of the River Humber, Lincolnshire).

These areas of the estuary are included within the SMP boundary because it has been shown that sediment cells straddle the mouth of the Humber so that coastal processes along the Holderness coast of Yorkshire also have an impact along the Lincolnshire coastline (Scott Wilson 2010, 7).

The three periods of time in which a Shoreline Management Plan is assessed are known as 'Epochs'. The first epoch is 0–20 years (to 2025), the second epoch is 20–50 years (to 2055) and the third epoch is 50–100 years (to 2105).

In terms of defences four generic options for shoreline management were considered by the SMP, as identified in the shoreline management guidance defined by Defra (2006). The options are listed in Table 10.1 below.

<i>Hold the line (HTL)</i>	Maintain or upgrade the level of protection provided by defences.
<i>Advance the line (ATL)</i>	Build new defences seaward of the existing defence line.
<i>Managed realignment (MR)</i>	Allowing retreat of the shoreline, with management to control or limit movement.
<i>No active intervention (NAI)</i>	A decision not to invest in providing or maintaining defences.

Table 10. 1 Shoreline management policies.

10.3.1 Policy Unit K: Easington Road to Stone Creek

Policy Unit K is within SMP Policy Development Zone 2 and Character Area 11, Easington Road to Stone Creek. Policy Unit K also falls within Flood Areas 2 and 3 as defined in the EA's 2008 Humber Flood Risk Management Survey (see Sections 4.1.1, 4.1.2, 6.1.1, 6.1.2, 10.1.1, 10.1.2).

The overarching policy is to Hold the Line and maintain the standard of flood protection in all three epochs except for the limited Managed Realignment of defences at Outstrays (Sunk Island) to Skeffling.

The SMP states that all property, and all known designated and significant historic environment assets and the majority of agricultural land will continue to be protected. However, in order to ensure sustainable defences and meet the requirements of environmental legislation, limited managed realignment of defences is likely and some Grade 2 agricultural land is likely to be lost as part of realignment. While the SMP at this stage cannot indicate where these schemes might take place, it reassures that, 'Detailed studies will identify sites which will be in the order of 100 hectares for epochs 1 and 2 combined. Any Managed Realignment of defences will not adversely affect property or known designated and significant historic environment assets' (Scott Wilson 2010, 143-149).

Since the SMP, the details of the Outstrays to Skeffling Managed Realignment Scheme have been designed and archaeological assessment and mitigation undertaken as part of the planning process (see Sections 6.1.2 and 6.1.3 for further discussion).

10.3.2 Policy Unit L: East Immingham to Cleethorpes

Policy Unit L is within the Policy Development Zone 3 and Character Area 12, East Immingham to Grimsby Docks.

The SMP outlines that the coastal defences will be held in their current position and their function will be maintained in all three epochs, if viable.

The policy for the south bank of the Humber will ensure continued protection from coastal erosion and coastal flooding for assets in the floodplain, including the significant industry, port and residential areas between Immingham and Grimsby.

It is also considered that this policy will also ensure that the historic environment assets within the area continue to be protected from coastal erosion and flooding. The decision to continue to 'hold the line' means that will erosion of this frontage is prevented, there will be a resulting reduction in the supply of sediment to intertidal and subtidal habitats creating coastal squeeze. This, the SMP considers, will further be exacerbated by sea level rise and this could require Limited Managed Realignment in the medium and long-term. This policy will ensure flood protection can be sustained over the longer term for

the majority of assets, including settlements, known significant and designated historic environment features and the majority of high-grade agricultural land (Scott Wilson 2010, 150-155).

11 Opportunities

The regional heritage themes and research aims for the Yorkshire and East Midlands Research Frameworks relevant to the Inner Humber estuary are presented in the first part of this section (Roskams and Whyman 2007; East Midlands Research Framework website respectively).

In the second part of this section, these strategic research priorities have been studied in conjunction with the results of the DBA component of this project, to produce recommendations for further fieldwork, research and outreach for a potential Phase Two RCZAS project (Dudley and Grant 2021).

11.1 Research priorities and themes

11.1.1 Yorkshire Archaeological Research Framework

The framework does not include summary statements for identified research objectives as with the East Midlands Framework (see Section 11.1.2 below). For each chronological period the framework has a section discussing the research objectives. Suitable sections relevant to the Inner RCZAS survey area are selected below.

- **Palaeolithic period**

'Further mapping of the palaeoenvironment might identify such 'niches' [other pre-Devensian sediments protected from later glaciation], for example on the fringes of the Vale of York [and the former extent of Lake Humber']. Finally, re-deposited artefacts could always be recovered from glacial tills elsewhere, although the implications of their spatial context may not be so obvious.' (p20).

- **Mesolithic period**

'To take things forward here, we require first a more balanced distribution of assemblages, whether by searching for material in a seemingly blank 'upland' area such as the Wolds or, more critically, by endeavouring to investigate the low-lying Vale of York (*cf* the issue of the margins of Lake Humber here, as noted under the discussion of the Palaeolithic period).'

'Whether we are endeavouring to acquire more material from or to give more chronological resolution to what we already have, it will be vital to research the functional and chronological aspects of the data in unison. This principle has been fundamental to the construction and analysis of the Resource Assessment database and remains essential if we are to approach questions of differences in chronology, subsistence strategy, site functions or 'cultural' grouping in a systematic way.' (p22).

- **Neolithic period**

'However, investigating these relationships and variations [of lithic assemblages and finds] in corresponding detail elsewhere is hampered by the lack of chronological resolution in much of the material in the database of the Resource Assessment.' 'Halkon (2003), in the east, has proven the value of integrating archaeological and palaeoenvironmental techniques.' (p23).

- **Iron Age**

'to consider more carefully the relationship between the start of the Iron Age and its predecessor; and the requirement to relate settlement to landscape development on a more systematic basis.' (p29).

- **Romano-British period**

'Equally, comparison of Roman and Iron Age land enclosure suggests a shift in focus from the Wolds to the Vale, with the aforementioned development of large rectangular fields sometime within this period on the Magnesian limestone (Roberts *et al* 2001).'

'we need to fill important gaps in the database for this period, notably in the not-so-obviously 'Romanised' parts of its settlement systems, and to increase the quality of that data.' (p31).

