

ENGLAND'S HISTORIC SEASCAPES: WITHERNSEA TO SKEGNESS PILOT STUDY

AGGREGATE LEVY SUSTAINABILITY FUND
MARINE AGGREGATES AND THE HISTORIC ENVIRONMENT

REVISED METHOD STATEMENT

Museum of London Archaeology Service

© **Museum of London**

Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
tel 0207 410 2200 fax 0207 410 2201 email molas@molas.org.uk



MUSEUM OF LONDON

Archaeology Service

12 June 2009

| | | |
|----------|--|-----------|
| 1 | Introduction | 7 |
| 1.1 | Project background | 7 |
| 1.2 | Project Aims | 7 |
| 1.3 | Project objectives | 8 |
| 1.4 | The final product and user interface | 8 |
| 1.5 | Key terms | 9 |
| 1.5.1 | <i>Attributes</i> | 9 |
| 1.5.2 | <i>Character_Areas</i> | 9 |
| 1.5.3 | <i>Characterisation polygons</i> | 9 |
| 1.5.4 | <i>Broad Character Type</i> | 9 |
| 1.5.5 | <i>Character Type</i> | 10 |
| 1.5.6 | <i>Sub-Character Type</i> | 10 |
| 1.6 | Revisions and modifications to Wessex’s Marine HLC GIS-based methodology | 10 |
| 2 | Core Datasets | 11 |
| 2.1 | Application of Core Datasets | 12 |
| 2.2 | Base mapping | 12 |
| 2.3 | Bibliographic and other documentary sources | 12 |
| 2.4 | Model of sea level change | 12 |
| 2.5 | Standards | 13 |
| 2.6 | Software | 13 |
| 3 | Approaches to Seascape Characterisation | 14 |
| 3.1 | Characterisation_polygons creation and Character_Area analysis | 14 |
| 3.2 | Methodological practicalities | 15 |
| 3.3 | Digitisation of UKHO charts | 16 |
| 4 | GIS approach to Seascape characterisation | 18 |

| | | |
|------------|---|-----------|
| 4.1 | GIS workflow | 18 |
| 4.1.1 | <i>Projection</i> | 18 |
| 4.1.2 | <i>Data integrity</i> | 19 |
| 4.1.3 | <i>Data capture</i> | 19 |
| 4.1.4 | <i>Combining datasets</i> | 19 |
| 4.1.5 | <i>Wreck clusters</i> | 19 |
| 4.1.6 | <i>Polygon rules and topology</i> | 20 |
| 4.1.7 | <i>Characterisation_polygons attribute population</i> | 20 |
| 4.1.8 | <i>Character_Area attribute population</i> | 24 |
| 4.2 | Metadata | 27 |
| 4.2.1 | <i>DESCRIPTION:</i> | 27 |
| 4.2.2 | <i>SPATIAL:</i> | 27 |
| 4.2.3 | <i>ATTRIBUTES</i> | 30 |
| 4.3 | Developing the multimedia resource | 33 |
| 4.3.1 | <i>Web pages</i> | 33 |
| 4.3.2 | <i>Interactive map</i> | 36 |
| 4.4 | Example pages from the web enabled resource | 37 |
| 5 | Relationship between character levels | 39 |
| 6 | Attribute Definitions and terminology | 42 |
| 6.1 | Attribute terminology | 42 |
| 6.2 | Attribute formatting | 42 |
| 6.3 | Characterisation_polygons layer attribute terminology: BROAD_CHARACTER, CHARACTER_TYPE and SUB_CHARACTER | 42 |
| 6.4 | Characterisation_polygons layer attribute terminology: Other attributes | 53 |
| 6.5 | Character_Area layer attribute terminology | 63 |
| 7 | Delivering the final product to NMR | 65 |
| 8 | Bibliography | 66 |

Table List

| | |
|--|----|
| Table 2 Recorded details of digitised UKHO mapping | 17 |
| Table 3 Characterisation_polygons characterisation classification | 22 |
| Table 4 Symbol Level hierarchy | 24 |
| Table 5 Character_Area characterisation classification differences | 25 |

Figure List

| | |
|--|----|
| Fig 1 Display of Characterisation_polygons attributes | 15 |
| Fig 2 Character_Area displayed at BROAD_CHARACTER level | 26 |
| Fig 3 'Characterisation and Mapping' website page | 37 |
| Fig 4 Interactive mapping with West Sole Character Area being investigated | 37 |
| Fig 5 West Sole character area document as it appears on the website | 38 |
| Fig 6 Zoomed into the interactive map | 38 |

SUMMARY

The Museum of London Archaeology Service has been commissioned by English Heritage to undertake a pilot project to develop a methodology for Historic Seascape Characterisation (HSC). The aim of the project is to create a coastal, intertidal and maritime historic characterisation for a pilot area between Withernsea and Skegness, extending out to the median line with Holland. The intention of the project is to build on the methodology developed by Wessex Archaeology in their Liverpool Bay Pilot Study and trial methods that could be used in the development of a nation-wide HSC. This document outlines the process of marine characterisation as undertaken by the Museum of London Archaeology Service.

The report addresses the project aims and objectives and how they have been met. It describes and discusses the decisions made regarding the choice of baseline data for characterisation, the processing and interpretation of the various datasets to create the final character map and character areas.

This Method Statement addresses the modification and revisions made to the methodology developed by Wessex during the initial Liverpool Bay Pilot Study and should be read in conjunction with Wessex's methodology document.

ACKNOWLEDGEMENTS

This England's Historic Seascapes pilot project was commissioned by English Heritage. The project is funded by that part of the Aggregate Levy Sustainability Fund distributed by English Heritage. Invaluable assistance and information was provided by Dave Hooley, Graham Fairclough, Virginia Dellino-Musgrave and Brian Kerr of English Heritage, which is gratefully acknowledged.

The Museum of London Archaeology Service would like to thank the following participants for their interest in the project and contributions in our two stakeholder meetings: Andrew Barron (Environment Agency), Giles Bartlett (North Eastern Sea Fisheries Committee), Mark Bennet (Lincolnshire HER), Trevor Brigham (Humber Archaeology Partnership), Paul Bryan (Defra MFA), John Buglass (Humber Archaeology Partnership), Glyn Coppack (English Heritage East of England Regional Team), Virginia Dellino-Musgrave (English Heritage Maritime Archaeology Team), Paul Eastwood (CEFAS), Dave Evans (Humber Archaeology Partnership), Graham Fairclough (English Heritage Characterisation Team), Helen Fenwick (Hull University), Naomi Field (Lindsey Archaeology Service), Andy Hammon (English Heritage Yorkshire and the Humber Regional Team), Guy Hannaford (UK Hydrographic Office), Dave Hooley (English Heritage Characterisation Team), Laura Jackson (Lincolnshire HER), Louise Jennings (Lincs CC), Isobel Johnson (Marine Fisheries Agency), Stewart Kemsley (DCMS), Brian Kerr (EH), Tom Lane (APS Archaeology), Kevin Leahy (North Lincs Museum), Edward Lewis (Lincolnshire HER), Malcolm Lillie (Hull University), Beryl Lott (Lincs Principle Arc), Michael Meekums (Defra), Bob Moss (UK Hydrographic Office), Peter Murphy (English Heritage Maritime Archaeology Team), Sally Murray (Natural England), Mark Newman (National Trust), Adam Partington (Lincs CC), Chris Pater (English Heritage Maritime Archaeology Team), Jim Rees (CEFAS), Ian Rowlandson (North Lincs Community Archaeologist), Mark Russell (BMAPA), Alison Williams (North Lincolnshire SMR), Jim Williams (East Midlands EH) and Jenny Young (Lincs Heritage).

The Museum of London Archaeology Service would like to thank all of the organisations that have provided data for the project and advice regarding the methodological development. These include the Joint Nature Conservation Committee (JNCC), The UK Hydrographic Office (UKHO), English Heritage, East Riding of Yorkshire SMR, The Humber Archaeology Partnership, Lincolnshire HER, North Lincolnshire HER, North East Lincolnshire HER, Lindsey Archaeological Services, Landmark Mapping, SeaZone Solutions Ltd, Ordnance Survey (OS), the Environment Agency (EA), the British Geological Survey (BGS), the North Eastern Sea Fisheries Committee, CEFAS.

The characterisation work and all project reports were compiled by Jo Lyon and Audun Clark. Geomatics support and database organisation was carried out by Sarah Jones. IT support was provided by Jeremy Ottovanger. Dick Malt managed the project for MoLAS.

1 Introduction

1.1 Project background

The Museum of London Archaeology Service (hereafter referred to as MoLAS) has been commissioned by English Heritage to carry out a pilot research project to develop a methodology that builds on Wessex Archaeology's initial pilot for extending Historic Landscape Characterisation (HLC) to the coastal, intertidal and marine zones of England. The pilot project area runs from Withernsea to Skegness, takes in the tidal extent of the Humber Estuary and extends out into the North Sea to the median line with Holland.

1.2 Project Aims

- To apply and, if necessary, develop the Wessex Archaeology Liverpool Bay methodology in a different type of coastal and marine environment (the Withernsea to Skegness and adjacent marine zone pilot area).
- To create a GIS-based characterisation of the historic and archaeological dimension in the present landscape, of the inter-tidal and marine zones of the project area to the limit of the UK Continental Shelf.
- To ensure that the historic environment GIS-database for the project area can be readily integrated with analogous databases for the natural environment.
- To create a framework of understanding which will structure and promote well-informed decision-making, relating to the sustainable management of change and conservation planning affecting the historic environment in the inter-tidal and marine zones.
- To enhance and contextualise the Maritime Record of the National Monuments Record and those County HERs impinging upon the project area, with particular regard to providing landscape-scale contextualisation of results from the Rapid Coastal Zone Assessment programme where available.
- To structure, inform and stimulate future research programmes and agendas relating to the project area.
- To improve the awareness, understanding and appreciation of the historic dimension of the project area to professional and non-professional users of the database.
- To be a demonstration project in the development of a methodology for extending HLC to the breadth of environmental and management conditions in England's inter-tidal and marine zones and adjacent UK Continental Shelf.

1.3 Project objectives

- To deploy, assess and, as appropriate, develop the GIS-database structure created for the Liverpool Bay pilot area to enable it effectively to accommodate the distinctive qualities of the Withernsea to Skegness and adjacent marine zone pilot area, while retaining compatibility of the database with the interfacing or partly overlapping terrestrial characterisation databases.
- To produce a GIS-based HLC characterising the project area's landscapes in historic and archaeological terms, by means of:
 - Identifying and gaining access to the range of data sources relevant to understanding the historic and archaeological dimension of the project area, placing greatest emphasis on sources with consistent national coverage.
 - Using GIS polygons to define areas sharing similar historic character.
 - Defining polygons on the basis of combined shared values of dominant character attributes, with secondary attributes recorded in a consistent, structured manner.
 - Identifying trends and recurrent groupings among the attributes to define historic landscape types which will, together, encompass all of the polygons and reflect the differing historical processes in their formation.
- To record the sources and data-sets supporting each stage of the characterisation, to meet the needs of transparency and assist future updates against the initial benchmark characterisation.
- To analyse and interpret HLC to produce preliminary syntheses from it.
- To assess present uses and potential for HLC to inform sustainable management of change and spatial planning issues surrounding marine aggregates extraction in the project area.
- To assess present uses and potential for HLC to inform broader sustainable management of change, spatial planning, outreach and research programmes.
- To produce an archive and a report reviewing the methodological validation, development and practical application of HLC in this project area and assessing the benefits of extending such characterisation more widely to the historic environment in the inter-tidal and marine zones to the limit of the UK Continental Shelf.
- To disseminate information on the progress and results of the project through professional and popular publications and other media.

1.4 The final product and user interface

The final product comprises an ARCGIS project, web-pages and interactive map, a report, method statement and archive.

The web interface requires no knowledge of GIS to be able to access the characterisation. The web pages consist of a gazetteer and interactive map to allow the user to either access character areas descriptions by name or via the interactive map (see Method Statement). The pages

contain the full characterisation narratives for each different character area with multimedia images (see Method Statement).

The ArcGIS project provides access to the Characterisation_polygon layer allowing the user initially to view the project by top most, or most dominant, layer. Querying the Characterisation_polygon layer reveals the layered internal structure of the project, revealing the rationale behind the project's basic construction. Polygons can be queried in different ways, according to the specific attributes that are of interest.

1.5 Key terms

The terminology used in this report conveys the underlying hierarchy of terms used by MoLAS in the development of the character map. The key terms are outlined here.

1.5.1 Attributes

The term attribute is used to describe the criteria that each polygon is measured and identified against. Every polygon has an attribute table and the range of different attributes that each polygon can possess in the GIS project are the same for every polygon, ie broad character type, sub character type, etc. The polygons in the GIS project are generated using the information contained in the attribute table. The attributes were chosen during initial study of all the activities/features that took place/existed in the study area. The attributes are designed to make explicit various bits of information about each feature's character. It was really through deciding and then studying the attributes in each area that characterisation occurred.

Attribute tables were populated via automatic or manual means, depending on the type of information it was necessary to capture. Definitions of attribute types are given in Section 4.1.7.

1.5.2 Character_Areas

Character_Areas essentially represent an aggregation of similar sub-character polygons, which can be found in close spatial proximity to one another. Character_Areas are named after their topographic location or in some cases according to the predominant human uses evident in the area. The Character_Area layer is separate from the Characterisation_polygon layer and forms a contiguous layer across the pilot area.

1.5.3 Characterisation polygons

Term used throughout the project to refer collectively to the layer of sub-character polygons from which the GIS project is generated and which form the finest scale of polygonisation in the database.

1.5.4 Broad Character Type

Broad Character type is the highest level of characterisation summarisation. The Pilot Area has been split up into seven different broad character categories: Coastal industry, Offshore industry, Flood defence and reclamation, Military, Navigation, Settlement and Recreation. Detailed definitions of the different Broad Character types are provided in Section 6.3.

1.5.5 Character Type

Character Type is the intermediate level of characterisation summarisation, between Broad Character and Sub-Character type. Detailed definitions of the different Character Types are provided in Section 6.3.

1.5.6 Sub-Character Type

Sub-Character is the finest scale of characterisation and represents a character assessment based on different features or attributes identified and digitised from different map and in some cases documentary sources. It is the base map for the higher levels of characterisation. More detailed definitions of the different Sub-Character types are provided in Section 6.3.

1.6 Revisions and modifications to Wessex's Marine HLC GIS-based methodology

This statement of revision and modification to the Method Statement written for Wessex's pilot study conducted in 2006. This modification document should be read in conjunction with the Marine HLC GIS-based methodology document prepared by Wessex.

The structure of the report will follow that of Wessex and additional entries will only be made where the methodology has been modified or not followed. The section numbering will mirror that of the Wessex report to aid cross referencing.

2 Core Datasets

The following table contains the datasets used in the project.

| Core data sources | Format | Location |
|---|-----------------------|---|
| Modern Charts | Hard Copy | UKHO |
| Historic Charts | Hard Copy | UKHO |
| Albert Close Chart | Hard Copy/Digital | |
| Modern OS Maps Coastal Industry Coastal Recreation Coastal Infrastructure | Digital | EH |
| Landmark OS Maps | Digital | EH |
| Hydrospatial Mapping: Bathymetry Wrecks & Obstructions Offshore Industry Seabed geology Protected areas Regulated areas Licensed areas Flora and Fauna Sea cover Tides & Currents Transportation Metafeatures | Digital | SeaZone Solutions Ltd |
| Supplementary data sources | Format | Location |
| CEFAS North Sea Fishing Effort | Digital and Hard Copy | CEFAS, Lowestoft |
| North Eastern Sea Fisheries Committee (NESFC) Fishing Effort | Digital and Hard Copy | NESFC |
| North Lincolnshire SMR | Digital | North Lincs CC |
| North East Lincolnshire SMR | Digital | North East Lincs CC |
| Lincolnshire SMR | Digital | Lincolnshire CC |
| Humber SMR | Hard Copy | Humber Archaeological Partnership, Hull |

| | | |
|--|-----------------------|---------------------------------------|
| NMR | Digital | National Monuments Record |
| Offshore Solid and Drift Geology, Seabed sediments | Hard Copy | British Geological Survey |
| Offshore Industry | Digital and Hard Copy | DTI Infrastructure Map, Crown Estates |
| Tidal range | Hard Copy | DTI |

2.1 Application of Core Datasets

All core datasets were extensively interrogated to define the overall character, character types and also shape the final character polygons. No specific shapes were derived exclusively from any one dataset but are an amalgam of data transposed into areas of human usage of the seascape as represented by the character polygons. In this respect the GIS Project represents a “new” map based on many inputs.