11.1.2 East Midlands Archaeological Research Framework

- **Strategic Research Objective: 2A Enhance understanding of the environmental background to Mesolithic activity.** 'There is a need to obtain more closely dated pollen sequences from upland, riverine and coastal peat deposits and to extend the investigation of ancient environments to include isotope studies of the organic fractions of coastal and riverine sediments.'
- **Strategic Research Objective: 2B Characterise the regional and local evidence for Mesolithic activity.** '...further review of the surface evidence, together with associated excavation, has much to contribute to our understanding of Mesolithic activity in the region.'
- **Strategic Research Objective: 2G Investigate the topographic locations of activity foci.** 'More attention should be paid to the topographical attributes of Mesolithic activity foci, which have been recorded in a wide variety of locations. Prominent or elevated sites seem often to have been favoured for open-air sites, including hilltops and, in regions of subdued topography, subtle ridges and sand islands. Proximity to wetland resources may have been important...'
- **Strategic Research Objective: 2I Exploring Doggerland: target submarine landscapes and the modern coastline.** 'Coastal erosion may also reveal Mesolithic deposits of environmental and cultural value, in some cases well preserved beneath blown sand, and it is recommended that priority be accorded to the identification and targeted investigation of such sites.'
- **Strategic Research Objective: 5I Support research and publication of landscape syntheses.** 'Such studies [landscape synthesis] could usefully be combined with palaeochannel surveys comparable to that conducted in the Trent Valley, which may assist in locating Roman river courses and hence areas of potential interest for the preservation of riverside installations.'
- **Strategic Research Objective 6H: Assess the evidence for extractive industries in the late Anglo-Saxon and Viking periods.** 'Key research questions include the [...], [and] the origin and character of the 'salt-hills' that it has been suggested were accumulating from before the early to mid-tenth century in the Lindsey marshes.'
- **Strategic Research Objective 9D: Investigate the use of rivers for transport and power and their relationship to other communications networks.** 'The rivers were important for moving and distributing not only the products of the extractive industries, especially coal and lead, but also the products of agriculture, such as grain and timber, and those of rural and urban industry, such as pottery, brick and tile. They were pivotal, therefore, to the industrialisation of the region.'

11.2 Recommendations for further work

The following opportunities for further fieldwork, assessment, research, and outreach focus on designated and non-designated heritage assets at risk, encouraging closer communication across the estuary, and developing a volunteer-based programme for the potential Phase Two component of the Inner Humber RCZAS.

11.2.1 Creating a Humber Estuary Historic Environment Forum

There is an opportunity to form a Humber Estuary historic environment forum which could help ensure that cross-border sharing of goals and research. The division, at present, is re-enforced by the splitting of the estuary between separate research frameworks.

In this respect, the forum could focus on specific items in an annual or bi-annual conference which switched between Yorkshire and Lincolnshire. Potential areas of research include recent palaeoenvironmental work undertaken on each side of the estuary and/or the research into the Roman period settlements close to Ermine Street, for example at Brough and in the area of Ferriby Sluice and Old Winteringham.

11.2.2 Celebrating the North Lincolnshire brick and tile industry

Thematic study could focus on the manufacture of brick and tiles to improve the understanding of the post-medieval development of the coastal edge of the estuary, and how these man-made features have contributed to the natural heritage of the area since their flooding and repurposing. Likewise, the research could link to the continuing vestiges of the industry at Goxhill and the William Blyth works at Barton, both in North Lincolnshire and to the past use of Humber barges for trading the products of the industry. The evidence and narrative generated from such work could be used to improve any interpretation material for the footpath that utilises the flood defences and passes dozens of flooded pits.

11.2.3 Explaining past environmental and landscape change to link to the present

There is an opportunity to link an understanding of flooding, past sea-level and climatic change with the challenges that are faced by people in the local area today. Due to the work of the Humber Wetlands project, and WAERC, combined with the results of several more recent sampling projects, the area has a wealth of palaeoenvironmental analysis (as demonstrated in Section 5 of this report).

The results of the Humber Wetlands Project have been synthesised for a wider audience by Van de Noort (2004), but there is an opportunity to update and summarise this information further into a downloadable pamphlet aimed to a popular audience, broadening the reach of this understanding further. This could show how and why the extent of the Humber Estuary and its surrounding landscape has continually fluctuated over time, with the aim to heighten the broader understanding the historic development of the estuary, the potential future challenges local residents face in terms of flooding and coastal change and explain the risk to heritage assets and how this is managed.

A critical component of this work could be to stress that non-designated heritage assets also make a valuable contribution to our heritage and cultural by providing evidential, historical, cultural and aesthetic value.

This potential project could tie in with, and support, the wider stakeholder engagement of the 2100+ Humber Strategy.

11.2.4 Assessing Scheduled Monuments

Paull in the East Riding of Yorkshire has a concentration of Scheduled Monuments associated with defence that are on Historic England's HAR Register. There is an opportunity to improve the recording and history of these monuments to aid their future conservation.

Paull Holme tower (NHLE 1007875), although not strictly a military defensive site, is an unusual mid-15th century three-storey brick tower house and moated site, originally part of a larger manorial complex. Historic England has recently grant-aided the reinstatement of the roof and the rebuilding of the crenellations but some further repairs are required to low-level brickwork and the ground floor vault. The nearby Paull Point Battery, coastal artillery battery and Submarine Mining Establishment (NHLE 1020425) is suffering from localised coastal erosion (Fig 11.1).

None of these heritage assets have been subject to historic building recording or archaeological assessment similar to that undertaken in 2013 for the anti-aircraft battery at Stone Creek farm (NHLE 1020187; Dennison 2013).

On the opposite side of the river at West Marsh, near Barton, the WWII HAA gun site 220m east of West Marsh Cottage (NHLE 1020024) is in need of conservation and is on the 2020 HAR Register. The heritage asset has not been subject to recording or assessment other than for designation, and the Scheduled area for the site has been recommended for review by the AI&M project (Fleming and Royall 2019).

On the Lincolnshire side of the estuary, the Old Winteringham Roman settlement (NHLE 1005243) is being affected by arable ploughing and is on the 2020 Heritage at Risk Register (Appendix 1). There is a potential opportunity for volunteer-led research and if the landowner is amenable, a programme of geophysical survey and field walking across

the entire site could be undertaken. This is an additional site where the Scheduled area has been recommended for review by the AI&M project (*ibid*).



Figure 11.1 Paull Point Coastal Battery – in places it is at risk of coastal erosion.

There is a high concentration of heritage assets close to the foreshore of the Hesse Country Park including the Scheduled and Grade II Listed Cliff tower mill and whiting works (NHLE 1021074; NHLE 1161742). While the tower is not at immediate risk from flooding, there is the potential for the flood defences here to receive less investment in the future (see Section 10.1.5), and a survey and assessment of these features at an early opportunity could benefit their future conservation.

11.2.5 Investigating Conservation Areas and Listed Buildings at risk

The PHS for Hull (Cornwall Archaeological Unit 2016a) identified the area of St Andrew's Dock and its heritage assets as at high risk (Fig 11.2). The assets include the remaining section of the Dock, its lock entrance and the cluster of port buildings either side of it, including the Grade II hydraulic tower (NHLE 1197632); all forming part of the adopted Conservation Area. All these buildings and structures are currently unused and in deteriorating condition. St Andrew's Dock is the last historic dock in Hull not to be fully redeveloped. The Conservation Area is currently included in Historic England's 2020 HAR Register (see Section 2.3.1).

The Lord Line building, hydraulic tower and pump house, and the ice factory in the Conservation Area are directly related to past use of the dock by the deep-sea fishing industry. The cluster of late 19th century and early 20th century dockside buildings at the eastern end of the Dock are unused and have been the repeated target of vandalism.

There is currently little public information available about the history of these iconic buildings, particularly the early 20th century Lord Line Building: The Conservation Area Character Assessment dates to the mid-1990s (Hull City Council 1996). Hull-based Fresh Design International have undertaken a virtual reality visualisation of the historic

buildings as part of a regeneration proposal. To enable this, a Level 3 Historic building survey (as defined by Historic England 2016) was undertaken with the use of a digital point-cloud scanner, the scan of which was used to produce a 3-dimensional model of the building which could be interrogated, manipulated and used for the development of potential schemes. (Fresh Design International, St Andrew's Dock Conservation Area web page).



Figure 11.2 The entrance to the St Andrew's Dock, St Andrew's Conservation Area, Hull. (Photograph taken by CAU in 2015).

STAND, The St Andrew's Dock Heritage Park Action Group, was founded to help celebrate Hull's past as a nationally important fishing port. The Group provide volunteer support for the *Artic Corsair* as well as for its shore-based museum, and organise an annual memorial service dedicated to the lives of trawlermen lost at sea (STAND website).

Supporting STAND's work to raise the awareness of their significance to Hull is an opportunity to raise the public profile of the Conservation Area further. This is more likely to result in a programme of redevelopment designed with the area's heritage in mind. It would also tie, and complement, the Hull: Yorkshire's Maritime City project (see website).

The Scheduled sluice at South Ferriby (NHLE 1005244) and Grade II Listed sluice at Weighton Lock (NHLE 1031829) and Scheduled lock (NHLE 1005217) are maintained as part of existing flood defences. In future, these may come under increasing pressure to be strengthened. While these improvements are likely to form part of a planning application, the conservation of these designated heritage assets could benefit from a programme of archaeological assessment and historic building recording.

As Section 10.1.2 explains, in the longer-term it is possible that a number of Listed Buildings in low-lying locations close to the estuary edge will come under increasing risk of coastal flooding. This includes South Farm, Sunk Island: a Grade II Listed farmhouse (NHLE 1083467; MHU 7503).

A programme of historic building recording, perhaps volunteer-led, could ensure that these buildings/structures are recorded before any major flooding event and to enable heritage-led conservation if damage from flooding occurs.

11.2.6 Sites and areas identified by the DBA component

Fieldwalking in areas of high coastal erosion and/or high potential

Several records of artefact findspots, mainly discoveries made by the Humber Wetlands Project, were added to the Humber HER in the area of Red Cliff, North Ferriby, East Yorkshire where the river cliff is rapidly eroding. This stretch of coastline, including the intertidal zone, could be incorporated into a regular programme of field walking and recording undertaken by local volunteers.

Other potential areas which could benefit from similar effort include the intertidal area and foreshore at South Ferriby Cliff, and from Goxhill Haven around to East Halton Skitter (North Lincolnshire) and in the area of Pyewype, to the west of the River Freshney (North East Lincolnshire). These areas have a high concentration of finds and artefact scatters being exposed by coastal erosion, and changes to the sediment cover of the intertidal area. The section of coast between Goxhill to East Halton Skitter is a potential priority as the EA anticipate the need for a major realignment of defences in the area of East Marsh after 2040 (see Section 10.2.6).

All these areas contain known sites of lithic material and could contribute to improving the evidence for Mesolithic flint scatters and assemblages, supporting the goals for the Mesolithic identified in the Yorkshire and East Midlands Research Agendas (Section 11.1).

A Palaeochannels project

There is the potential to extend the Trent Valley palaeochannels project (Malone and Stein 2017) to cover the coastal margins of the Humber Estuary. As part of the AI&M component of this survey there was limited plotting of palaeochannels from aerial photographs and the existing EA Lidar data, however, the EA are currently resurveying the entire area with more detailed Lidar data, including places where potential realignment is planned and/or where the research potential exists.

This project could tie in with the research objectives identified in the East Midlands Research Framework (2a, 2b, 2g, 5i and 6H) and the Mesolithic period for the Yorkshire equivalent (see Section 11.1) by creating a better understanding of the estuary edge, its tributaries and the micro topography of the flanking landscape, enabling to better target potential sites for early settlement in the Mesolithic period, later prehistoric and Romano-British activity and early salt-making industry.

Two areas where the potential could be investigated further is in the areas of surrounding the Romano-British settlements at Brough and Old Winteringham. This would tie in with the Research Objective 5I, Support research and publication of landscape syntheses of the East Midlands Research Framework (see Section 11.1.2).

Another area where there is potential is the Ancholme Valley, where there is a known as a high concentration of later prehistoric features and sites, and several phases of comprehensive landscape change.

Rapid surveys

Survey of smaller, under-studied, riverine settlements is likely to result in a higher density of recorded heritage assets, especially long-established settlements such as Blacktoft, Faxfleet, Brough and Paull (East Riding of Yorkshire); South Ferriby and New Holland (North Lincolnshire) (Fig 11.3).

Paull has a concentration of heritage assets associated with the military defence of the estuary and its strategically important ports (with some considered at risk, see Section 11.2.4). The defensive needs of the estuary over time is a fascinating story which is under-celebrated and deserves further research (Marcus Jecock, pers comm). This theme could be incorporated into the proposed rapid survey of Paull and if necessary, widened to show how the defences here tie in with the other defences along the estuary.