2.2 Base mapping

As a member of the Ordnance Survey (OS) Pan-Government agreement, English Heritage has an organisation-wide license to provide OS digital base mapping for projects funded by them. OS digital data was used for terrestrial base mapping during the project. These were loaded directly into the project.

Digital chart data was acquired through digitisation of UKHO historical and modern charts for the Humber estuary area and from SeaZone Solutions Ltd which provided the coastal and offshore base mapping and core dataset. These were loaded directly into the project after some rationalisation to select the necessary details to be displayed.

Hard copy and digital copy of the Albert Close Fishing Chart was obtained from UKHO and the digital image was geo-referenced to British National Grid (OSGB 36) at MoLAS. This map provided excellent spatial detail on historic fishing activities and favourable and unfavourable areas.

2.3 Bibliographic and other documentary sources

MoLAS performed an initial project bibliographic review to gather sources on general archaeological, historic and contemporary information on the study area. Following the bibliographic search MoLAS staff undertook visits to Hull, Lincoln and other locations to collect maps and written sources from local libraries, museum collections, record offices and archives.

2.4 Model of sea level change

A model of sea level change was not produced for the Withernsea to Skegness pilot study (see Final Report, section 4.8, for more detail). The palaeolandscape was considered when assigning attributes and where possible identified and recorded. The features of the palaeolandscape were identified from the SeaZone bathymetric data, the underlying geology and supplementary documentary sources and used predominantly to inform on the previous character of the Characterisation_polygons.

2.5 Standards

The project has followed the best practice principles proposed by Aldred and Fairclough's *Historic Landscape Characterisation Taking Stock of the Method* (2002). This project has also built on the concept that GIS has great potential to be used not simply as a display tool but as an interpretation tool. The project has taken potential beyond idea that it can be used as a tool for producing amalgamated map overlays but that also it can be used to create a complex layered sequence of character polygons, which can be ordered in different ways depending on how the user wishes to query the database.

With regard to standards for GIS, mapping, and terminology, the Withernsea to Skegness pilot has adhered to *Guidelines for English Heritage projects involving GIS* (English Heritage 2004) and utilised EH online thesauri (*Inscription*) (see MoLAS Method Statement).

The core datasets were maintained in their original projections for the intermediary analysis period of the project and the final layers were projected in WGS_1984_UTM_Zone_31N. For more on projection see 4.1.1

2.6 Software

The characterisation process undertaken for the England's Historic Seascapes: Withernsea to Skegness pilot study used ESRI ArcGIS 9.1, ArcINFO license level.

The multimedia component within England's Historic Seascapes: Withernsea to Skegness pilot study offers interactive and illustrative insights into the characterisation of the modern and historic environment for the marine and maritime areas. The microsite was developed using ESRI ArcIMS and Microsoft Content Management Server 2002 SP3.

3 Approaches to Seascape Characterisation

The methodological development, analysis and trialing of previous approaches and the detailed philosophical approach to characterising coastal and marine historic seascapes are described in the main report for the project (MoLAS 2009, 28).

The approach taken by MoLAS is similar to Wessex's 'multi-mode' approach, with the exception that an intermediate layering system, grouped under broad themes, was not created. An intermediate layer was created which included all the core datasets, grouped and arranged for maximum efficacy and inter-visibility. This intermediate GIS project was visually investigated and interrogated to inform on the shape and attributes of the Characterisation_polygons, which in turn informed on the shape and attributes of the Character_Area(s).

3.1 Characterisation_polygons creation and Character_Area analysis

There are broad similarities between the WA and the MOLA approach and essentially the two levels of characterisation – “Character Analysis” and “Character Area Analysis”, previously employed by Wessex, were adopted for this study. The characterisation levels were renamed, “Characterisation_polygons” and “Character_Area”, however, in order to prevent confusion with the WA method and highlight the focus of the MoLAS study on the overlapping polygon method.

The Characterisation_polygons level represents an analysis of the morphology and recorded human usage of individual areas of the seascape as informed by the underlying core datasets and other external documentary sources. The Characterisation_polygons are designed to be overlapping to enhance the depth of available characterisation and interpretation by the user. See the main report for more on this.

The polygons were created by a process of data logging, observation and interpretation of combined data sets.

The attributes which form the descriptors of these polygons fall into three sections:

- Observation of anthropogenic activity (e.g. primary intrusive activity, other use)
- Observation of natural features (e.g. morphology, location)
- Data logging (e.g. unique identification number, main informing core dataset, area)

For example, if we interrogate the Characterisation_polygons ‘Traffic control’ in the Humber Estuary mouth, the following is recorded (see Fig 1):

- Primary intrusive activity (PRI_INT_ACT) = Navigation
- MORPHOLOGY = Sandy bedded channel
- DATASOURCE = SeaZone

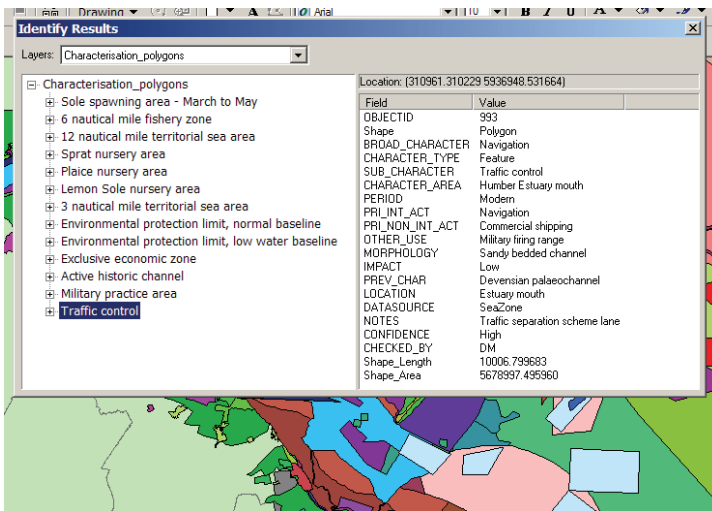


Fig 1 Display of Characterisation_polygons attributes

Interpretation of the features indicates that the primary industry at work in this polygon is navigation. The period attribute also adds to interpretation. In the MoLAS reading of period, period applies to the date of origin of the dominant features of the polygon itself, the features that have been judged to give it its dominant character. The period attribute does not describe any of the other attributes of the polygon (ie sea bed floor), as is often the case in the WA pilot study.

The Character_Area polygons can be understood as a summary of the underlying Characterisation_polygons. The Character_Areas were generated by first displaying the Characterisation_polygons by Broad_Character, so patterns of use could be seen across the landscape. This was then studied in conjunction with the underlying OS mapping. Character_Areas were then assigned according to Broad_Character/geographic location. The Character_Area polygons are discrete and contiguous.

3.2 Methodological practicalities

As the majority of the datasets obtained were not directly incorporated into the final analysis layers little processing was necessary to make them usable as informative resources.

No division of data, other than by source, was employed which provided the possibility of a holistic approach allowing for sequenced and layered investigation and interrogation of the spatial and historical character of each location and polygon. The Characterisation_polygons in the GIS project were constructed to be overlapping and were layered sequentially according to dominance. The location of the polygon, on the sea floor, water column or sea surface, is recorded in the attribute table of each polygon. The result is that there will be whole sequences of polygons, in any of these locations, at any one point in the project. Layering by dominance, not by location, allows dominant use to be recorded and made visible, regardless of location in sea column. This is one of the great strengths of this approach as it allows multiple human uses to be made visible in any one area/point.

External data was provided in different formats including vector data (points, polygons and polylines) and raster data (image files stored as .Tiff, .JPG, .BMP file extensions). Each dataset was maintained as an independent originator entity, projected into the necessary co-ordinate system within the intermediary GIS analysis project. The only exception to this were the

shapefiles provided by DEAL/DTI which were directly incorporated into the final analysis Characterisation_polygons layer, as there were no copyright issues pertaining to this data.

Point data was converted into polygons, where necessary (ie wellheads), and buffered to 500m radius to render them visible. The radius chosen was not arbitrary but related to the official exclusion zone which surrounds them. Polyline data was present for the pipeline locations and was converted into visible polygons by applying a 100m radius buffer around the polyline.

A vector grid system was not utilised as it was deemed to represent a degradation of the accuracy of the data being presented at the fine scales available during GIS operations. The scale for viewing the project area was set at 1:1,149,441.

As there was no intermediate processing of the datasets the MoLAS methodology deviates from the Wessex methodology, obviating the need for intensive processing and reprocessing of the information layers.

3.3 Digitisation of UKHO charts

MoLAS undertook the digitisation of a sequence of UKHO Admiralty charts covering the Humber Estuary area. To this end AutoCAD 2005 was utilised to digitise those features deemed pertinent to the classification of seascapes character.

| | | |
|---------------------------------|-----------------------------|------------------------------------|
| Ukho_1828_-4fathoms | ukho_1902_navigation_buoys | ukho_2006_havens |
| Ukho_1828_0-4fathoms | ukho_1902_navigation_lights | ukho_2006_land |
| Ukho_1828_breakwaters | ukho_1902_railways | ukho_2006_military |
| Ukho_1828_docks_piers | ukho_1902_removed_details | ukho_2006_navigation_buoys |
| Ukho_1828_drying | ukho_1902_restricted_area | ukho_2006_navigation_lights |
| Ukho_1828_ferrys | ukho_1902_routes | ukho_2006_oil |
| Ukho_1828_havens | ukho_1926_breakwater | ukho_2006_pipeline_discharge |
| Ukho_1828_land | ukho_1926_depth_-3fathoms | ukho_2006_railways |
| Ukho_1828_lifeboats | ukho_1926_depth_0-3fathoms | ukho_2006_removed_details |
| Ukho_1828_marsh | ukho_1926_docks | ukho_2006_restricted_areas |
| Ukho_1828_military | ukho_1926_drying | ukho_2006_routes |
| Ukho_1828_navigation_buoys | ukho_1926_groynes | ukho_2006_spoilground |
| Ukho_1828_navigation_lights | ukho_1926_havens | ukho_2006_submarine_cables |
| Ukho_1828_removed_details | ukho_1926_land | ukho_2006_submarine_cables_disused |
| Ukho_1828_routes | ukho_1926_lifeboat | ukho_2006a_depth_0m-5m |
| Ukho_1851-2_anchorages | ukho_1926_marshes | ukho_2006b_depth_-5m-10m |
| ukho_1851-2_conjectured_railway | ukho_1926_military | |
| Ukho_1851-2_depth_-18_feet | ukho_1926_navigation_buoys | |
| Ukho_1851-2_depth_0-18_feet | ukho_1926_navigation_lights | |
| Ukho_1851-2_docks_piers | ukho_1926_railway | |
| Ukho_1851-2_drying | ukho_1926_restricted_areas | |
| Ukho_1851-2_embankments | ukho_1926_routes | |
| Ukho_1851-2_havens | ukho_1926_submarine_cable | |
| Ukho_1851-2_land | ukho_2006_bathy | |
| Ukho_1851-2_lifeboat | ukho_2006_bathy_-10m | |
| Ukho_1851-2_marshes | ukho_2006_bathy_-15m | |
| ukho_1851-2_navigation_buoys | ukho_2006_bathy_-20m | |
| Ukho_1851-2_navigation_lights | ukho_2006_bathy_-2m | |
| Ukho_1851-2_railways | ukho_2006_bathy_-5m | |

| | |
|----------------------------|-------------------------------|
| Ukho_1851-2_routes | ukho_2006_bathy_-7m |
| Ukho_1902_-18_feet | ukho_2006_bathy_0m |
| Ukho_1902_0-18_feet | ukho_2006_breakwater |
| Ukho_1902_anchorage | ukho_2006_conjectured railway |
| Ukho_1902_breakwaters | ukho_2006_depth_-10m-20m |
| Ukho_1902_discharge_sewage | ukho_2006_depth_-5m-10m |
| Ukho_1902_docks_piers | ukho_2006_depth_+5m0m |
| Ukho_1902_drying | ukho_2006_depth_0m-5m |
| Ukho_1902_havens | ukho_2006_diffusers |
| Ukho_1902_land | ukho_2006_docks |
| Ukho_1902_lifeboats | ukho_2006_embankment |
| Ukho_1902_marsh | ukho_2006_gas_pipeline |
| Ukho_1902_military | ukho_2006_groynes |

Table 1 Recorded details of digitised UKHO mapping

Charts from 1828, 1851-2, 1902, 1926 and 2006 were digitised to provide time depth of changes to the landscape and seascape. A standardised nomenclature was created to ensure that the same details were recorded (where present) for each temporally distinct map and that the recorded information would be readily comparable and elucidated.

The digitised CAD files were then imported into ArcGIS and investigated in conjunction with the other core datasets.

4 GIS approach to Seascape characterisation

The following sections provide an overview of the steps taken in the construction of the Characterisation_polygons layer and the Character_Area layer. These layers contain the distilled, interpreted and conflated information from the core datasets and secondary digital and documentary material. The workflow presented below should provide the reader with a framework for understanding the process and enable the methodological approach to be replicated and applied elsewhere.

The description of the stages of processing are presented as generic conceptual GIS processes which should be adaptable across a wide range of GIS platforms and not restrictive to the software used for this particular project (ESRI ArcGIS 9.1). The text is written at the level appropriate to a reader familiar with GIS practices, software and terminology and a working knowledge of co-ordinate systems and transformations.

4.1 GIS workflow

All the spatial datasets used for this project were stored in personal geodatabases, in nested folder hierarchies to separate out the mapping by projection (ED50, OSGB36, WGS84 and the final layer projection UTM31N).

Personal geodatabases were utilised as they allow for up to 2 gigabytes of spatial and attribute data to be stored conveniently and also allow for additional processes and tools to be used on the data, such as the application of topological rules to ensure that the final layers conform to their stated rules.

4.1.1 Projection

Using the power of GIS it was possible, once the intermediary analysis project was set up with the final projection and co-ordinate transformations, to import the other mapping, retaining its original projection but transformed to fit the spatial projection of the final layers. All AutoCAD digitisation was done in OSGB36.

The final layers were projected into UTM31N:

```
WGS_1984_UTM_Zone_31N  
Projection: Transverse_Mercator  
False_Easting: 500000.000000  
False_Northing: 0.000000  
Central_Meridian: 3.000000  
Scale_Factor: 0.999600  
Latitude_Of_Origin: 0.000000
```

The Universal Transverse Mercator (UTM) coordinate system is a grid-based method of specifying locations on the surface of the Earth. It is used to identify locations on the earth, but differs from the traditional method of latitude and longitude in several respects. The UTM system is not a single map projection. The system instead employs a series of sixty zones, each of which is based on a specifically defined Transverse Mercator projection.

The UTM system divides the surface of the Earth between 80° S latitude and 84° N latitude into 60 zones, each 6° of longitude in width and centred over a meridian of longitude. Zones are numbered from 1 to 60. Zone 1 is bounded by longitude 180° to 174° W and is centred on the 177th West meridian. Zone numbering increases in an easterly direction.

Each of the 60 longitude zones in the UTM system is based on a Transverse Mercator projection, which is capable of mapping a region of large north-south extent with a low amount of distortion. By using narrow zones of 6° in width, and reducing the scale factor along the central meridian to 0.9996, (a reduction of 1:2500) the amount of distortion is held below 1 part in 1,000 inside each zone. Distortion of scale increases to 1.0010 at the outer zone boundaries along the equator.

The reduction in the scale factor along the central meridian creates two lines of true scale located approximately 180 km on either side of, and approximately parallel to, the central meridian. The scale factor is too small inside these lines and too large outside of these lines, but the overall distortion scale inside the entire zone is minimized. The UTM system is not a single map projection. The system instead employs a series of sixty zones, each of which is based on a specifically defined Transverse Mercator projection

4.1.2 Data integrity

Prior to data processing and/or capture, all sources were assessed and checked for reliability and co-ordinate system, projection and units. The differing data sources were stored in nested folder paths to keep the distinction between projections clear and then the data was imported into the ArcGIS intermediary project for analysis.

4.1.3 Data capture

The hard copy UKHO Admiralty charts for the Humber estuary were digitised on AutoCAD tablets in point and closed polygon format. The layer system was employed to identify each classification by date of chart and by feature record (see Section 3.3 for full list). Once digitised the CAD files were imported into personal geodatabases for ease of manipulation and imported into the intermediary GIS project. Their original co-ordinate system was maintained throughout.

4.1.4 Combining datasets

As the characterisation polygons were created by two authors it was necessary to combine their efforts at periodic intervals. This was done using a custom designed tool incorporating the 'Merge' function of the ArcGIS Toolbox.

4.1.5 Wreck clusters

The wreck cluster polygons in the Characterisation_polygons were generated by creating a geo-referenced 500m² grid in AutoCAD which was then imported into the GIS project.

A combined featureclass containing the NMR wreck data and UKHO wreck data (from SeaZone) was created through the "Select by Attributes" GIS tool and the "Merge" tool mentioned described previously. The 500m² grid was then "joined" (another GIS tool) to the combined wreck data to produce a count of wrecks within each square.

The resulting polygons were interrogated to identify those containing "wreck clusters" and those polygons lifted out and merged with the Characterisation_polygons. Wreck clusters were defined as any 500m² grid square that contained 3 or more recorded wrecks. The decision was

made to not to look at wreck densities because the vast amount of wreck data in the study area would have made the GIS project unweildy. It was decided that the presence of 3 wrecks or more would indicate the presence of ‘wreck character’ and that this would be adequate for characterisation purposes. If it became necessary to look at wreck density as a particular focus, the characterisation project would be useful for highlighting the areas of highest potential. A separate project could then be devised to study this in more depth.

The originator NMR and SeaZone wreck data was examined in conjunction with the other originator data sources to provide the entries for the attributes of the Characterisation_polygons and the Character_Area documents.

4.1.6 Polygon rules and topology

The Characterisation_polygons were defined by the following rules:

- Overlapping polygons are allowed to provide depth of information (see section 3.1)
- No multi-part polygons were to be used
- No gaps were allowed
- Where appropriate the Project_Area provides the outer extent of the polygon
- All attributes are to be filled in where possible and “Unknown” or “NA” used for empty entries appropriately

The Character_Area polygons were defined by the following rules

- Polygons are to be discrete (No Overlaps)
- Polygons are to be contiguous (No Gaps)
- Polygons are to use the Project_Area as outer extent where appropriate
- Character_Area must cover the Characterisation_polygons
- All attributes are to be filled in where possible

Topological rules were applied using ESRI ArcCatalog 9.1 and ArcGIS to the Characterisation_polygons (No Gaps) and the Character_Area polygons (No Gaps, No Overlap and Must Be Cover By) to ensure that the spatial rules were followed and any detected errors manually corrected from within the GIS.

4.1.7 Characterisation_polygons attribute population

The main characterisation attributes were populated by manual entry. Only the automatic systems administrative fields were automated (OBJECTID, Shape, Shape_length, Shape_Area).

| Attribute | Population method | Example of terminology |
|------------------|---|--|
| OBJECTID | Automatically populated | 279 |
| SHAPE | Automatically populated | Polygon |
| BROAD_CHARACTER | Manual entry | Broadest level of characterisation – ie Coastal industry, Navigation, etc |
| CHARACTER_TYPE | Manual entry | Intermediate level of characterisation – ie Docks ports and terminals, Navigation feature |
| SUB_CHARACTER | Manual entry. Dominant primary character of area in question. Checked for | Finest level of characterisation and most primary attribute in this table – ie. Historic fish dock, Active |

| | | |
|----------------|---|--|
| | accuracy and confidence | historic channel, etc |
| CHARACTER_AREA | Auto populated by SUB_CHARACTER type via database | Topographical location – each character area contains groups of polygons with similar attributes, ie ‘Markham’s Hole’ |
| PERIOD | Manual entry from assessment of maps and documentary sources | Benchmark period of origin of the area represented in the polygon, ie ‘Post medieval’ |
| PR_INT_ACT | Manual entry from assessment of SUB_CHARACTER type and associated documentary sources | Primary Intrusive Activity – ie. Aggregate dredging, Maintenance dredging |
| PR_NON_INT_ACT | Manual entry from assessment of SUB_CHARACTER type and associated documentary sources | Primary Non Intrusive Activity – ie. Commercial shipping, Water sports |
| OTHER_USE | Manual entry. Assessment of SUB_CHARACTER type and associated documentary sources | Other secondary seascape uses that are apparent, but are not the dominant characteristic of the polygon, ie ‘Nature reserve’ |
| MORPHOLOGY | Manual entry from study of map and documentary sources. | Form and structure of sea floor/coastal area, ie ‘Coastal plain’ |
| IMPACT | Manual entry, derived from study of documentary sources | Impact of primary activities/characteristics evident in polygon on area of coast/sea represented in polygon. Assessed broadly as High, Moderate or Low |
| PREV_CHAR | Manual entry, derived from study of documentary sources and map regression | The previous character of the current seascape (where known), ie ‘Active historic salterns’ |
| LOCATION | Manual entry | Where the polygon is physically located: Estuarine, Coastal or Sea |
| DATASOURCE | Manual entry | Where raw info used for characterisation was collected from |
| NOTES | Manual entry | More background information on the history of the polygon. Basically an expansion of information recorded in Broad_Character, Character_Type and Sub_Character |
| CONFIDENCE | Manual entry | Degree of certainty assigned to interpretation. Assessed broadly as High, Moderate or Low |
| CHECKED_BY | Manual entry. | Initials of the person responsible for checking the information before |

| | | |
|--------------|-------------------------|--------------------------------|
| | | final output |
| SHAPE_LENGTH | Automatically populated | Automatically generated number |
| SHAPE_AREA | Automatically populated | Automatically generated number |

Table 2 Characterisation_polygons characterisation classification

Note that only one field for Prev_Character was included in the attribute table, as opposed to the multiple fields (ie Prev_Char_1, Prev_Char_2) that are used in land based HLC and the WA pilot project. The overlapping, layered approach negated the need for more than one Prev_Character field as successive changes in previous character could be accommodated in the multiple, overlapping layers and their Prev_Character fields.

The nomenclature for the characterisation attributes was allowed to develop through the course of the analysis and evolved and adapted to the strictures and information contained within the originator datasource layers. By creating an initial framework for characterisation (developed out of Wessex's work) MoLAS has been able to adjust and evolve the characterisation classification system to produce a rigorous and robust classification system during the characterisation process itself. All modifications to the character terms were retro-actively implemented onto pre-existing Characterisation_polygons to ensure homogeneity of nomenclature. This ensured that the descriptions remained robust and applied equally to all similar polygons, making the Characterisation_polygons data clear, easily accessible and searchable.

Manual entry was preferred for the majority of the attributes over automatic entry as it allowed for ongoing assessment of the Characterisation_polygons nomenclature at every point of data entry. This constant assessment aided the evolutionary nature of the classification system as it was rigorously tested each time it was implemented, which helped to identify weak areas and non-viability quickly.

Due to the layered, overlapping nature of the polygons stored in the Characterisation_polygons layer it was necessary, once the Characterisation_polygons had all been generated, to arrange them into a visibility hierarchy where the SUB_CHARACTER field was used to rank the polygons into order. It was decided that the SUB_CHARACTER classifications that had the highest impact should be given the highest positions and so forth downwards. Fortuitously those polygons which had the greatest impact on the seabed, the gas installations, were also the smallest and would have been obscured by any overlying polygon.

The benefit of the overlapping, multi layered system is that, although the project is currently ranked by impact, it can be reordered quickly and simply without loss of information, according to another characteristic, such as Period, Prev_Char, etc.

The hierarchy is displayed by in Table 3 below. By applying the layering symbol hierarchy MoLAS was able to preserve the depth and breadth of data within the Characterisation_polygons while still allowing for iconic visuals of the primary dominant characteristics to be displayed at SUB_CHARACTER level. See the final report for more on the philosophy behind the layered approach.

| SUB_CHARACTER | Symbol Level | SUB_CHARACTER | Symbol Level |
|---------------------------------------|---------------------|------------------------------------|---------------------|
| Template | 127 | Historic haven | 72 |
| Wellhead | 126 | Modern anchorage | 71 |
| Active aggregate dredging zone | 125 | Historic drying area | 70 |
| Active chemical pipeline | 124 | Modern drying area | 69 |
| Active gas pipeline | 123 | Spoil ground | 68 |
| Manifold | 122 | Disused historic channel | 67 |
| Disused pipeline | 121 | Disused historic quarantine area | 66 |
| Platform | 120 | Active historic anchorage | 65 |
| Subsea structure | 119 | SAC | 64 |
| Active mixed hydrocarbon pipeline | 118 | Leisure beach | 63 |
| Active other fluid pipeline | 117 | Angling | 62 |
| Active pipeline | 116 | Holiday village | 61 |
| Active power cable | 115 | Nature reserve | 60 |
| Offshore production area | 114 | Holiday camp | 59 |
| Oil field | 113 | NNR | 58 |
| Gas field | 112 | SPA | 57 |
| Active wind farm area | 111 | Caravan park | 56 |
| Wreck cluster | 110 | Marina | 55 |
| Modern cargo dock | 109 | SSSI | 54 |
| Chemical works | 108 | Golf course | 53 |
| Modern dredged channel | 107 | Historic sand dunes | 52 |
| Warehouses | 106 | RAMSAR | 51 |
| Historic cargo dock | 105 | SAM | 51 |
| Oil storage and works | 104 | Submerged forest | 50 |
| Gas terminal and works | 103 | Water sports | 50 |
| Oil terminal and works | 102 | Historic canal | 49 |
| Dock and port related industrial area | 101 | Aquarium | 48 |
| Historic fish dock | 100 | Disused WWII minefield | 47 |
| Deep water route | 99 | Proposed gas pipeline | 46 |
| Submarine exercise area | 98 | Precommissioned gas pipeline | 45 |
| Modern channel | 97 | Disused WWI fort | 44 |
| Modern deep water anchorage | 96 | Disused WWII airfield | 43 |
| Traffic control | 95 | Disused WWII anti aircraft battery | 42 |
| Active historic channel | 94 | Disused WWII decoy | 41 |
| Coastal wreck cluster | 93 | Disused chemical pipeline | 40 |
| Maritime settlement area | 92 | Disused WWII barracks | 39 |
| Maritime conservation area | 91 | Military practice area | 38 |
| Historic maritime settlement | 90 | Overfalls | 37 |
| Eel fishing | 89 | Flats | 36 |
| Samphire picking | 88 | Spit | 35 |
| Dive site | 87 | Ridge | 34 |
| Salmon and sea trout fishing | 86 | Shoal | 33 |
| Scrap metal storage | 85 | Sands | 32 |

| | | | |
|---|---------------------|--|---------------------|
| Inactive licensed shellfish beds | 84 | Bank | 31 |
| Active licensed shellfish beds | 83 | Knoll | 30 |
| Bait digging area | 82 | Ridge and bank | 29 |
| SUB_CHARACTER | Symbol Level | SUB_CHARACTER | Symbol Level |
| Disused historic salterns | 81 | Sandeel nursery area | 18 |
| Generic coastal fishery | 80 | Environmental protection limit, normal baseline | 17 |
| Generic coastal fishing area | 79 | Sole spawning area - March to May | 16 |
| Historic ship breaking area | 78 | Exclusive economic zone | 15 |
| Sole trawling area | 77 | Sandeel spawning area November to February | 14 |
| Historic fishing ground | 76 | Offshore fishing area | 13 |
| Whitefish longlining | 75 | Environmental protection limit, low water baseline | 12 |
| Land based wind farm | 74 | Sprat nursery area | 11 |
| Crab and lobster potting | 73 | Sprat spawning area - May to August | 10 |
| Licensed aggregate dredging area | 28 | Plaice nursery area | 9 |
| Licensed wind farm area | 27 | Lemon sole spawning area - April to September | 8 |
| License application aggregate dredging area | 26 | Lemon sole nursery area | 7 |
| Firing range | 25 | Restricted fishing area | 6 |
| Modern flood risk area | 24 | Cod nursery area | 5 |
| Post medieval reclaimed land | 23 | Herring spawning area - August to October | 4 |
| Medieval and earlier reclaimed land | 22 | 6 nautical mile fishery zone | 3 |
| Airfield | 21 | 3 nautical mile territorial sea area | 2 |
| RAF practice area | 20 | Whiting nursery area | 1 |
| Crab fishery | 19 | 12 nautical mile territorial sea area | 0 |

Table 3 Symbol Level hierarchy

4.1.8 Character_Area attribute population

The purpose of the Seascapes Character_Area layer is to summarise and spatially define areas where polygons of similar attributes are found in close spatial relationship (see Section 3.1). The Character_Area polygons were created using the underlying Characterisation_polygons and the originator data sources, with particular reference to the Albert Close fishing chart which contained invaluable information on named sea areas which gave historic character to the area. Local place names (eg Leman Ground), major named features (eg Bessemer gas field) or major designations (eg North Sea transport route) were used to provide the names of the Character_Areas to enhance their local applicability and conceptual lineage from the seascape itself.

The Character_Area characterisation attributes used the same structure as the Characterisation_polygons except for the following:

| Attribute | Population method | Example of terminology |
|------------------|--|---|
| CHARACTER_AREA | Manual entry, derived from dominant character of Characterisation_polygons | Topographical location – each character area contains groups of polygons with similar attributes, ie ‘Markham’s Hole’ |
| IMPACT | Automated entry | Not applicable. Spatial concept with no impact |
| DATASOURCE | Automated entry | Not applicable. Polygons generated by MoLAS |

Table 4 Character_Area characterisation classification differences

Seventy Character areas were defined for the Withernsea to Skegness area (Fig 2) and these were then used to fill in the CHARACTER_AREA attribute of the Characterisation_polygons layer by use of a custom investigative GIS tool.