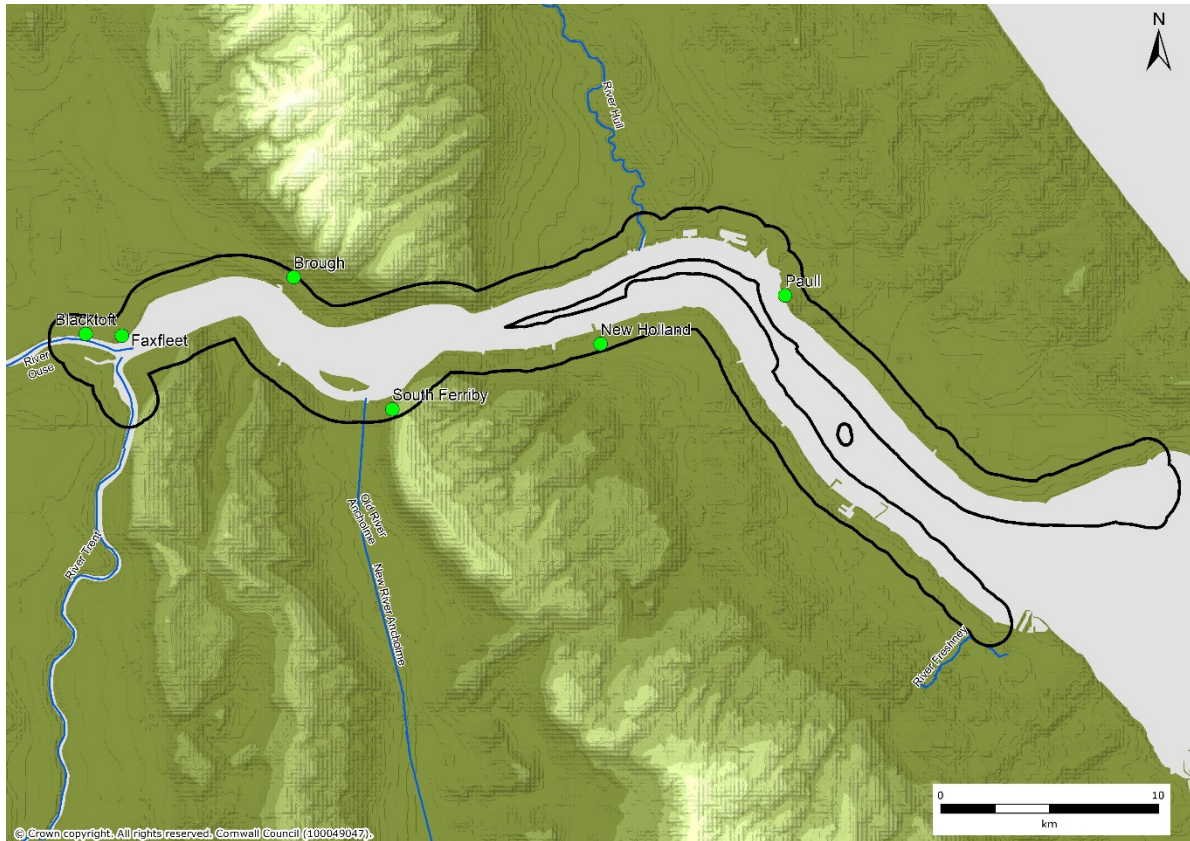


Figure 11.3 Settlements which could benefit from rapid survey.

Further archaeological assessment and investigation of non-designated heritage assets

The AI&M component noted several sites that could benefit from further archaeological assessment and a programme of investigation (field visits and field walking, metal detecting, and if appropriate geophysical survey) to better understand their significance and evidential value (Fleming and Royall 2019, appendix 2).

There is an opportunity for a community and/or volunteer-based project, or for an existing group, to investigate these sites. The potential sites include:

- enclosures, mounds and possible saltern sites at Immingham (MNL4105);
- a WWI anti-aircraft battery at Sunk Island (MHU9587);
- ploughed earthworks associated with a medieval preceptory at Faxfleet;
- potential later prehistoric ring-ditches at Old Fleet Drain, Pyewype and East Marsh, Goxhill (MLS26227-8);
- earthworks to the north of the moated site at South Ferriby (MLS26449); and
- historic earthworks and possible medieval settlement at Paull Holme tower and moated site (MHU8515).

To this list, could be added the Romano-British settlement site at South Ferriby Cliff (MLS1661) and the nearby site at Leggott's Quarry (MLS22764). Both sites have been recorded as cropmarks from aerial photographs and are located in an area where extensive finds have been found on the foreshore, having eroded out of the neighbouring cliff (for example, MLS22014).

11.2.7 Surveys within areas of low monument density

One of the aims of this RCZAS Phase 1 work was to improve the density of features in the area west of Brough (including Twin Rivers)– an aim highlighted by the Humber HER team at the project-design stage of this project. While the present project has increased the density of identified features in this area, further survey could be undertaken by local heritage groups.

This work could be combined with the analysis of more recently taken and more detailed Lidar data held by EA (when made available) in the vicinity of Brough and the Weighton Canal (which have recently been re-surveyed at 0.5m resolution). The work could focus on low-lying areas (and extend beyond the extent of the Inner Humber RCZAS survey area) to include rural land vulnerable to flooding, inundation and/or managed realignment in the next 100 years (or perhaps the whole Flood Area). This would bolster the baseline evidence if unexpected flood events were to occur and flood risk management infrastructure needs to be developed in a short timeframe. Analysis of the updated Lidar imagery could be combined with volunteer-led programme of documentary research, geophysical survey and field-walking and, if resources allow, borehole survey and test-pitting – building on and extending the Humber Wetlands Project but targeting areas at highest flood risk.

11.2.8 Designation assessment

No further sites, other than those identified by the Phase 1 AI&M component (Fleming and Royal 2019, appendix 3), have been identified for designation assessment. Of the six sites summarised in this earlier piece of work, five were recommended for the existing Scheduled area to be assessed for extension. The only new site suggested for assessment was the WWII searchlight battery at Whitton, North Lincolnshire (MLS26494) which analysis of aerial imagery and a rapid field visit suggests survives in good condition.

12 Assessment of project's impact

The project has successfully undertaken a rapid assessment of easily accessible material from a wide variety of sources including websites, historic maps, plans and charts in local and national archives, published books and grey literature.

This has resulted in the addition of 674 new records into the HERs within the survey area, building on the 1828 records identified by the supporting AI&M project for a broadly similar area (Fleming and Royall 2019).

An initial stakeholder event at the Ropewalk, Barton on the 5 December 2019 attracted 19 local stakeholders. A presentation at this event highlighted the aims of the project with stakeholders invited to put forward areas that could benefit from research, followed by a discussion amongst participants about the archaeology, history and character of the Humber Estuary, its coastline and cultural identity. The momentum generated from this event helped to ensure that a body of local people and organisations were aware of the project, enabling a successful switch to engagement by newsletter and digital means due to the ongoing restrictions caused by the Covid-19 pandemic.

13 Project archive

CAU project number: **146905**.

Online Access to the Index of archaeological investigations (OASIS) references: Humber HER (**cornwall2-371360**), North Lincolnshire HER (**cornwall2-371369**) and North East Lincolnshire HER (**cornwall2-371375**).

This project report will be uploaded to the Archaeology Data Service.

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14.2 Websites

- BAE Systems, Brough, East Yorkshire webpage –
<https://www.baesystems.com/en/heritage/brough>
- British Geological Survey Borehole record viewer –
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
- Defence of Britain Archive, Archaeology Data Service webpage –
<https://archaeologydataservice.ac.uk/archives/view/dob>

East Midlands Research Framework –

<https://researchframeworks.org/emherf/>

Environment Agency, Humber 2100+ webpage –

<https://consult.environment-agency.gov.uk/humber/strategyreview/>

Environment Agency, new flood defences press release 2nd December 2014 –

<https://www.gov.uk/government/news/146-million-to-be-spent-on-new-flood-defences>

Environment Agency, Press release 23rd August 2016 –

<https://www.gov.uk/government/news/365-million-flood-scheme-begins-in-hull>

Environment Agency, Outstrays to Skeffling Managed Realignment Scheme webpage –

<https://consult.environment-agency.gov.uk/yorkshire/outstrays-to-skeffling-managed-realignment-scheme>

Environment Agency, The Humber: Hull Frontage Scheme Information webpage –

<https://consult.environment-agency.gov.uk/yorkshire/humber-hull-frontages>

Fresh Design International, St Andrew's Dock Conservation Area web page –

<https://www.freshdesigninternational.com/work/st-andrews-dock>

Grace's Guide –

<https://www.gracesguide.co.uk>

Hull: Yorkshire's Maritime City project –

<https://maritimehull.co.uk/>

Humber Yawl boat club –

<http://www.humberyawlclub.com>

Inland Water Ways Association, River Anchole Navigation –

https://www.waterways.org.uk/waterways/canals_rivers/river_ancholme/river_ancholme

Lincolnshire Wildlife Trust, Far Ings webpage –

<https://www.lincstrust.org.uk/get-involved/top-reserves/far-ings>

Old Ferry Wharf, Barrow Haven –

oldferrywharf.com

Natural England, Humber Estuary SSSI citation –

<https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/2000480.pdf>

Ports and Harbours of the UK, Hessel Haven –

Ports.org.uk/port.asp?id=33

RSPB, Blacktoft Sands –

<https://www.rspb.org.uk/reserves-and-events/reserves-a-z/blacktoft-sands>

RSPB, Whitton Island news item –

<http://ww2.rspb.org.uk/our-work/rspb-news/news/438454-rspbs-newest-reserve-is-an-island-paradise-for-birds>

RSPB, Blacktoft Sands –

<https://www.rspb.org.uk/reserves-and-events/reserves-a-z/blacktoft-sands/>

STAND (St Andrew's Dock Heritage Park Action Group) –

<http://www.hullfishingheritage.org.uk>

Society for Lincolnshire History and Archaeology –

<http://www.slha.org.uk/index.php>

Welton Water Sport Club –

www.weltonwatersports.co.uk

Wrecks Site EU –

<https://www.wrecksite.eu>

Yorkshire Wildlife Trust, Paull Holme Strays –

<https://www.ywt.org.uk/nature-reserves/paull-holme-strays-nature-reserve>

Appendix 1: Scheduled Monuments within the survey area

Entries shown with a darker background are included in HE's 2020 Heritage at Risk Register and the threat to them described in the 'HAR threat' column.

NHLE no.	Name	NGR	HAR threat
1430250	Beverley Gate and adjacent archaeological remains forming part of Hull's medieval and post-medieval defences	TA 09710 28735	
1007737	Camera and moated site at Faxfleet Hall	SE 86353 24943	
1007875	Paull Holme moated site and tower	TA 18502 24825	Slow decay; solution agreed but not yet implemented
1020022	World War II decoys for Hull docks, 1580m south east, 600m west and 90m south west of Little Humber	TA 19810 23611	
1020187	Stone Creek Heavy Anti-aircraft gunsite, at Sunk Island Clough	TA 23814 18853	
1020024	Heavy Anti-aircraft gunsite 220m east of West Marsh Cottage	TA 05642 23199	Deterioration - in need of management
1020425	Paull Point Battery, coastal artillery battery and Submarine Mining Establishment	TA 17070 25168	Coastal erosion
1020426	Hull Castle, South Blockhouse and part of late 17th century Hull Citadel Fort at Garrison Side	TA 10444 28739	
1005217	Weighton Lock, Blacktoft	SE 87447 25627	
1021074	Tower mill and whiting works 100m south east of the Country Park Inn	TA 02200 25391	
1005219	Brough Petuaria Roman settlement	SE 93863 26734	
1005244	Ferriby sluice	SE 97514 21066	
1005243	Old Winteringham Roman settlement	SE 94742 21490	Arable ploughing
1017289	Countess Close moated site	SE 87952 21589	

Appendix 2: Grade I and Grade II* Listed Buildings within the survey area

There are no Listed Buildings within the survey area identified within HE's 2020 Heritage at Risk Register.

NHLE no.	Name	Grade	NGR
1083434	Church of St Andrew	I	TA 17228 25738
1161766	Church of All Saints	I	TA 03303 26433

NHLE no.	Name	Grade	NGR
1208200	Hull Charterhouse and Attached Boundary Wall and Railings	I	TA 10042 29353
1219563	Hull Trinity House	I	TA 09886 28600
1283090	Maisters House	I	TA 10172 28750
1366242	Paull Holme Tower	I	TA 18522 24881
1292280	Parish Church of The Holy Trinity and Churchyard Wall	I	TA 09963 28554
1197723	Roman Catholic Church of St Charles Borromeo With Attached Presbytery and Associated Boundary Walls and Railings	I	TA 09641 29099
1209831	Wilberforce House Museum and Attached Garden Wall	I	TA 10239 28835
1197697	Statue of King William III and Flanking Lamps	I	TA 10004 28476
1447321	The Humber Bridge	I	TA 02412 24487
1117354	Church of St John	II*	SE 90253 24525
1197653	Northern Academy of Performing Arts	II*	TA 09198 28719
1197660	Hands on History Museum	II*	TA 09880 28526
1197696	The Old White Hart Inn (Ye Olde White Harte)	II*	TA 09996 28706
1197754	Statue of William Wilberforce In Garden of Wilberforce House	II*	TA 10228 28834
1217998	Church of St Mary	II*	TA 10083 28776
1218434	Paragon Station Station Hotel	II*	TA 09177 28803
1219232	Former National Westminster Bank	II*	TA 09971 28689
1260341	Walcot Old Hall	II*	SE 87872 21011
1283082	100 Ton Steam Crane at Alexandra Dock	II*	TA 12791 28992
1288277	Church of Saint Nicholas	II*	SE 98845 20838
1293046	Minerva Lodge of Freemasons Number 250	II*	TA 09781 28556
1293252	Masters House at Hull Charterhouse and Attached Boundary Wall	II*	TA 10044 29317
1347005	Ferriby House	II*	SE 98772 26148