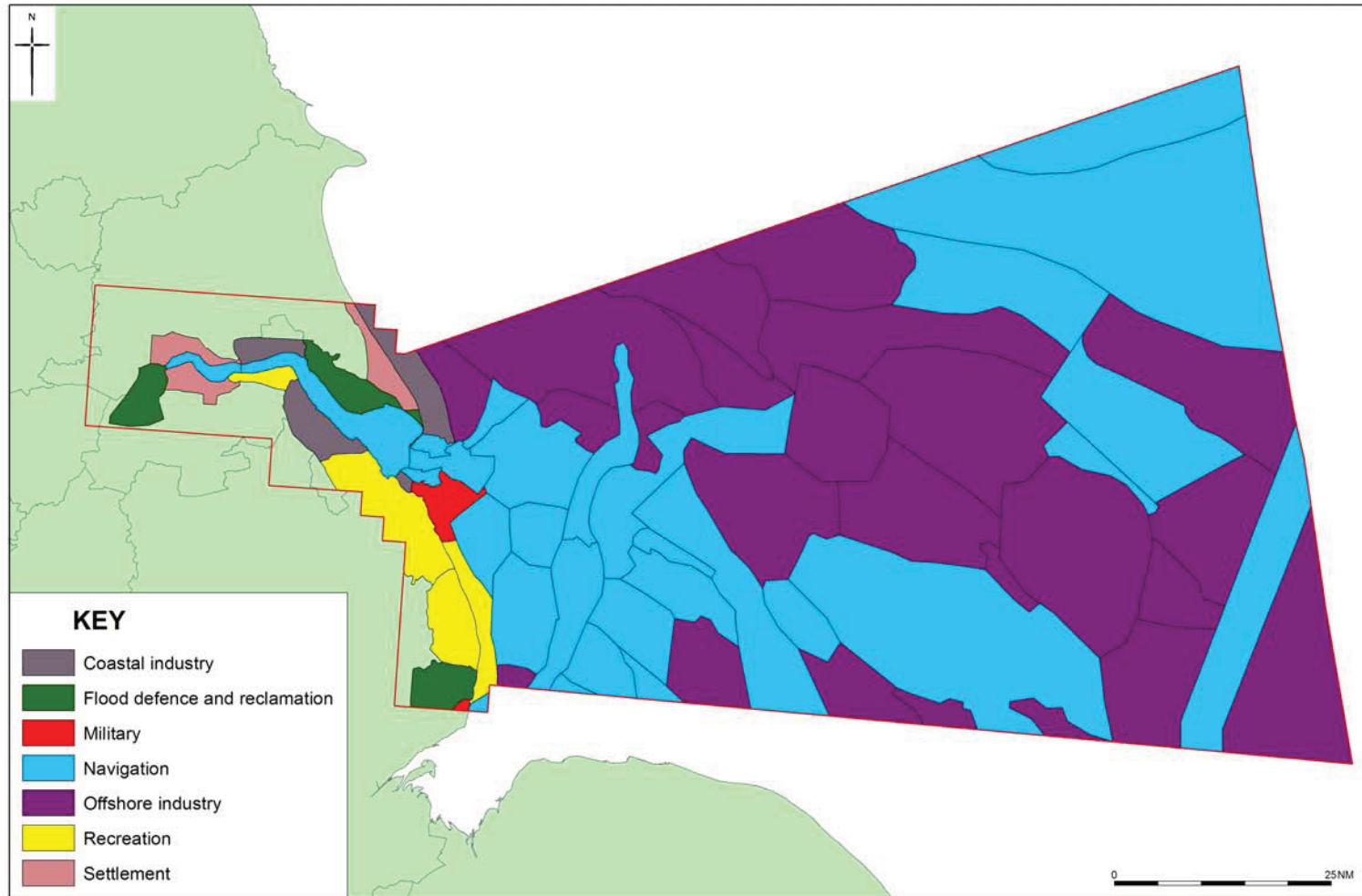


Fig 2 Character_Area displayed at BROAD_CHARACTER level

4.2 Metadata

Metadata was automatically generated during the course of operations by ArcGIS and can be investigated within Gis and the ArcCatalog framework. This metadata includes the co-ordinate system used, any transformations employed and all processes implemented on the feature class. The metadata standard used was UKGEMINI format.

An example of the metadata generated for the final Characterisation_polygons layer is presented below with all entries expanded to show available metadata:

4.2.1 DESCRIPTION:

Data storage and access information

File name: Characterisation_polygons

Type of data: vector digital data

Location of the data:

- \\data-mwh-1\projects\LINC\1002\na\ARCGIS\UTM31N\Deliverables\MoLAS_Seascapes.mdb
- Data processing environment:* Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 2; ESRI ArcCatalog 9.1.0.780

Constraints on accessing and using the data

Details about this document

Contents last updated: 20070316 at time 13171300

Who completed this document

Standards used to create this document

Standard name: FGDC Content Standards for Digital Geospatial Metadata

Standard version: FGDC-STD-001-1998

Time convention used in this document: local time

Metadata profiles defining additional information

- ESRI Metadata Profile: <http://www.esri.com/metadata/esriprof80.html>

4.2.2 SPATIAL:

Horizontal coordinate system

Projected coordinate system name: WGS_1984_UTM_Zone_31N

Geographic coordinate system name: GCS_WGS_1984

Details

Altitude System Definition

Resolution: 0.000010

Encoding Method: Explicit elevation coordinate included with horizontal coordinates

Bounding coordinates

Horizontal

In decimal degrees

West: -0.924656

East: 3.149396

North: 54.335805

South: 52.937346

In projected or local coordinates

Left: 244483.615883

Right: 509713.846388

Top: 6020884.536345

Bottom: 5872071.276329

Lineage

ESRI geoprocessing history

1. Merge

Date and time: 20070307 at time 153843

Tool location: C:\Program Files\ArcGIS\ArcToolbox\Toolboxes\Data Management Tools.tbx\Merge

Command issued

```
Merge SC_columns_Merge_070307_Merg;'Hull_and_outwards_polygons_V2 selection'
P:\LINC\1002\na\ARCGIS\UTM31N\Expo\CA_and_SC_columns.mdb\SC_columns_Merge_0
70307_Merg2 "BROAD_CHARACTER BROAD_CHARACTER true true false 2147483647 Text
0 0 ,First,#,SC_columns_Merge_070307_Merg,BROAD_CHARACTER,-1,-
1,Hull_and_outwards_polygons_V2 selection,BROAD_CHARACTER,-1,-1;CHARACTER_TYPE
CHARACTER_TYPE true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,CHARACTER_TYPE,-1,-
1,Hull_and_outwards_polygons_V2 selection,CHARACTER_TYPE,-1,-1;SUB_CHARACTER
SUB_CHARACTER true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,SUB_CHARACTER,-1,-
1,Hull_and_outwards_polygons_V2 selection,SUB_CHARACTER,-1,-1;CHARACTER_AREA
CHARACTER_AREA true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,CHARACTER_AREA,-1,-
1,Hull_and_outwards_polygons_V2 selection,CHARACTER_AREA,-1,-1;PERIOD PERIOD true
true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PERIOD,-1,-
1,Hull_and_outwards_polygons_V2 selection,PERIOD,-1,-1;PRI_INT_ACT PRI_INT_ACT
true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,PRI_INT_ACT,-1,-1;PRI_NON_INT_ACT
PRI_NON_INT_ACT true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,PRI_NON_INT_ACT,-1,-
1,Hull_and_outwards_polygons_V2 selection,PRI_NON_INT_ACT,-1,-1;OTHER_USE
OTHER_USE true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,OTHER_USE,-1,-
1,Hull_and_outwards_polygons_V2 selection,OTHER_USE,-1,-1;MORPHOLOGY
MORPHOLOGY true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,MORPHOLOGY,-1,-
1,Hull_and_outwards_polygons_V2 selection,MORPHOLOGY,-1,-1;IMPACT IMPACT true true
false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,IMPACT,-1,-
1,Hull_and_outwards_polygons_V2 selection,IMPACT,-1,-1;PREV_CHAR PREV_CHAR true
true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PREV_CHAR,-
1,-1,Hull_and_outwards_polygons_V2 selection,PREV_CHAR,-1,-1;LOCATION LOCATION
true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,LOCATION,-1,-
1,Hull_and_outwards_polygons_V2 selection,LOCATION,-1,-1;DATASOURCE DATASOURCE
true true false 2147483647 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,DATASOURCE,-1,-
1,Hull_and_outwards_polygons_V2 selection,DATASOURCE,-1,-1;NOTES NOTES true true
false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,NOTES,-1,-
1,Hull_and_outwards_polygons_V2 selection,NOTES,-1,-1;CONFIDENCE CONFIDENCE true
true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,CONFIDENCE,-
1,-1,Hull_and_outwards_polygons_V2 selection,CONFIDENCE,-1,-1;CHECKED_BY
CHECKED_BY true true false 255 Text 0 0
,First,#,SC_columns_Merge_070307_Merg,CHECKED_BY,-1,-
1,Hull_and_outwards_polygons_V2 selection,CHECKED_BY,-1,-1;Shape_Length
Shape_Length false true true 8 Double 0 0
,First,#,SC_columns_Merge_070307_Merg,Shape_Length,-1,-
1,Hull_and_outwards_polygons_V2 selection,Shape_Length,-1,-1;Shape_Area Shape_Area
```

false true true 8 Double 0 0 ,First,#,SC_columns_Merge_070307_Merg,Shape_Area,-1,-1,Hull_and_outwards_polygons_V2 selection,Shape_Area,-1,-1;PR_INT_ACT PR_INT_ACT true true false 255 Text 0 0 ,First,#,Hull_and_outwards_polygons_V2 selection,PR_INT_ACT,-1,-1"

2. Two file merger_1

Date and time: 20070307 at time 153844

Tool location: P:\LINC\1002\na\ARCGIS\UTM31N\Expo\New Tools.tbx\Two file merger

Command issued

Two file merger SC_columns_Merge_070307_Merg "Hull_and_outwards_polygons_V2 selection" "BROAD_CHARACTER BROAD_CHARACTER true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,BROAD_CHARACTER,-1,-1,Hull_and_outwards_polygons_V2 selection,BROAD_CHARACTER,-1,-1;CHARACTER_TYPE CHARACTER_TYPE true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,CHARACTER_TYPE,-1,-1,Hull_and_outwards_polygons_V2 selection,CHARACTER_TYPE,-1,-1;SUB_CHARACTER SUB_CHARACTER true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,SUB_CHARACTER,-1,-1,Hull_and_outwards_polygons_V2 selection,SUB_CHARACTER,-1,-1;CHARACTER_AREA CHARACTER_AREA true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,CHARACTER_AREA,-1,-1,Hull_and_outwards_polygons_V2 selection,CHARACTER_AREA,-1,-1;PERIOD PERIOD true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PERIOD,-1,-1,Hull_and_outwards_polygons_V2 selection,PERIOD,-1,-1;PRI_INT_ACT PRI_INT_ACT true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PRI_INT_ACT,-1,-1;PRI_NON_INT_ACT PRI_NON_INT_ACT true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PRI_NON_INT_ACT,-1,-1,Hull_and_outwards_polygons_V2 selection,PRI_NON_INT_ACT,-1,-1;OTHER_USE OTHER_USE true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,OTHER_USE,-1,-1,Hull_and_outwards_polygons_V2 selection,OTHER_USE,-1,-1;MORPHOLOGY MORPHOLOGY true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,MORPHOLOGY,-1,-1,Hull_and_outwards_polygons_V2 selection,MORPHOLOGY,-1,-1;IMPACT IMPACT true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,IMPACT,-1,-1,Hull_and_outwards_polygons_V2 selection,IMPACT,-1,-1;PREV_CHAR PREV_CHAR true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,PREV_CHAR,-1,-1,Hull_and_outwards_polygons_V2 selection,PREV_CHAR,-1,-1;LOCATION LOCATION true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,LOCATION,-1,-1,Hull_and_outwards_polygons_V2 selection,LOCATION,-1,-1;DATASOURCE DATASOURCE true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,DATASOURCE,-1,-1,Hull_and_outwards_polygons_V2 selection,DATASOURCE,-1,-1;NOTES NOTES true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,NOTES,-1,-1,Hull_and_outwards_polygons_V2 selection,NOTES,-1,-1;CONFIDENCE CONFIDENCE true true false 2147483647 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,CONFIDENCE,-1,-1,Hull_and_outwards_polygons_V2 selection,CONFIDENCE,-1,-1;CHECKED_BY CHECKED_BY true true false 255 Text 0 0 ,First,#,SC_columns_Merge_070307_Merg,CHECKED_BY,-1,-1,Hull_and_outwards_polygons_V2 selection,CHECKED_BY,-1,-1;Shape_Length Shape_Length false true true 8 Double 0 0 ,First,#,SC_columns_Merge_070307_Merg,Shape_Length,-1,-1,Hull_and_outwards_polygons_V2 selection,Shape_Length,-1,-1;Shape_Area Shape_Area false true true 8 Double 0 0 ,First,#,SC_columns_Merge_070307_Merg,Shape_Area,-1,-1,Hull_and_outwards_polygons_V2 selection,Shape_Area,-1,-1;PR_INT_ACT PR_INT_ACT

true true false 255 Text 0 0 ,First,#,Hull_and_outwards_polygons_V2
selection,PR_INT_ACT,-1,-1"
P:\LINC\1002\na\ARCGIS\UTM31N\Expo\CA_and_SC_columns.mdb\SC_columns_Merge_0
70307_Merg2

3. Process

Date and time: 20070307 at time 154918

Tool location: C:\Program Files\ArcGIS\ArcToolbox\Toolboxes\Data Management
Tools.tbx\CopyFeatures

Command issued

CopyFeatures

P:\LINC\1002\na\ARCGIS\UTM31N\Expo\CA_and_SC_columns.mdb\SC_columns_Merge_0
70307_Merg2

P:\LINC\1002\na\ARCGIS\UTM31N\Expo\Topo_050307.mdb\CA_topo\SC_columns_Merge_
070307_Merg2 # 0 0 0

4. Process

Date and time: 20070308 at time 165441

Tool location: C:\Program Files\ArcGIS\ArcToolbox\Toolboxes\Data Management
Tools.tbx\CopyFeatures

Command issued

CopyFeatures

P:\LINC\1002\na\ARCGIS\UTM31N\Expo\Topo_050307.mdb\CA_topo\SC_columns_Merge_
070307_Merg2

P:\LINC\1002\na\ARCGIS\CleanData.mdb\SC_columns_Merge_070307_Merg2 # 0 0 0

5. Process

Date and time: 20070313 at time 150835

Tool location: C:\Program Files\ArcGIS\ArcToolbox\Toolboxes\Data Management
Tools.tbx\CopyFeatures

Command issued

CopyFeatures "P:\LINC\1002\na\ARCGIS\UTM31N\Expo\Clean
Data\CleanData.mdb\SC_MEND_AND_DEFEND"

P:\LINC\1002\na\ARCGIS\UTM31N\Deliverables\MoLAS_Seascapes.mdb\SC_MEND_AND_D
EFEND # 0 0 0

Spatial data description

Vector data information

ESRI description

Characterisation_polygons

ESRI feature type: Simple

Geometry type: Polygon

Topology: FALSE

Feature count: 1019

Spatial Index: TRUE

Linear referencing: FALSE

SDTS description

Feature class: SDTS feature type, feature count

- Characterisation_polygons: G-polygon, 1019

4.2.3 ATTRIBUTES

Details for Characterisation_polygons

Type of object: Feature Class

Number of records: 1019

Attributes

OBJECTID

Alias: OBJECTID

Data type: OID

Width: 4

Precision: 0

Scale: 0

Definition: Internal feature number.

Definition Source: ESRI

Shape

Alias: Shape

Data type: Geometry

Width: 0

Precision: 0

Scale: 0

Definition: Feature geometry.

Definition Source: ESRI

BROAD_CHARACTER

Alias: BROAD_CHARACTER

Data type: String

Width: 2147483647

Precision: 0

Scale: 0

CHARACTER_TYPE

Alias: CHARACTER_TYPE

Data type: String

Width: 2147483647

Precision: 0

Scale: 0

SUB_CHARACTER

Alias: SUB_CHARACTER

Data type: String

Width: 2147483647

Precision: 0

Scale: 0

CHARACTER_AREA

Alias: CHARACTER_AREA

Data type: String

Width: 2147483647

Precision: 0

Scale: 0

PERIOD

Alias: PERIOD

Data type: String

Width: 2147483647

Precision: 0

Scale: 0

PRI_INT_ACT

Alias: PRI_INT_ACT

Data type: String

Width: 2147483647
Precision: 0
Scale: 0

PRI_NON_INT_ACT

Alias: PRI_NON_INT_ACT
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

OTHER_USE

Alias: OTHER_USE
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

MORPHOLOGY

Alias: MORPHOLOGY
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

IMPACT

Alias: IMPACT
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

PREV_CHAR

Alias: PREV_CHAR
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

LOCATION

Alias: LOCATION
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

DATASOURCE

Alias: DATASOURCE
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

NOTES

Alias: NOTES
Data type: String
Width: 2147483647

Precision: 0
Scale: 0

CONFIDENCE

Alias: CONFIDENCE
Data type: String
Width: 2147483647
Precision: 0
Scale: 0

CHECKED_BY

Alias: CHECKED_BY
Data type: String
Width: 255
Precision: 0
Scale: 0

Shape_Length

Alias: Shape_Length
Data type: Double
Width: 8
Precision: 0
Scale: 0
Definition: Length of feature in internal units.
Definition Source: ESRI

Shape_Area

Alias: Shape_Area
Data type: Double
Width: 8
Precision: 0
Scale: 0
Definition: Area of feature in internal units squared.
Definition Source: ESRI

4.3 Developing the multimedia resource

It is envisaged that the website for the ALSF English Heritage Seascapes (EHS) project will have two main components: a suite of web pages which constitute the project's micro-site and an interactive mapping environment. The exact structure of the proposed website is unknown at present as MoLAS will not be the host.