NHLE no.	Name	Grade	NGR
1209566	Blaydes House	II*	TA 10261 28998
1219019	Maritime Museum (Formerly Town Docks Museum)	II*	TA 09670 28780
1197685	City Hall	II*	TA 09542 28763
1279708	Guildhall	II*	TA 09983 28850
1197675	10-15, Whitefriargate	II*	TA 09854 28681

Appendix 3: List of UKHO charts relevant to the survey area

UKHO ref	DATE	SURVEYOR	TITLE
A43	1734	John Scott	The River Humber
A51	1775	Robert Mitchell	Chart from Spurn Head to Wells, Norfolk
A40	1787	Joseph Southgate	The Draught of the Sea Coast from Foulness to the Spurnhead with the Norfolk and Lincolnshire Coast
109 A2	1828	William Hewett	A Survey of the Entrance to the River Humber
H723	1828	William Hewett	A Survey of the River Humber with the dangers at its entrance
E135	1828	William Hewett	None
L6483	1848	EK Calver	A Chart of Part of the Rivers Humber and Ouse from Hull Roads to Goole
109 A3	1848?	W Hewett	A Survey of the Entrance to the River Humber
109 B2	1851	E K Calver	Entrance to the River Humber
L9005	1851	EK Calver	River Humber Sea to Kingston upon Hull
D6359	1861	EK Claver	Humber and Ouse from New Holland to Goole
109 B3	1872?	E K Calver	Entrance to the River Humber
109 C3	1875-1877	J Parsons	Entrance to the River Humber
A4520	1875	No name given	The Upper Part of the Humber
A4686	1875	J Parsons	River Humber
109 C7	1893?	J Parsons	Entrance to the River Humber
109 C14	1899	J Parsons	Entrance to the River Humber
109 D1	1902	GE Richards	Entrance to the River Humber
C2181	1902	George Pirie	Upper Humber from Barton Haven to Trent Falls

UKHO ref	DATE	SURVEYOR	TITLE
C2035	1906	George Pirie	Upper Humber from Trent Falls to Hessle Cliff
C2034	1906	JW Combe and FW Weldon	River Humber from Hessle Cliff to Skitter Haven including Hull Road
109 D10	1907	GE Richards	Entrance to the River Humber
C2165	1907	Earle's Company Ltd?	Earle's Shipbuilding and Engineering Company Limited, Hull - Plan of Works
C3983	1910	Captain J H Henning	Lower Humber
C3982-1	1910	Captain J H Henning	Lower Humber - reduced from the Conservator's Survey
C3982-2	1910	Captain J H Henning	Lower Humber - reduced from the Conservator's Survey
3497 A10	1912	Hydrographic office	Hull Road
C4852	1912	Arthur Butterfield	River Humber
C5213-1	1912	Captain J H Henning	Lower Humber - reduced from the Conservator's Survey
C5213-2	1912	Captain J H Henning	Upper Humber - reduced from the Conservator's Survey
109 D15	1912?	GE Richards	Entrance to the River Humber
109 D28	1914?	FC Learmouth	Entrance to the River Humber
3497 B1	1914	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
109 E4	1916	FC Learmouth	Entrance to the River Humber
C7763	1916	Admiralty	Humber, enlargement of part of chart 1190
C6680	1916	GS Ridgeway	River Humber - North Killingholme Pier and approaches
109 E20	1918	Hydrographic office	Entrance to the River Humber
3497 B8	1920	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
109 E35	1921	Hydrographic office	Entrance to the River Humber
109 G1	1926	Hydrographic office	Entrance to the River Humber

UKHO ref	DATE	SURVEYOR	TITLE
109 G6	1928	Hydrographic office	Entrance to the River Humber
3497 B16	1932	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
109 G12	1935	Hydrographic office	Entrance to the River Humber
109 G18	1938	Hydrographic office	Entrance to the River Humber
3497 B20	1939	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
109 G20	1942	Hydrographic office	Entrance to the River Humber
109 H4	1945	Hydrographic office	Entrance to the River Humber
3497 B24	1945	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
109 H10	1950	Hydrographic office	Entrance to the River Humber
3497 B28	1951	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road
3497 B37	1959	Hydrographic office	Thorngumbald Lights to Barton Haven including Hull Road

Appendix 4: New sites by period and monument type

Summary statistics listed for each Local Authority for NEW sites added by the project. In total, across the entire survey area, 674 new sites were added by the project.

Period

MESOLITHIC	3
LATE PREHISTORIC	2
BRONZE AGE	32
MIDDLE BRONZE AGE	1
LATE BRONZE AGE	1
IRON AGE	1
EARLY IRON AGE	3
ROMAN	20
EARLY MEDIEVAL	1
MEDIEVAL	27
POST MEDIEVAL	250
WORLD WAR ONE	5
WORLD WAR TWO	11
MODERN	292
UNCERTAIN	25
Total	674

Monument Type

AIR RAID SHELTER	2	CRANE	1
AIRCRAFT CRASH SITE	1	CRICKET PITCH	1
ALLOTMENT	1	CUSTOMS LOOKOUT	1
ANTI INVASION DEFENCE SITE; Anti destroyer defence	1	DEDICATION STONE, FINDSPOT	1
ANTI SUBMARINE DEFENCE	2	DOCK	2
ARTEFACT SCATTER	1	DOCKMASTERS OFFICE	2
ASSEMBLY ROOMS	1	DOLPHIN	1
BANK (FINANCIAL)	4	DRAW BRIDGE	2
BARK MILL	1	DWELLING	1
BARRAGE BALLOON SITE	1	ENGINE HOUSE	4
BATHS	1	ENGINE SHED	3
BEACH DEFENCES	1	ENGINEERING WORKS	2
BEACH DEFENCES, GROUYNE	1	EXTRACTIVE PIT	1
BEACON	22	FARM BUILDINGS	1
BEACON, JETTY	1	FARM?, OUTFARM?	1
BEACON, LIGHTHOUSE	1	FERRY CROSSING	1
BEACON?	1	FERRY CROSSING, LANDING POINT	2
BLACKSMITHS WORKSHOP	5	FIELD SYSTEM, OCCUPATION SITE?	1
BOAT HOUSE	2	FIELD SYSTEM, SETTLEMENT?	1
BOAT HOUSE, LANDING STAGE, SLIPWAY	1	FINDSPOT	65
BOAT YARD	2	FINDSPOT, BUILDING?	2
BOMB CRATER?	1	FINDSPOT, SETTLEMENT	1
BOMB CRATERS	2	FIRING RANGE	2
BRASS WORKS	2	FISH PROCESSING FACTORY	2
BREAKWATER	6	FISH TRAP	4
BREWERY	1	FITTERS WORKSHOP	1
BRICK KILN	1	FLAGPOLE	5
BRICKWORKS, CLAY PIT	2	FLINT SCATTER	11
BRICKYARD	3	FLOOD DEFENCE	1
BRUSH FACTORY	1	GAS HOLDER	1
BUILDING	1	GAS WORKS	2
BURIED LAND SURFACE?	16	GRAIN SILO	1
CAISSON	1	GRAIN STORE	1
CATTLE DOCKS	1	GRANARY	1
CHALK PIT	3	GRAVEL PIT	4
CHALK PIT, REFUSE DISPOSAL SITE?	1	GROYNE	1
CHAPEL	1	GROYNE, BREAKWATER?	1
CHAPEL, NONCONFORMIST	1	GROYNE, FLOOD DEFENCES	7
CHAPEL?	1	GROYNE, LANDING POINT?	1
CHURCH	2	GROYNE?	1
CHURCH HALL	1	HEAVY ANTI AIRCRAFT BATTERY	3
CHURCH, SUNDAY SCHOOL	1	ICE WORKS	2
CINEMA	2	IRON FOUNDRY	1
CLAY PIT	1	IRON FOUNDRY, FISH PROCESSING FACTORY	1
CLOCK TOWER	1	IRON WORKS	2
CLUB	2	JETTY	63
COACH WORKS	2	JETTY, FLOOD DEFENCES	1
COAL YARD, TIMBER YARD	1	JETTY, PIER	6
COASTGUARD STATION	1		
CONVENT	1		