4.3.1 Web pages

The web page examples were built using Microsoft Content Management Server 2002. This system comprises a series of templates into which content is inserted, a resource gallery into which images, downloads and so fourth may be loaded and a work flow to manage the approval and publishing process. The EHS project makes use of 'micro site' templates developed by the Museum System Team, which are characterized by having their own navigation, and as such can function as a stand alone site.

The main products of the project are covered in the *Characterisation* channel, where content is organized by the *Broad Character* categories. From the home page of the characterisation channel one can jump to the interactive map to see all the areas within a particular broad character. Within each channel (e.g. Offshore industry-Gas) there is a page for each zone and

from each of these it is possible to link to the interactive map to see the polygon defining the area in question.

The descriptive text for each character area was generated using a wide variety of sources, from historic written sources to point data of recorded ship losses. To clearly present this information in a standardised and accessible way the following headings were devised:

- Present Day Form
- Sea Use: Present
- Sea Use: Past
- Archaeological Potential
- Character Perceptions
- References

These headings were devised and defined by Wessex in their Method Statement. The definitions are the same for the MoLAS project as well. Please refer to the Wessex Method statement for the full definitions (WA 2006). An example Character Area document follows:

West Sole

The West Sole offshore character area is situated in the northern central section of the study area in the area of major gas fields of the West Sole and Amethyst fields off the east coast of East Yorkshire.

Present Day Form

The geology of the area comprises a complex of Jurassic and Triassic bedrock overlain by glacial till (clay, sand and gravel debris deposited from ice sheets) known as the Boulders Bank Formation. The water depth across the area varies between 20m and 35m and the maximum tidal range is 2-3m.

Sea Use: Present

The West Sole character area dominant character is gas related industry. It has no active aggregate extraction or wind farm industries. The West Sole field was discovered in 1965 and started production in 1983. With reserves of 60 billion cubic metres of gas and a peak production of 2.3 billion cubic metres of gas per year it is one of the southern North Sea's major hydrocarbon fields with permanent installations both on the seabed and free standing rigs. The field is connected directly to the Easington Gas Terminal in East Yorkshire by two pipelines.

The principal fishing activity in the area is part of the Off Ground fishing area. The principal fishing activity in the area is trawling for white fish such as cod and whiting and flat fish such as sole and plaice by beam trawlers. There is also shrimp fishing for brown and pink shrimp. The area is a moderately fished offshore ground and is locally important, particularly for trawling vessels and for vessels following the more mobile fisheries, for example, pink shrimp.

Commercial shipping crosses the area on a regular basis. The fishing in the character area is limited by the number of sea bed obstructions and exclusion zones associated with gas exploitation.

Sea Use: Past

The West Sole character area has been shaped by thousands of years of dynamic sea level changes and erosion and deposition. The relatively shallow nature of the sea bed means that the area was dry land almost certainly in the Upper Palaeolithic period and at least the earlier part of the Mesolithic period. Marine traffic would have crossed this area on a regular basis from the Roman period onwards. Fishing activity would have been carried out in the area from the medieval period onwards. The Close's Fisherman's Chart (UKHO 1953) taken from surveys and reports from 1904 to 1925 describes the area as *good ground for all kinds of fish with a stoney and sometimes catchy bottom but Trawlers and some Seine netters work it*. The best months for fishing are Jan, Mar, May, June, July and Oct.

Archaeological Potential

The West Sole character area has potential for the presence of drowned land surfaces resulting from the fact that sea level has fluctuated between -120 metres and +10 metres over the past 500,000 years. From the period 500,000 BP to 22,000 BP (before present), human population levels were low, and little more than stray finds may be expected, although these may still be of considerable archaeological importance.

From 22,000 BP to 2100 BP parts of the North Sea were dry land and human population levels were higher, especially in the Mesolithic age. Finds dating to the Mesolithic have been found to a depth of 40m so any area of sea bed above that has potential for habitation. Inundation of the North Sea landscapes occurred between 10,000 and 6,000 BP and the most likely evidence for human occupation would be, therefore, Mesolithic in date. Earlier Palaeolithic occupation is less likely to be found and later Neolithic occupation is likely to have been limited to the inshore and very highest of the banks and shoals such as the Dogger Bank. The areas position makes it a possible Upper Palaeolithic and Mesolithic habitation area.

Consequently, there is some potential for surviving evidence of human activity within the area. Over the last 6000 years (if not more), humans have used sea faring vessels and this area may contain wrecks and related material that may lie on the sea floor or be buried beneath the sea floor. UKHO and NMR data show a total of 4 known wrecks in this area, 3 unnamed and 1 named, the Sea Gem jack up drilling rig which collapsed on 28th December 1965 with the loss of 13 lives. This is a historically significant wreck as the Sea Gem was the first rig to find offshore hydrocarbons in the UK sector in July 1965 whilst drilling in the West Sole field.

Character Perceptions

The area is perceived as an important industrial area as it contains the West Sole production field with an important legacy of this industry in the form of the wreck of the Sea Gem. It is also an offshore fishing ground with, at present, direct offshore industrial pressures from the gas fields in the area.

References

Close's Fisherman's Chart (UKHO 1953)
Fisheries Sensitivity Maps in British Waters (MAFF 1989)
Scandoil, North Sea Oil and Gas production Fields (Scandoil Oil and Gas Magazine online)

4.3.2 Interactive map

The Character Area documents would be made available via a microsite and interactive mapping system. The interactive map is built using ESRI's ArcIMS9.1 application. This compliments ESRI's ArcGIS product (which was the main GIS engine used by the project), since it is able to directly take shape files and layers from it for projection on the internet. The default ArcIMS environment has been modified to reflect the project identity and aid usability. Spurious tools have been removed, fonts sizes increased, and explicit titled buttons replace icons where appropriate.

The map is navigated in the conventional manner using the button and mouse, while enquiries about any one zone can be made by click onto the map. This action causes information about the area to be displayed in a table at the base of the screen, and if one wishes to know more a hyperlink is provided. This hyperlink links back to the CMS page for the area in question. Area searches can be conducted where the result form a number of areas will be displayed, while attribute queries will interrogate the background tables for all instances of a particular string. Rows returned in response to the latter can be clicked in order to zoom to a chosen area.

4.4 Example pages from the web enabled resource

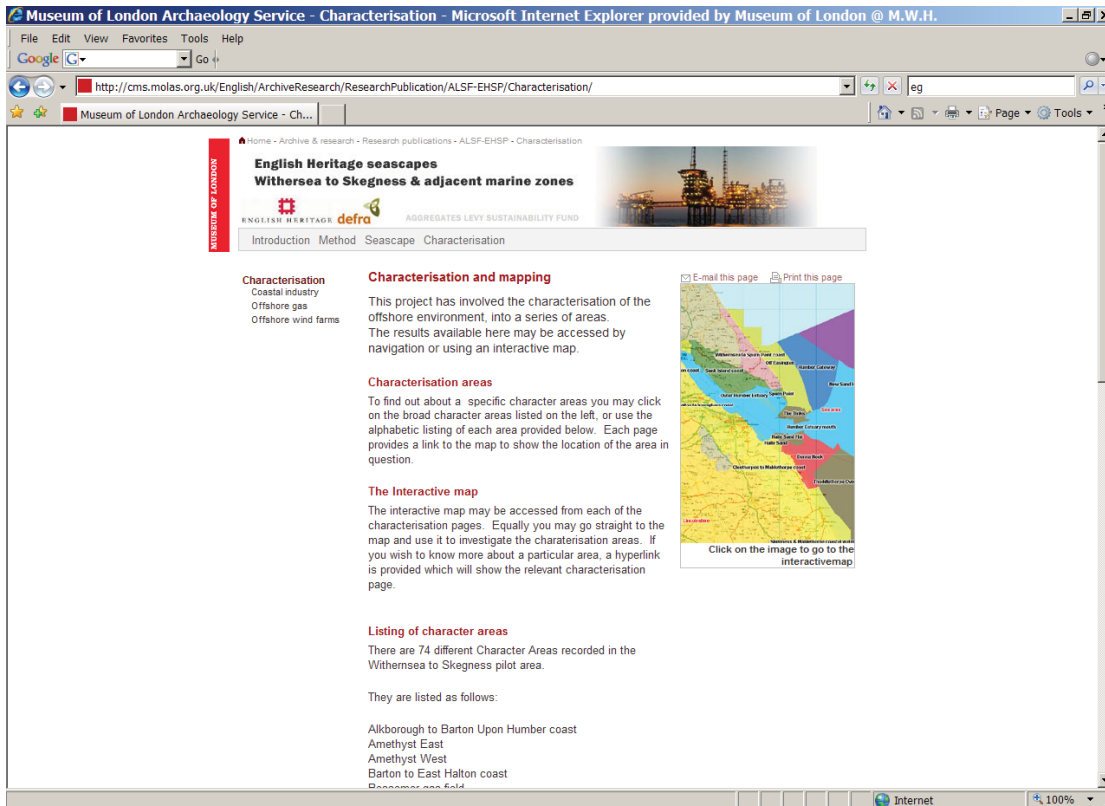


Fig 3 'Characterisation and Mapping' website page

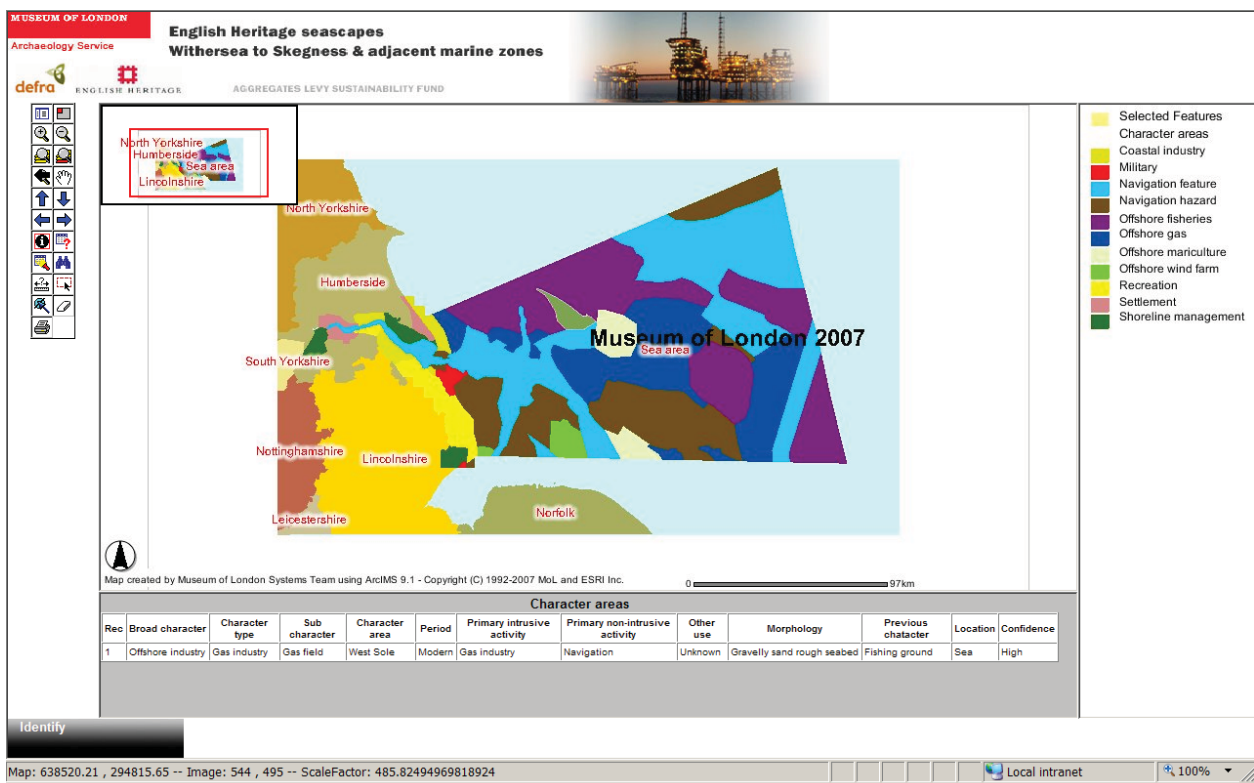


Fig 4 Interactive mapping with West Sole Character Area being investigated

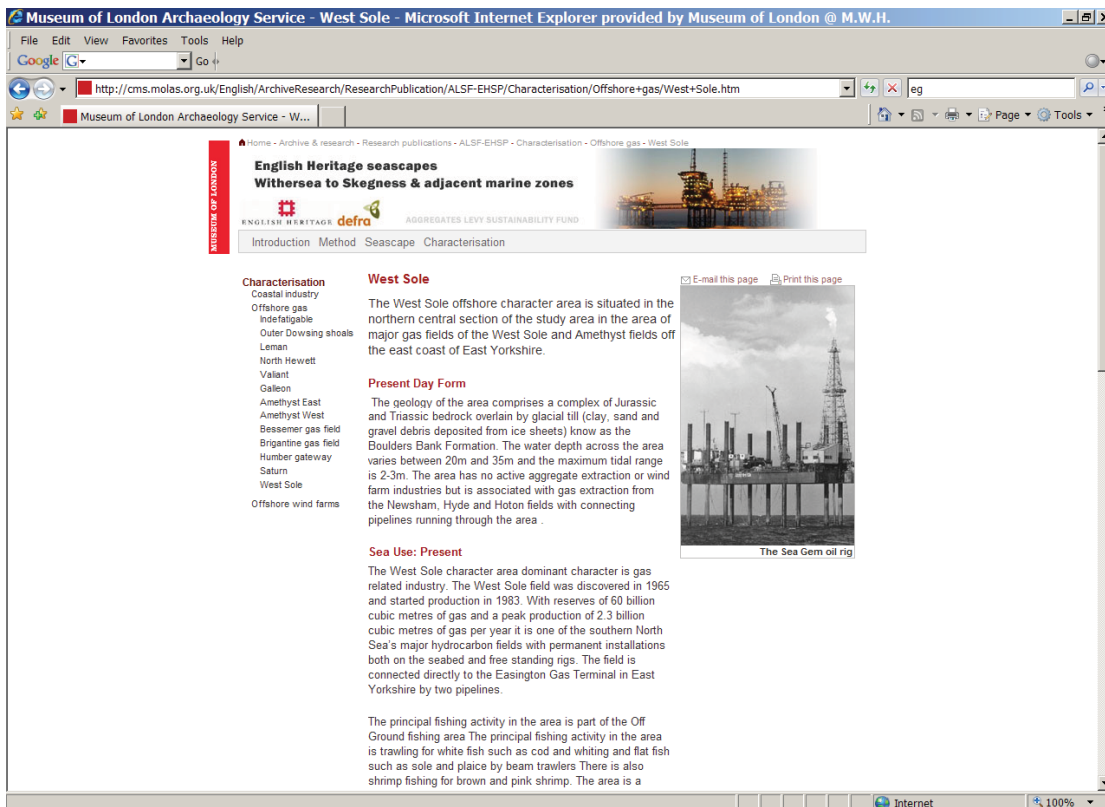


Fig 5 West Sole character area document as it appears on the website

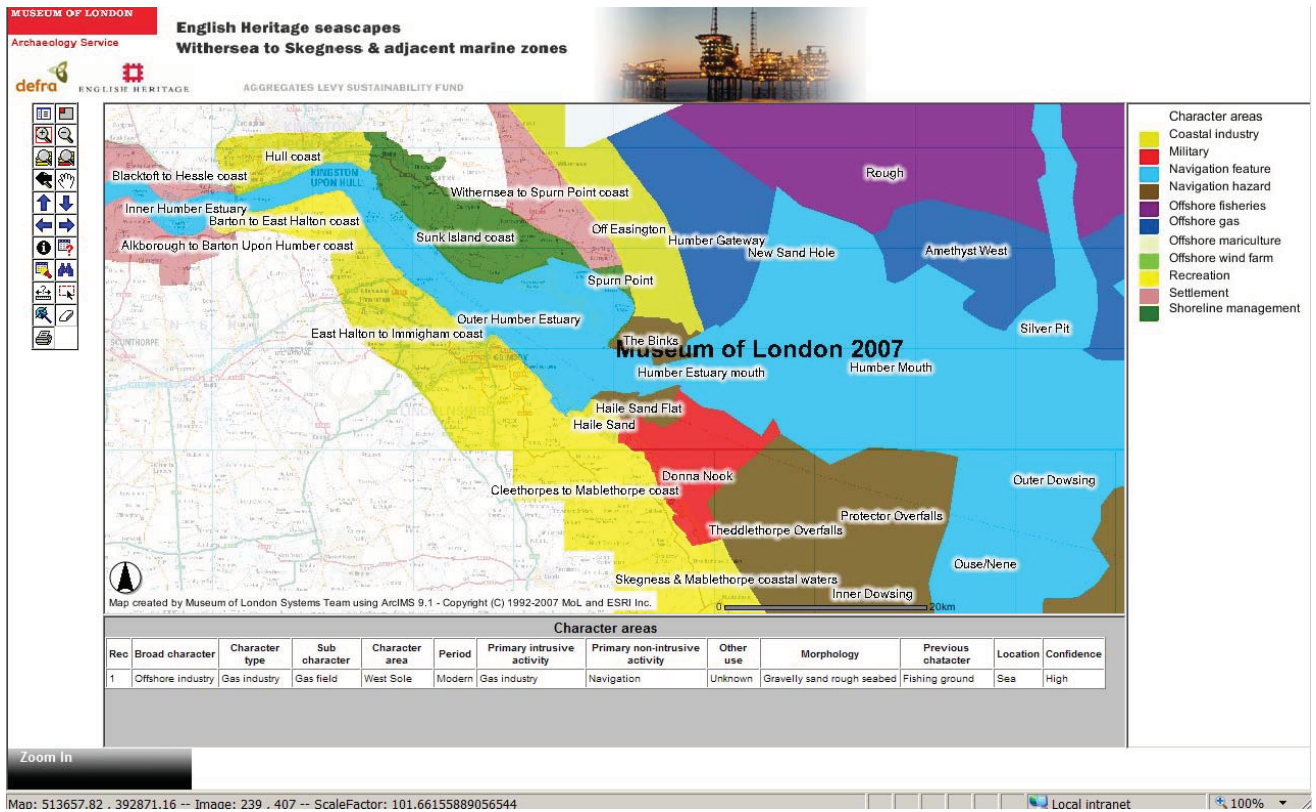


Fig 6 Zoomed into the interactive map

5 Relationship between character levels

The table below summarises the hierarchical relationship between ‘BROAD_CHARACTER’, ‘CHARACTER_TYPE’ and ‘SUB_CHARACTER’.