JETTY, SLIPWAY	3	SAW MILL, CREOSOTE WORKS	1
JETTY, WHARF	1	SCHOOL	5
JETTY; QUAY	2	SEA DEFENCE, GROUYNE	1
JEWISH CEMETERY	1	SEA DEFENCES	1
LANDING POINT	10	SEA DEFENCES, GROUYNE	4
LANDING STAGE	4	SEA DEFENCES, GROUYNE?	1
LAUNDRY	1	SEA LOCK	1
LEATHER FACTORY	1	SEARCHLIGHT BATTERY	1
LIVESTOCK MARKET	2	SETTLEMENT	2
LOCK, LOCK GATE	1	SEWAGE WORKS	1
LODGE	1	SHAFT	1
MAST POND	1	SHEEP WASH	1
METAL BOX FACTORY	1	SHIPYARD	4
MINERAL WATER FACTORY	1	SHIPYARD, SLIPWAY	3
MISSION CHURCH	1	SLIPWAY	2
MISSION HALL	4	SMELTERY	1
MISSION HALL, CINEMA	1	SMOKE HOUSE	8
MOORING BOLLARD	1	STABLE	4
MOORING BOLLARDS	2	STOCK ENCLOSURES,	
MORTUARY	1	OCCUPATION SITE	1
MUSEUM	1	STONE CRUSHING PLANT	1
OBSERVATION POST	1	STONE WORKING SITE	1
OIL WORKS	1	STRUCTURE	1
PALAEO-CHANNEL	1	STRUCTURE, Gun	1
PALAEO-CHANNEL?	2	STRUCTURE, JETTY?	1
PARISH HALL	1	STRUCTURE, Wheel	1
PIER	6	STRUCTURE?	5
POST ALIGNMENT	5	SUNDAY SCHOOL	1
POST ALIGNMENT,		SWING BRIDGE	6
STRCUTURE?	1	THEATRE	1
POUND	1	THEATRE, CINEMA	1
POWER STATION	1	TIDAL GAUGE	2
PRIMITIVE METHODIST		TIMBER POND	3
CHAPEL	1	TIMBER YARD	14
PUBLIC HOUSE	99	TIMBER YARD, SAWMILL	1
QUARRY	4	TIMBER YARD; COPPER	
RAILWAY	1	WORKS	1
RAILWAY STATION	2	TRACKWAY	2
RAILWAY TURNTABLE	1	TRACKWAY, Lane	1
REFUSE DESTRUCTOR		TRANSIT SHED	3
STATION	1	VENTILATION SHAFTS	1
RESERVOIR	1	WAREHOUSE	2
RIDGE AND FURROW	4	WATER TANK	1
RIFLE BUTT	1	WATERWORKS	1
ROAD	1	WELL	1
ROPERY	1	WHARF	11
ROPEWALK	3	WINDMILL?	1
RUGBY FOOTBALL GROUND	1	WOOL WAREHOUSE	1
SALVATION ARMY HALL	1	WRECK	27
SANATORIUM	1	WRECK?	4
SAND PIT	1	Total	674
SAW MILL	14		

Appendix 5: GIS Method

GIS and Excel were used to produce gazetteers as a structured way to update and create records. GIS provided spatial accuracy with Excel enabling rapid and efficient data entry into the relevant fields. The gazetteers included new sites and the existing records that require spatial amendment and/or their description/details updated.

ESRI ArcGIS version 10.2.2 GIS software was used and all the GIS-based layers produced by the project were held within a geodatabase (gdb) and to OSGB 1936 projection. All work followed the latest guidelines for Historic England projects involving GIS (Historic England 2015).

The second stage involved the data from the gazetteers being inputted into HBSMR. For new sites this was undertaken by ExeGIS and for updated sites, by the staff of each HER.

Stage 1

Export and preparation

The existing HBSMR/SMR data from the North Lincolnshire, Humber and the North East Lincolnshire HERs for the entire survey area were exported as shapefiles with pdf and html copies of the monument data.

For the creation of the RCZAS data, the following FIELDS were used in Excel for data entry and were joined to the corresponding GIS layer, via a unique ID. (The fields are listed with field parameters.)

GAZ – Unique Identifier – Numeric, integer, 10 [Existing field]

X – DOUBLE, precision 15; scale 6 – AUTO POPULATE

Y – DOUBLE, precision 15; scale 6 – AUTO POPULATE

RECORDTYPE – text, 10 – USE STANDARDISED LIST

NAME – Location – text, 254 – FREE TEXT

MONTYPE – text, 100 – USE HE THESAURUS

PERIOD – text, 100 – USE STANDARDISED LIST

FORM – text, 100 – USE STANDARDISED LIST

SUMMARY – text, 254 – FREE TEXT

LONG DESCRIPTION – text, 254 – FREE TEXT

MON UID – existing MonUID reference number (for amend, update and duplicate records)

SOURCE 1,2,3,4,5 – text, 254 – USE STANDARDISED LIST

UPDATE – text, 50 – USE STANDARDISED LIST

NOTES – text, 254 – FREE TEXT

Methodology for mapping

Group features together were not over-recorded. For example, a group of field boundaries surviving as earthworks were, if the field shape and size could be identified, recorded as a field system (single entry).