The descriptors are tied together and the SUB_CHARACTER classification directly informs on the CHARACTER_TYPE and hence the BROAD_CHARACTER. For example, SUB_CHARACTER ‘Samphire picking’ falls within CHARACTER_TYPE ‘Coastal mariculture’, which falls within BROAD_CHARACTER ‘Coastal industry’.

| BROAD_CHARACTER | CHARACTER_TYPE | SUB_CHARACTER |
|-------------------|-----------------------------|---|
| Coastal industry | Docks ports and terminals | Modern cargo dock Historic cargo dock Historic fish dock Gas terminal and works Oil terminal and works |
| | Haven | Historic haven |
| | Coastal processing industry | Warehouses Dock and port related industrial area Scrap metal storage Oil storage and works Chemical works Historic ship breaking area Disused historic salterns |
| | Coastal power generation | Land based wind farm |
| | Coastal mariculture | Active licensed shellfish beds Inactive licensed shellfish beds Bait digging area Samphire picking |
| | Coastal fisheries | Generic coastal fishing area Generic coastal fishery Sole trawling area Whitefish longlining Crab and lobster potting Salmon and sea trout fishing Eel fishing |
| Offshore industry | Offshore fisheries | Crab fishery Historic fishing ground Restricted fishing area Offshore fishing area |
| | Offshore mariculture | Lemon sole nursery area Sprat nursery area Plaice nursery area Cod nursery area Sandeel nursery area Whiting nursery area Lemon sole spawning area - April to September Sprat spawning area - May to August Herring spawning area - August to October |

| | | |
|-------------------------------|---------------------------|---|
| | | Sole spawning area - March to May Sandeel spawning area November to February |
| | Aggregate industry | Licensed aggregate dredging area Active aggregate dredging zone License application aggregate dredging area |
| | Offshore power generation | Offshore licensed wind farm area Offshore active wind farm area |
| | Oil industry | Oil field |
| | Gas industry | Gas field Offshore production area Template Subsea structure Wellhead Platform Manifold Proposed gas pipeline Active pipeline Active gas pipeline Active chemical pipeline Active mixed hydrocarbon pipeline Active other fluid pipeline Precommissioned gas pipeline Disused pipeline Disused chemical pipeline Active power cable |
| Flood defence and reclamation | Flood defended area | Modern flood risk area |
| | Historic reclaimed land | Post medieval reclaimed land Medieval and earlier reclaimed land |
| Military | Military structure | Disused WWII anti aircraft battery Disused WWII decoy Disused WWI fort Disused WWII airfield Disused WWII barracks Airfield |
| | Military area | Military practice area RAF practice area Firing range Disused WWII minefield Submarine exercise area |
| Navigation | Coastal hazard | Historic drying area Coastal wreck cluster Modern drying area |
| | Seabed hazard | Knoll Spit Overfalls Sands Ridge and bank Ridge Bank Shoal Flats |

| | | |
|------------|------------------------------|--|
| | | Wreck cluster |
| | Navigation feature | Active historic channel Active historic anchorage Disused historic channel Traffic control Modern channel Modern dredged channel Deep water route Modern anchorage Modern deep water anchorage Disused historic quarantine area Spoil ground |
| | Jurisdiction area | Exclusive economic zone 12 nautical mile territorial sea area 6 nautical mile fishery zone 3 nautical mile territorial sea area Environmental protection limit, normal baseline Environmental protection limit, low water baseline |
| Settlement | Maritime town and city | Maritime conservation area Maritime settlement area |
| | Maritime village | Historic maritime settlement |
| Recreation | Designated area | Nature reserve NNR RAMSAR SAC SSSI SAM SPA |
| | Archaeological interest area | Submerged forest |
| | Amusements | Leisure beach Marina Angling Water sports Holiday camp Caravan park Holiday village Historic canal Historic sand dunes Aquarium Golf course |
| | Offshore recreation | Dive site |

6 Attribute Definitions and terminology

6.1 Attribute terminology

Where possible MoLAS has used clear and concise language in its attribute naming, terminology and definitions. It is hoped these will be understandable and /or familiar to both marine stakeholders and terrestrial stakeholders. The attribute definitions has been covered earlier in this method statement (see Section 4.1.7)

6.2 Attribute formatting

Following English Heritage's guidelines the following formatting was followed:

- Each spatial feature was assigned a unique reference number (Automatically generated)
- All attribute names were in block capitals (Except where automatically set up by GIS).
- No spaces or exotic symbols were used in the attribute names. Underscores were used instead.
- Only where the full name would be inconveniently long were contractions used (eg PRI_INT_ACT = PRImary_INTrusive_ACTivity)

6.3 Characterisation_polygons layer attribute terminology: BROAD_CHARACTER, CHARACTER_TYPE and SUB_CHARACTER

The following tables contain the definitions of the BROAD_CHARACTER, CHARACTER_TYPE and SUB_CHARACTER classifications.

| BROAD_CHARACTER | Definition |
|-------------------------------|--|
| Coastal industry | This refers to the coastal area where industrial activity is the dominant influence on the character of the seascape. This includes the docks at Immingham and Hull, historic havens coastal fisheries and mariculture and all the coastal processing industries associated with the seascape |
| Offshore industry | This refers to the offshore area where industrial activity is the dominant influence on the character of the seascape. This includes gas production in the numerous offshore fields in the southern North Sea. Aggregate dredging in 9 licensed areas and 2 active wind farms. Industrial fishing takes place throughout the area. |
| Flood defence and reclamation | Includes the large area of flood defended land around the Humber Estuary and the Historic |

| | |
|------------|---|
| | reclaimed land of the Isle of Axholme, Sunk Island and the Lincolnshire Grazing Marsh |
| Military | Areas used by the military (Army Navy and Air Force) for defence and operational bases. Includes military structures such as batteries, forts airfields and areas such as firing ranges and practice areas. |
| Navigation | Related to the movement of shipping over the water. The broad character includes active and historic channels and anchorages, offshore and coastal hazards and U K jurisdiction zones. |
| Settlement | Areas of the coastal zone with a built environment specifically associated with the sea. This includes historic and modern ports and havens and coastal villages |
| Recreation | This broad character refers to activities related to pleasure or amusement but associated specifically with the sea or the coastal area. It includes designated areas such as Nature Reserves and the areas of the Lincolnshire coast given over to holiday activities. |

| CHARACTER_TYPE | Definition |
|-----------------------------|---|
| Docks ports and terminals | Relates to activities transferring materials from or to the sea. This includes modern and historic cargo and fish docks and oil and gas terminals. |
| Haven | Specifically relates to historic harbours and havens. |
| Coastal processing industry | This character type relates to all docks and port related industries, oil and gas storage areas and chemical works. Historic ship breaking and coastal salt production are also included. |
| Coastal power generation | Specifically relates to coastal wind farms |
| Coastal mariculture | Relates to the coastal shellfish industry of the Humber Estuary along with bait digging in the ITZ and samphire picking on the Lincolnshire saltmarsh. |
| Coastal fisheries | Relates to all the fishing activity in the 12 |

| | |
|-------------------------|---|
| | nautical mile limit from the coast |
| Offshore fisheries | Relates to all the fishing activity beyond the 12 nautical mile limit. Includes historic fisheries as defined by Close's Fisherman's Chart (UKHO, 1953) |
| Offshore mariculture | Relates specifically to areas defined by CEFAS as important nursery or spawning areas for a number of fish species caught in the North Sea |
| Aggregate | Includes all the licensed, active and application areas for aggregate extraction in the study area. |
| Wind farm | Includes all the licensed, active and application sites for wind farms in the study area. |
| Oil industry | Oil is minor by product of the offshore gas industry (see below) |
| Gas industry | Includes all the licensed, active and application areas for the offshore gas industry in the study area. There are more than 50 active gas fields in the study area and the character type includes all the production areas plus their associated infrastructure of sea bed structures and pipelines |
| Flood defended area | Relates to the modern flood risk area |
| Historic reclaimed land | Relates to land reclaimed in the post medieval period and that reclaimed in the medieval and earlier periods. |
| Military structure | Includes WWII anti aircraft batteries, decoys, airfields and barracks. The 2 WWI forts at the mouth of the Humber are also included. |
| Military area | Includes all military practice areas, disused minefields and offshore exercise areas. |
| Coastal hazard | Relates to modern and historic drying areas and coastal wrecks. |
| Seabed hazard | Relates to the terminology used on charts to describe the sea bed topography. |
| Navigation feature | Relates to all active and historic navigation channels, anchorages, quarantine zones and spoil grounds. |
| Jurisdiction area | This character type relates to all the UK economic and territorial zones within the study area. |

| | |
|------------------------------|--|
| Maritime town and City | This character type relates to all maritime conservation and settlement areas |
| Maritime village | This character type relates specifically to historic maritime settlement often now in areas away from the sea on reclaimed land |
| Designated area | All nature reserves and categories of protected sites are included in this character type. |
| Archaeological interest area | Specifically relates to the Lincolnshire coast submerged forest. |
| Amusements | This character type relates to all activities to do with coastal recreation specifically the tourist industry. It includes beaches, holiday camps, marinas and other leisure related activities. |
| Offshore recreation | Specifically relates to dive sites. |

| SUB_CHARACTER | Definition |
|---------------------------------------|--|
| Modern cargo dock | Related to the function of ports and harbours and dock related industries and the transfer of goods via sea transport. |
| Historic cargo dock | Related to the historic function of ports (possibly now non functioning) and harbours and dock related industries and the transfer of goods via sea transport. |
| Historic fish dock | Related to the historic function of a port or harbour to a specific industry: fishing, the supply of the fleet and distribution of the catch |
| Gas terminal and works | Related to the collection, distribution and use of gas from the southern North Sea gas fields via sub-sea pipeline . |
| Oil terminal and works | Related to the collection, distribution and use of oil from tanker terminals. |
| Historic haven | Small usually non functioning harbour related to shipping activities |
| Warehouses | Port, harbour or riverside buildings used for the storage of cargo. |
| Dock and port related industrial area | Industry specifically related to the import or export of goods from a dock or port and the servicing, building and supply of vessels |
| Scrap metal storage | Port or dock related scrap metal yard sometimes related to ship breaking activities |
| Oil storage and works | Related to the collection and distribution of oil products |

| | |
|----------------------------------|---|
| Chemical works | Industry associated with gas and oil terminals (see above) |
| Historic ship breaking area | Defined areas (often beaches or havens) where ships were dismantled for scrap timber and metal |
| Disused historic salterns | Related to the production of salt from sea water salterns are found along Lincolnshire Coast at the high spring tide mark and date from the Bronze Age through to the medieval period. The process creates large mounds of discarded sand and silt. |
| Land based wind farm | Renewable energy, electricity producing turbines usually placed in a coastal position to maximise the use of wind power |
| Active licensed shellfish beds | Licensed area (NEFSC), usually in the inter tidal drying zone, for cockle, whelk etc fishing |
| Inactive licensed shellfish beds | Licensed area (NEFSC), usually in the inter tidal drying zone, for cockle, whelk etc fishing which has been closed due to over fishing or pollution |
| Bait digging area | Area, usually in the inter tidal drying zone, where digging for Lugworm and Ragworm takes place. The worms are usually used as bait by recreational fishers. |
| Samphire picking | Area of saltmarsh where samphire (sea asparagus) is collected for cooking – has a small commercial value. |
| Generic coastal fishing area | Relating to an area where inshore fishing takes place. Includes trawling, longlining and the use of static gear (potting) |
| Generic coastal fishery | Relating to an area where inshore fishing takes place for a particular type of fish or shellfish |
| Sole trawling area | Relating to an area where trawling for sole (a flatfish) takes place. |
| Whitefish longlining | Relating to an area where long lining takes place for whitefish (cod, haddock, whiting etc) |
| Crab and lobster potting | Relating to an area (usually inshore) where the use of static gear (potting) takes place for crab and lobster |
| Salmon and sea trout fishing | Relating to an area where fishing takes place for salmon and sea trout usually using drift nets. |
| Eel fishing | Relating to an area where fishing takes place for eels (usually in the rivers which empty into the Humber) using traps |
| Crab fishery | Relating to an area where potting (usually inshore) takes place for crabs |
| Historic fishing ground | Offshore area, usually named, which was |

| | |
|---|--|
| | exploited for fish. The areas can either be generic or specific. Many historic fishing grounds are still exploited others have become unusable through over fishing or industrial activity |
| Restricted fishing area | Offshore area which is exploited for fish. The areas can either be generic or specific but activity is restricted because of industrial or economic exclusion zones (wind farms, gas fields etc) |
| Offshore fishing area | Offshore area, usually named, which is exploited for fish. The areas can either be generic or specific. |
| Lemon sole nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of the lemon sole |
| Sprat nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of sprat |
| Plaice nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of plaice |
| Cod nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of cod |
| Sandeel nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of the Sandeel |
| Whiting nursery area | Area of the North Sea defined by CEFAS as an important area for the early life cycle of the whiting |
| Sprat spawning area - May to August | Area of the North Sea defined by CEFAS as an important area in reproductive cycle (spawning) of the sprat |
| Herring spawning area - August to October | Area of the North Sea defined by CEFAS as an important area in reproductive cycle (spawning) of herring |
| Lemon sole spawning area - April to September | Area of the North Sea defined by CEFAS as an important area in reproductive cycle (spawning) of the lemon sole |
| Sole spawning area - March to May | Area of the North Sea defined by CEFAS as an important area in reproductive cycle (spawning) of sole |
| Sandeel spawning area November to February | Area of the North Sea defined by CEFAS as an important area in reproductive cycle (spawning) of the Sandeel |
| Licensed aggregate dredging area | Offshore area of the North Sea licensed by the Crown Estates for the extraction of sand and gravel from the sea floor. |
| Active aggregate dredging zone | Active dredging area within the overall area licensed by the Crown Estates for the extraction |