This was a general rule and there were exceptions but generally mapping was kept simple and straightforward.

There was no deletion of records - only amendment of existing and creation of new.

Existing records

In Excel, if records needed to be revisited by the HER due to duplication a DUPLICATE value was added to the UPDATE field. If an NGR was wildly out of place an AMEND NGR was added to the UPDATE field with the new NGR co-ordinates entered in the X,Y fields.

New features

A NEW point was created for each new record. This was centrally placed over the feature with reference to the modern map at scale of 1:2500.

Buildings and features = the point was centrally placed. Linear features = the point was placed in a central location along the length of the feature.

Documentary sites were located against the modern map when possible. If not possible, then a note was added to the description indicating that it was an approximate location.

Rules for each field

GAZ

Numeric. Unique number to link GIS to Excel.

RECORD TYPE

Text. ONE of the following will be entered –

- BLD (BUILDING)
- FS (FINDSPOT)
- HDG (HEDGEROW)
- LND (LANDSCAPE)
- MAR (MARITIME)
- MON (MONUMENT)
- NF (NATURAL FEATURE)
- PLA (PLACE NAME)
- RT (ROUTE)

NAME

Lower case, text, short, concise, type of feature and its location e.g., Bowl barrow, one of the Southover Heath Group, Tolpuddle or Coastguard Station, St Aldhelm's Head

MONTYPE

Use FISH Thesaurus of Monument Types

Upper case, text. For multiple features a comma and space will be entered eg SETTLEMENT, COUNTRY HOUSE

For a possible site a question mark will be added e.g., SETTLEMENT? Or POSSIBLE SITES, MANOR?, SETTLEMENT?

PERIOD FROM, PERIOD TO

Upper case, text. Broad period only. This will reflect the chronology and terminology expressed in the summary text. One from the following –

- PALAEOLITHIC (-5mya to -10,001)
- LOWER PALAEOLITHIC (-5mya to -150,001)
- MIDDLE PALAEOLITHIC (-150,001 to -40,001)
- UPPER PALAEOLITHIC (-40,000 to -10,001)
- MESOLITHIC (-10,001 to -4,001)
- EARLY MESOLITHIC (-10,001 to -7,001)
- LATE MESOLITHIC (-7,000 to -4,001)
- NEOLITHIC (-4,000 to -2,351)
- EARLY NEOLITHIC (-4,000 to -3,001)
- MIDDLE NEOLITHIC (-3,000 to -2,701)
- LATE NEOLITHIC (-2,700 to -2,351)
- BRONZE AGE (-2,350 to -801)
- EARLY BRONZE AGE (-2,350 to -1,501)
- MIDDLE BRONZE AGE (-1,501 to -1,001)
- LATE BRONZE AGE (-1,000 to -801)
- IRON AGE (-801 to 42)
- EARLY IRON AGE (-801 to -401)

MIDDLE IRON AGE (-400 to - 101)
LATE IRON AGE (-100 to 42)
ROMAN (43 to 410)
EARLY MEDIEVAL (410 to 1065)
MEDIEVAL (1066 to 1539)
POST MEDIEVAL (1540 to 1900)
MODERN (1901 to present)
UNCERTAIN

FORM

Upper case, text. See HE Evidence thesaurus for further info and options

[http://thesaurus.english-](http://thesaurus.english-heritage.org.uk/thesaurus.asp?thes_no=92&thes_name=EH%20Evidence%20Thesaurus)

[heritage.org.uk/thesaurus.asp?thes_no=92&thes_name=EH%20Evidence%20Thesaurus](http://thesaurus.english-heritage.org.uk/thesaurus.asp?thes_no=92&thes_name=EH%20Evidence%20Thesaurus)

ARCHITECTURAL COMPONENT
ARTEFACT SCATTER
BOTANICAL FEATURE
BURIED VESSEL STRUCTURE
COHERENT VESSEL STRUCTURE
COLLAPSED VESSEL STRUCTURE
CONJECTURAL EVIDENCE
CROPMARK
DOCUMENTARY EVIDENCE
DEMOLISHED STRUCTURE
DEMOLISHED BUILDING
DESIGNED LANDSCAPE
DESTROYED MONUMENT
EARTHWORK
ENHANCED NATURAL FEATURE
EXTANT STRUCTURE
FIND
LEVELLED EARTHWORK
MOVED BUILDING
MOVED STRUCTURE
ORAL EVIDENCE
RUINED BUILDING
RUINED STRUCTURE
SUB SURFACE DEPOSIT
SCATTERED VESSEL STRUCTURE
STRATIFIED FIND
SUBMERGED MONUMENT
SUB SURFACE DEPOSIT
UNSTRATIFIED FIND
VESSEL STRUCTURE
WRECKAGE

One from the above list was selected or if multiple options a comma and space was used to separate entries e.g., WRECKAGE or SCATTERED VESSEL STRUCTURE, ARTEFACT SCATTER

SUMMARY

Short text

Lower case, free text. This is summary text and will be a succinct and clear summary of no more than 254 characters in length. Full sentences in grammatically correct non-technical English. Abbreviations and acronyms not used e.g., One of nine round barrows that make up the Southover Heath Group. If quoting measurements then use metres e.g., measuring 10 metres in diameter.

LONG DESCRIPTION

Lower case, free text. Full description with reference to relevant source given in brackets for example, (1). As the field was over 254 characters in length this field was only used in the Excel table.

MONUID – added if existing otherwise N/A

SOURCE (1, 2, 3, 4, 5)

Five fields to add the relevant source data for the record. If an existing record within the HER and where possible the existing SLS record id was given.

In advance of the Stage 2 CAU will create a list of sources that need to be entered into the relevant HERs.

UPDATE (field)

Upper case, text. Added to all sites updated or created to enable a record of type of work undertaken.

One of the following will be selected.

NEW (newly created feature)

UPDATED (updated feature)

DUPLICATE (a record we think is a duplicate – in summary text record details of the record you think it duplicates)

AMEND NGR (a record where the NGR is misplaced)

NOTES

Free text field to add relevant notes to assist with input into HBSMR.

Final processing

The updated GIS layer/shapefile(s) contained new and amended data (including those recommended for amend, NGR update and probable duplicate records).

The layer was double-checked to ensure data consistency and topology rules.

Stage Two

This stage was broadly undertaken in a similar manner to that undertaken by the AI&M assessment undertaken for Phase 1 of this RCZAS (Fleming and Royall 2019).

The final data for upload into the relevant HER was supplied in the format of GIS layers and supporting Excel spreadsheets for direct import into their various HBSMR databases.

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