| | |
|---|--|
| | of sand and gravel from the sea floor. |
| License application aggregate dredging area | Offshore area of the North Sea defined by the Crown Estates for future extraction of sand and gravel from the sea floor. |
| Licensed wind farm area | Offshore area of the North Sea licensed by the DTI for the production of renewable energy through wind farm construction. There are currently those farms either active or under construction (round 1) and those under application (round 2). |
| Active wind farm area | Offshore area of the North Sea licensed by the DTI for the production of renewable energy through wind farm construction. Those farms either active or under construction (round 1) |
| Oil field | Specific named offshore area of the North Sea where oil has been discovered and exploited usually within one of the DTI licensed blocks |
| Gas field | Specific named offshore area of the North Sea where gas has been discovered and exploited usually within one of the DTI licensed blocks |
| Offshore production area | Specific named offshore area of the North Sea where a large gas field or more usually a group of fields has been discovered and exploited. They are usually linked by sub sea infrastructure of pipelines and wellheads |
| Template | Subsea structure associated with the gas industry. Specifically the components supporting the wellhead extraction and injection infrastructure |
| Subsea structure | Any subsea structure associated with offshore industry, navigation or remote sensing. |
| Wellhead | Subsea structure associated with the gas industry. Specifically the components supporting the wellhead drilling or extraction of gas |
| Platform | Free standing structure attached to the seafloor associated with the gas industry. The platforms are usually manned and specifically support all the operations concerned with the exploration, drilling and production of hydrocarbons |
| Manifold | Subsea or platform based structure associated with the gas industry. Specifically the components of a gas pipeline where many pipes feed into one. |
| Proposed gas pipeline | Relating to the proposed transfer of gas by pipeline usually from the North Sea to the gas terminals at Easington Dimlington and Theddlethorpe. |
| Active pipeline | Relating to the transfer of fluids and gas by pipeline usually from the North Sea to the gas |

| | |
|-------------------------------------|--|
| | terminals at Easington Dimlington and Theddlethorpe. Pipe lines could also take mareils out to the gas fields for re - injection into the depleted fields |
| Active gas pipeline | Relating to the active transfer of gas by pipeline usually from the North Sea to the gas terminals at Easington Dimlington and Theddlethorpe. |
| Active chemical pipeline | Relating to the active transfer of chemicals (petrol etc) usually associated with coastal oil, gas and chemical works (see above) |
| Active mixed hydrocarbon pipeline | Relating to the proposed transfer of gas and oil by pipeline usually from the North Sea to the gas terminals at Easington Dimlington and Theddlethorpe. |
| Active other fluid pipeline | Relating to the active transfer of fluids such as water by pipeline. |
| Precommissioned gas pipeline | Relating to a built gas pipeline not yet actively transferring gas from the North Sea to the gas terminals at Easington, Dimlington and Theddlethorpe. |
| Disused pipeline | Relating to a decommissioned pipeline which is still in situ. |
| Disused chemical pipeline | Relating to a decommissioned chemical pipeline which is still in situ. |
| Active power cable | Relating to electricity power cables (usually subsea or sub estuarine) . |
| Modern flood risk area | The area of land mostly along the Humber Estuary and the Lincolnshire coast which would be inundated to the level of Mean High Water if not for the flood defences along the coast and the tidal rivers of the study area. |
| Post medieval reclaimed land | Land reclaimed after 1500 specifically that land associated with Isle of Axhrome, Sunk Island and large areas of the Humber coastal land. Also some coastal areas of the Lincolnshire Grazing Marsh |
| Medieval and earlier reclaimed land | Land reclaimed before 1500 specifically that land associated with The medieval villages of Tetney, Marsh Chapel etc and the production of salt and formation of salterns. |
| Disused WWII anti aircraft battery | WWII coastal gun installations for the protection of the populace and industry from enemy airborne attack. |
| Disused WWII decoy | WWII coastal installations built to mimic other important areas such airfields or docks to divert enemy airborne attack away from the intended target. The installation a Paull on the Humber Estuary was built specifically to divert bombers |

| | |
|-------------------------|---|
| | away from Hull docks |
| Disused WWI fort | WWI military installation located in an area to protect or defend against enemy forces or shipping. Specifically refers to the forts of Haille Sand and Bull built at the mouth of the Humber to protect Hull and shipping from surface and submarine attack. |
| Disused WWII airfield | WWII coastal bomber and fighter installations, now disused. |
| Disused WWII barracks | WWII coastal installations for housing military personnel, now disused. |
| Airfield | Active coastal airfield. |
| Military practice area | Active military practice area, Army, Navy and RAF. |
| RAF practice area | Large offshore areas where mariners are advised that RAF aircraft are likely to be operating. |
| Firing range | Coastal, inshore or offshore areas where mariners are advised that live ordnance practice takes place, specifically the Donna Nook firing range on the NE coast of Lincolnshire. |
| Disused WWII minefield | Offshore areas where mariners are advised that WWII naval mines were laid. Mines are still occasionally found in these areas. |
| Submarine exercise area | Offshore areas where mariners are advised that naval submarines are likely to be operating below the surface. |
| Historic drying area | Relating to the area of the coast which was charted (UKHO historic charts) as dry at the point of the Lowest Astronomical Tide (LAT). |
| Coastal wreck cluster | Coastal area defined in a 500m square grid that contains 3 or more wrecks. Data from NMR, UKHO and SeaZone. |
| Modern drying area | Relating to the area of the coast which is charted (modern UKHO Admiralty) as dry at the point of the Lowest Astronomical Tide (LAT). |
| Knoll | A rounded hill or mound rising from the sea floor. |
| Spit | A section of land that extends into the sea often uncovered at low tide. A navigation hazard. |
| Overfalls | A turbulent area of the sea floor caused by strong tidal currents setting over submerged ridges. Specifically those areas off the study area coast that are remnant deposits of the Devensian terminal moraine. |
| Sands | Areas of sandy seabed in shallow water often uncovered at low tide. A navigation hazard |

| | |
|-----------------------------|---|
| Ridge and bank | Elevations in the sea floor either linear or over a large area. |
| Ridge | A long narrow elevation of the sea floor. |
| Bank | A large elevated area of the sea floor. |
| Shoal | A shallow place in the sea floor constituting a navigation hazard |
| Flats | Regular level areas of the sea floor, especially in the intertidal zone (eg tidal flats, mud flats etc) |
| Wreck cluster | Offshore area defined in a 500m square grid that contains 3 or more wrecks. Data from NMR, UKHO and SeaZone. |
| Active historic channel | Navigational area of the sea or estuary used in the past and which still is currently in use by modern shipping. The channel is often defined by buoyage. |
| Active historic anchorage | Area of the sea or estuary used in the past as a safe anchorage and which still is currently in use by modern shipping. The anchorages are often defined by buoyage. |
| Disused historic channel | Navigational area of the sea or estuary used in the past and which still not currently in use by modern shipping. |
| Traffic control | Points or areas in navigation channels where shipping direction and position is controlled by marine legislation or the use of pilots such as the Humber Pilot for shipping entering the Humber Estuary |
| Modern channel | Navigational area of the sea or estuary not used in the past which is currently in use by modern shipping. The channel is often defined by buoyage. |
| Modern dredged channel | Navigational area of the sea or estuary which is currently in use by modern shipping but requires regular dredging to maintain its depth. The channel is often defined by buoyage. |
| Deep water route | Navigational area of the sea or estuary used in the past and which still is currently in use by modern shipping which often require a certain depth of water for safe passage. The channel is often defined by buoyage. |
| Modern anchorage | Area of the sea or estuary used as a safe anchorage and currently in use by modern shipping. The anchorages are often defined by buoyage. |
| Modern deep water anchorage | Area of the sea or estuary used as a safe anchorage and currently in use by modern shipping requiring a certain depth of water to |

| | |
|--|---|
| | anchor safely . The anchorages are often defined by buoyage. |
| Disused historic quarantine area | Area of the sea or estuary used in the past as a quarantine area for vessels not allowed to make landfall because of infection or disease. |
| Spoil ground | Area of the sea or estuary used as a dumping ground for various materials. The areas are often defined by buoyage. |
| Exclusive economic zone | The area of the sea over which a state (GB) has special rights over the exploration and use of marine resources. The EEZ normally extends to a distance of 200 miles from the coast but in the case of the study extends to the median line with Holland. |
| 12 nautical mile territorial sea area | Inshore area of the sea extending 12 miles offshore regarded as sovereign territory of GB but where shipping is allowed innocent passage |
| 6 nautical mile fishery zone | Inshore area of the sea extending 6miles offshore regarded as sovereign territory of GB where fishing is exclusively GB based |
| 3 nautical mile territorial sea area | Economic and territorial jurisdiction zone extending 3 miles offshore |
| Environmental protection limit, normal baseline | Area of protection for specific area |
| Environmental protection limit, low water baseline | Area of protection for specific area |
| Maritime conservation area | A conservation |
| Maritime settlement area | Xxx |
| Historic maritime settlement | Xxx |
| Nature reserve | Nature reserves are protected areas of land of importance to wildlife, flora, fauna or features of special interest. Reserves fall into different categories depending on the level of protection afforded by local laws |
| NNR | National Nature Reserves protected by national laws covering areas of land of importance to wildlife, flora, fauna or features of special interest. |
| RAMSAR | Wetlands considered internationally important under the articles of the Ramsar conference. |
| SAC | Special Areas of Conservation as defined by a national list of 189 habitat and 788 species types (JNCC) |
| SSSI | Site of Special Scientific Interest denoting a protected are such as NNR, RAMSAR, SAC or SPA |

| | |
|---------------------|--|
| SAM | Scheduled Ancient Monument a historic or archaeological area, building or site as defined by English Heritage afforded special protection under law. |
| SPA | Special Protection Areas strictly protected sites classified in accordance with Article 4 of EC directive on the conservation of wild birds. |
| Submerged forest | Relating to the area off the coast of Lincolnshire once a Neolithic land surface covered in oak forest now submerged by the sea. |
| Leisure beach | An area of coastal beach used for recreation such as those at Skegness, Mablethorpe and Cleethorpes |
| Marina | A dock area specifically for pleasure craft and yachts such as the Historic fish dock in Hull now converted to a marina |
| Angling | Recreational fishing either freshwater or seawater |
| Water sports | Sports associated with sea such as yachting, diving, waterskiing etc. |
| Holiday camp | Coastal area providing accommodation and entertainments |
| Caravan park | Coastal area for holiday caravans. The Lincolnshire coast has the biggest concentration of caravan parks in Europe. |
| Holiday village | Permanent holiday accommodation such as that at Humberston |
| Historic canal | Commercial waterway constructed in the 18th or 19th century for the transportation of goods such as the Louth canal running from Tetney lock to Louth. |
| Historic sand dunes | Sand dunes formed in the past now some distance from the sea such as those at Theddlethorpe |
| Aquarium | Recreational and education building specifically for the display of marine wildlife. Eg The Deep in Hull. |
| Golf course | Coastal golf course or links. |
| Dive site | Recognised area for diving especially on wrecks such as those off the Dowsing Shoal. |

6.4 Characterisation_polygons layer attribute terminology: Other attributes

Attribute name: OBJECTID

Definition: automatically generated by GIS

Entry: auto generated by ArcGIS

Data: '1'-'1019'

Attribute name: Shape

Definition: automatically generated by GIS

Entry: auto generated by ArcGIS

Data: 'Polygon'

Attribute name: CHARACTER_AREA

Definition: Record of the CHARACTER_AREA that the polygon falls within. Will include multiple entries if the polygon inhabits multiple CHARACTER_AREAs

Entry: Populated by custom tool which attributed the name of each Character_Area polygon to all the polygons which were completely contained by, or intersected it

Sample Data: 'Docking Shoal, Inner Dowsing, Ouse/Nene, Race Bank & North Ridge', 'Skegness to Wainfleet coast, Wainfleet Sand', 'Cleethorpes to Mablethorpe coast, Dudgeon shoals, Galleon, Inner Dowsing, Leman Ground, Ouse/Nene, Outer Dowsing navigation channel, Outer Dowsing shoals, Outer Dowsing, Ower Bank, Protector Overfalls, Saturn, Skegness & Mablethorpe coastal waters, Theddlethorpe Overfalls, Triton Knoll', etc [Full list not recorded, see Section XXX for full list of CHARACTER_AREA names]

Attribute name: PERIOD

Definition: Benchmark period of origin of the area represented in the polygon, ie 'Post medieval'

Entry: Manual entry from assessment of maps and documentary sources

Data:

| | |
|--------------------|---------------|
| Devensian/Holocene | Neolithic |
| Medieval | Post medieval |
| Modern | Prehistoric |
| NA | |

Attribute name: PRI_INT_ACT

Definition: Primary Intrusive Activity – eg. Aggregate dredging, Maintenance dredging

Entry: Manual entry from assessment of SUB_CHARACTER type and associated documentary sources

Data:

| | |
|---------------------------------|------------------------------|
| Active Dredge Zone | Historic maritime settlement |
| Active licensed shellfish beds | Maintenance dredging |
| Active shellfish beds | Maritime settlement |
| Aggregate extraction | Military firing range |
| Anchorage | Military practice area |
| Bait digging area | Navigation |
| Coastal fisheries | Processing industry |
| Coastal industry | Recreation |
| Coastal mariculture | Samphire picking |
| Commercial fishing | Shellfish digging |
| Crab Fishery | Spoil ground |
| Crab and lobster potting | Transport |
| Dock and port related industry | Trawling |
| Gas Terminal | Unknown |
| Gas industry | Wind farm |
| Gas terminal in southern extent | |

Attribute name: PRI_NON_INT_ACT

Definition: Primary None Intrusive Activity – eg. Commercial shipping, Water sports

Entry: Manual entry from assessment of SUB_CHARACTER type and associated documentary sources

Data:

| | |
|------------------------------------|-----------------------------|
| Active historic anchorage | Modern passenger port |
| Angling | Nature reserve |
| Caravan parks | Navigation |
| Coastal fishing | Pleasure beach |
| Commercial shipping | Public park |
| Crab and lobster potting | RAF practice area |
| Disused WWII anti aircraft battery | RAF practise area |
| Disused WWII minefield | Recreation |
| Eel fishing | Recreation designated areas |
| Generic coastal fishing area | Recreation designated zone |
| Historic cargo dock | Spoil ground |
| Leisure beach | Submarine exercise area |
| Local shipping | Unknown |
| Military practice area | Water sports |
| Modern flood defence | Whitefish longlining |

Attribute name: OTHER_USE

Definition: Other secondary seascape uses that are apparent, but are not the dominant characteristic of the polygon, eg 'Nature reserve'

Entry: Manual entry. Assessment of SUB_CHARACTER type and associated documentary sources

Data:

| | | |
|------------------------------------|----------------------------------|---------------------------|
| Active historic anchorage | Historic maritime settlement | Recreation dive site |
| Active historic channel | Inactive licensed shellfish beds | Ridge |
| Aggregate extraction | Inactive shellfish beds | Salmon and trout fishing |
| Angling | Inshore fisheries | Sea |
| Channel | Marina | Seafront |
| Coastal fisheries | Maritime settlement area | Seafront and marshland |
| Coastal industry | Marshland | Ship repair industry |
| Coastal mariculture | Medieval reclaimed land | Shipwreck site |
| Coastline | Military firing range | Spoil ground |
| Commercial fishing | Military practice area | Submarine practice area |
| Commercial shipping | Military submarine exercise area | Submerged gravel terraces |
| Conservation area | Modern cargo dock | Tideway |
| Disused WWII anti aircraft battery | Modern flood defence | Unknown |
| Disused historic quarantine area | Nature reserve | Water sports |
| Eel fishing | Navigation | Whitefish longlining |
| Gas field | Navigation channel | Wreck cluster |
| Gas industry | Post medieval reclaimed land | |
| Gas terminal | Proposed wind farm | |
| Gravel beds | Proposed wind farm area | |
| Harbour | RAF practise area | |
| Historic drying area | Recreation | |
| Historic fish dock | Recreation designated area | |

Attribute name: MORPHOLOGY

Definition: Impact of primary activities/characteristics evident in polygon on area of coast/sea represented in polygon. Assessed broadly as High, Moderate or Low

Entry: Manual entry, derived from study of documentary sources

Data:

| | |
|---|--|
| Active channel | Humberhead levels |
| All offshore areas outside 12 mile limit | In mega ripple area |
| Bank | Inland coastal |
| Beachfront and coastal sand and gravel banks | Knock |
| Beachfront and shelving coastal seabed | Knoll |
| Besides gravelly sand bank | Knoll and relic gravel terrace banks of Ouse/Nene palaeochannel valley |
| Besides gravelly sand bank in mega ripple area | Mega ripple area |
| Besides gravelly sand banks in mega ripple area | Mega ripple banks |
| Between gravelly sand banks of mega ripple area | Mega ripple banks and Devensian moraine field |
| Channel | Mega ripple banks and Devensian moraine field |
| Channel in the Estuarine sand and mud | Mega ripple banks, gravelly sand bed |
| Cliff top | Mega ripple sand bank area |
| Coast | Morph: Crossing gravelly sand banks of mega ripple area |
| Coastal cliffs | Mud flats |
| Coastal marshland | Muddy relic palaeochannel |
| Coastal mudflats | Navigation channel |
| Coastal plain | Outer Dowsing relic Devensian palaeochannel |
| Coastal sand and mud | Overfalls |

| | |
|---|---|
| Coastal shoals | Overfalls and coastal waters |
| Coastal waters channel | Protector overfalls, gravel terrace to west of Ouse/Nene relic palaeochannel |
| Coastline | Relic Devensian upland landscape. Gravel terraces north of Outer Silver Pit palaeolake |
| Coastline and coastal waters | Relic Ouse/Nene palaeochannel |
| Coastline and estuarine sand and mud | Relic gravel terrace beside Devensian palaeochannel |
| Cromer knoll | Relic gravel terrace beside palaeochannel |
| Crosses relic Devensian moraine field and mega ripple area | Relic gravel terrace besides Devensian palaeochannel |
| Crosses relic Devensian moraine field and mega ripple area out to deepwater | Relic gravel terrace to east of Silver Pit palaeochannel |
| Crosses relic moraine field into gravelly sand banks of mega ripple area | Relic gravel terraces and shoreward shelving seabed |
| Crossing from relic gravel terraces into Outer Silver Pit relic palaeolake | Relic gravel terraces between Devensian palaeochannels |
| Crossing gravel terraces and Devensian palaeochannel | Relic gravel terraces north of Outer Silver Pit relic palaeolake now the Dogger Bank |
| Crossing gravelly sand bank | Relic landscape of Late Devensian/Early Holocene Humber palaeochannel and flanking gravel terrace |
| Crossing gravelly sand bank in mega ripple area | Relic landscape of Late Devensian/Early Holocene Humber palaeochannel and flanking gravel terraces |
| Crossing gravelly sand banks of mega ripple area | Relic landscape of Late Devensian/Early Holocene Ouse/Nene palaeochannel and flanking gravel terrace |
| Crossing gravelly sand shoals of mega ripple area | Relic landscape of Late Devensian/Early Holocene Ouse/Nene palaeochannel and flanking gravel terraces |
| Crossing relic Devensian moraine field and sand gravelly seabed | Relic landscape of Late Devensian/Early Holocene Outer Silver Pit lake sourced from the ice sheet to the north. |
| Crossing relic gravel terraces and Devensian Silver Pit palaeochannel | Relic landscape of Late Devensian/Early Holocene Silver Pit palaeochannel |
| Crossing relic gravel terraces and relic Devensian palaeochannel | Relic landscape of Late Devensian/Early Holocene Silver Pit palaeochannel and flanking gravel terrace |
| Crossing relic landscape of Late Devensian/Early Holocene palaeochannel and flanking gravel terrace | Relic landscape of Late Devensian/Early Holocene Silver Pit palaeochannel and flanking gravel terraces |
| Crossing sand bank | Relic landscape of Late Devensian/Early Holocene palaeochannel |
| Crossing sand bank in mega ripple area | Relic landscape of Late Devensian/Early Holocene palaeochannel and flanking gravel terrace |
| Crossing sand flats | Relic landscape of Late Devensian/Early Holocene palaeochannel and flanking gravel terraces |
| Deep water | Relic palaeochannel |
| Deep water channel | Relic palaeochannel and gravel terrace |
| Deep water over sandy gravel beds | Relic upland landscape now the Dogger Bank |
| Devensian gravel terrace on edge of moraine field | Remnant island |
| Disused WWII anti aircraft battery | Ridge |
| Dogger Bank. Relic gravel bank | Ridge and Bank |
| Eroded relic landscape of the Ouse/Nene palaeochannel | Riverine sand and mud |
| Estuarine mud flats | Riverine sandy mud |
| Estuarine plain | Rough gravelly sand bank in mega ripple area |
| Estuarine sand | Rough gravelly sand seabed |
| Estuarine sand and mud | Rough sandy seabed |
| Estuarine sand and mud flats | Rough seabed |
| Estuarine sandy mud | Sand Flats and riverside |

| | |
|---|---|
| Estuary | Sand bank |
| Estuary mouth | Sand bank in mega ripple area |
| Estuary mouth and coastal sand flats | Sand banks and gravel terraces |
| Estuary mouth and shelving coastal seabed | Sand banks and gravelly shoals |
| Fairly flat sandy sea bed | Sand banks in mega ripple area |
| Flat gravelly sandy seabed | Sand beds |
| Gravel flats to east of Ouse/Nene relic palaeochannel | Sand beds of estuary mouth |
| Gravel knoll | Sand flats |
| Gravel sand bank | Sand flats and coastal marshland |
| Gravel sand bank Dogger Bank | Sand flats and dunes |
| Gravel sand bank in mega ripple area | Sandy bedded channel |
| Gravel shoal and sand bank | Sandy gravel bed in mega ripple area |
| Gravel terraces on side of Silver Pit relic palaeochannel to east | Sandy gravel seabed in mega ripple area |
| Gravelly sand banks in mega ripple area | Sandy knoll in mega ripple area |
| Gravelly and rocky seabed | Sandy ridge |
| Gravelly sand bank | Sandy shoals and gravel terraces to east of Ouse/Nene relic palaeochannel |
| Gravelly sand bank and deep water channel | Sea front |
| Gravelly sand bank in mega ripple area | Shelving coastal waters |
| Gravelly sand banks in mega ripple area | Shelving coastal waters and submerged relic moraine field |
| Gravelly sand bed | Shelving gravelly sand seabed |
| Gravelly sand bed in mega ripple area | Shelving gravelly seabed and coastal waters |
| Gravelly sand bed of relic palaeochannel | Shelving seabed |
| Gravelly sand beds | Shelving seabed in deep water area |
| Gravelly sand beds in mega ripple area | Shoaling area |
| Gravelly sand beds of mega ripple area | Shoals |
| Gravelly sand knoll in mega ripple area | Shorewards shelving seabed |
| Gravelly sand ridge | Varied deepwater to coastal waters, excluding mega ripple area |
| Gravelly sand rough seabed | Varied flat seabed and relic Outer Silver Pit palaeolake |
| Gravelly sand shoal | Varied relic sub glacial features |
| Gravelly sand shoal in relic Devensian moraine field | Varied seabed |
| Gravelly sand shoals | Varied. Crossing from beachfront to deepwater |
| Gravelly sand shoals and bank | Varied. Deep water channel and gravelly sand bank |
| Gravelly sandy seabed | Varied. From beachfront out to deepwater |
| Gravelly sandy shelving coastal seabed in estuary mouth | Varied. Gravelly sand mega ripple bank shorewards to shelving seabed |
| Harbour | Varied. Relic moraine field and mega ripple area |
| Headland | Varied. Shoals and palaeochannel |

Attribute name: IMPACT

Definition: Impact of primary activities/characteristics evident in polygon on area of coast/sea represented in polygon.

Entry: Manual entry, derived from study of documentary sources

Data:

| | |
|----------|----------|
| High | Variable |
| Moderate | Unknown |
| Low | NA |

Attribute name: PREV_CHAR

Definition: The previous character of the current seascape (where known), ie 'Active historic salterns'

Entry: Manual entry, derived from study of documentary sources and map regression

Data:

| | |
|---|---|
| Active WWII airfield | Generic coastal fishing area |
| Active WWII anti aircraft battery | Generic river fishing |
| Active WWII decoy | Gravel terrace beside Devensian Ouse/Nene palaeochannel |
| Active anti aircraft battery | Gravel terrace beside Devensian outer Silver Pit palaeolake |
| Active historic channel | Gravel terrace beside Devensian palaeochannel |
| Active historic salterns | Gravel terrace beside palaeochannel |
| Active licensed shellfish beds | Gravel terrace besides Devensian palaeochannel |
| Active sluice | Gravel terrace into Outer Silver Pit palaeolake |
| Airfield | Gravel terrace on east bank of Ouse/Nene palaeochannel |
| Bank | Gravel terrace to east of Late Devensian/Early Holocene Ouse/Nene palaeochannel |
| Bank of Devensian Outer Silver Pit palaeochannel | Gravel terrace to east of Ouse/Nene palaeochannel |
| Banks | Gravel terrace to east of Silver Pit palaeochannel |
| Bull Sand Island | Gravel terrace to west of Ouse/Nene palaeochannel |
| Clay extraction pits | Gravel terraces and Devensian palaeochannel |
| Coastal fishing | Gravel terraces between Devensian palaeochannels |
| Coastal industry | Gravel terraces north of Outer Silver Pit palaeolake now the Dogger Bank |
| Coastal mariculture area | Historic citadel |
| Coastal marsh | Historic clay extraction pits |
| Crossing from gravel terraces into Outer Silver Pit palaeolake | Historic coastal settlement |
| Crossing gravel terraces and Devensian Silver Pit palaeochannel | Historic cockling area |
| Crossing gravel terraces and Devensian palaeochannel | Historic drying area |
| Crossing gravel terraces and Outer Silver Pit palaeolake | Historic ferry port |
| Devensian Silver Pit palaeochannel | Historic ferry route |
| Devensian gravel terrace on edge of moraine field | Historic fish dock |
| Devensian lowland landscape. Gravel terraces north of Outer Silver Pit palaeolake | Historic fish dock area |
| Devensian moraine field | Historic fishing ground |
| Devensian moraine field and palaeochannels | Historic haven |
| Devensian palaeochannel | Historic maritime settlement |
| Devensian palaeochannel and flanking gravel terraces | Historic port |
| Devensian palaeochannel and gravel terrace in eastern half | Historic shipbuilding industry |
| Devensian upland landscape. Gravel terraces north of Outer Silver Pit palaeolake | Humber palaeochannel |
| Fishing ground | Island |
| Flats | Knoll |
| Flood defended area | Land |

| | |
|--|--|
| Knoll and gravel terrace banks of Ouse/Nene palaeochannel valley | Late Devensian/Early Holocene Outer Dowsing palaeochannel and flanking gravel terrace |
| Gravel terrace beside palaeochannel | Late Devensian/Early Holocene Outer Silver Pit palaeolake |
| Gravel terrace besides Devensian palaeochannel | Late Devensian/Early Holocene Outer Silver Pit palaeolake and flanking gravel terrace to south |
| Gravel terrace into Outer Silver Pit palaeolake | Late Devensian/Early Holocene Outer Silver Pit palaeolake and gravel terrace to north |
| Gravel terrace on east bank of Ouse/Nene palaeochannel | Late Devensian/Early Holocene Silver Pit palaeochannel |
| Gravel terrace to east of Late Devensian/Early Holocene Ouse/Nene palaeochannel | Late Devensian/Early Holocene Silver Pit palaeochannel and flanking gravel terrace |
| Gravel terrace to east of Ouse/Nene palaeochannel | Late Devensian/Early Holocene Silver Pit palaeochannel and flanking gravel terraces |
| Gravel terrace to east of Silver Pit palaeochannel | Late Devensian/Early Holocene palaeochannel and flanking gravel terrace |
| Gravel terrace to west of Ouse/Nene palaeochannel | Late Devensian/Early Holocene palaeochannel and flanking gravel terraces |
| Gravel terraces and Devensian palaeochannel | Late Devensian/Early Holocene palaeochannel and flanking gravel terraces |
| Gravel terraces between Devensian palaeochannels | Late Devensian/Early Holocene palaeochannel and flanking gravel terraces |
| Gravel terraces north of Outer Silver Pit palaeolake now the Dogger Bank | Local shipping |
| Historic citadel | Maritime settlement area |
| Historic clay extraction pits | Medieval reclaimed land |
| Historic coastal settlement | Ouse/Nene palaeochannel |
| Historic cockling area | Outer Dowsing Devensian palaeochannel |
| Historic drying area | Palaeo upland. Dogger Bank |
| Historic ferry port | Palaeochannel |
| Historic ferry route | Post medieval haven |
| Historic fish dock | Post medieval reclaimed land |
| Historic fish dock area | Relic landscape of Late Devensian/Early Holocene palaeochannel and flanking gravel terrace |
| Historic fishing ground | Relic landscape of Late Devensian/Early Holocene palaeochannel and flanking gravel terraces |
| Historic haven | River channel |
| Historic maritime settlement | Shoal |
| Historic port | Unknown |
| Historic shipbuilding industry | Varied. Devensian palaeo lake and palaeochannels dominate |
| Humber palaeochannel | |
| Island | |
| Knoll | |
| Knoll and gravel terrace banks of Ouse/Nene palaeochannel valley | |
| Land | |
| Late Devensian/Early Holocene Humber palaeochannel and flanking gravel terrace | |
| Late Devensian/Early Holocene Humber palaeochannel and flanking gravel terraces | |
| Late Devensian/Early Holocene Ouse/Nene palaeochannel and flanking gravel terrace | |
| Late Devensian/Early Holocene Ouse/Nene palaeochannel and flanking gravel terraces | |

Attribute name: LOCATION

Definition: Where the polygon is physically located: Estuarine, Coastal or Sea

Entry: Manual entry

Data:

Coastal
Coastal waters
Estuarine
Estuary mouth
Riverine
Sea
Sea & Coastal

Attribute name: DATASOURCE

Definition: Originator core dataset used for characterisation

Entry: Manual entry

Data:

UKHO, Mastermap
BMAPA
CEFAS
DEAL
Humber Management Scheme
Local dive club
Mablethorpe tourist information website
Mablethorpe town historic website
Mastermap
Mastermap, Environment Agency
Mastermap, Hull City Council Character Area Appraisal 1999 and Conservation Area Character Appraisals 2004 & 2005
Mastermap, Hull City Docklands Plan 2000
Mastermap, Hull City Plan 2000
Mastermap, Humber Estuary and Coast 1994
Mastermap, Landark, Multimap
Mastermap, Landmark
Mastermap, Multimap
Mastermap, NMR
Mastermap, NMR, Humber SMP
Mastermap, Riverhumber.co.uk
Mastermap, Riverhumber.co.uk, ABP
Mastermap, SeaZone
Mastermap, UKHO
Multimap
NESFA
NESFC
NMR
NMR, Mastermap
NMR, SeaZone, Mastermap
SeaZone
SeaZone & Admiralty chart 107 (2005)
SeaZone & OS250K mapping
SeaZone SEA_COVER and Bathymetry & personal interpretation

SeaZone and MEHRA's DETR Marine Traffic Data
SeaZone bathymetry and Cardinal Buoys
SeaZone buoy and MEHRA's DETR Marine Traffic Data
SeaZone, NMR, Mastermap
UKHO
UKHO & NMR
UKHO, Mastermap
UKHO, Mastermap, SeaZone

Attribute name: NOTES

Definition: More background information on the history of the polygon. An expansion of information previously recorded

Entry: Manual entry

Sample Data: 'Navigation channel defined by Cardinal and Lateral buoys either side of channel.'

'Firing practice area: Wainfleet Range (D308)'

'3 probable remains of stranded vessels'

Attribute name: CONFIDENCE

Definition: Degree of certainty assigned to interpretation.

Entry: Manual entry

Data:

High

Moderate

Low

Attribute name: CHECKED_BY

Definition: Initials of the person responsible for checking the information before final output

Entry: Manual entry

Data: 'DM'

Attribute name: Shape_Length

Definition: automatically generated by GIS

Entry: auto generated by ArcGIS

Data: 5989.323443

Attribute name: Shape_Area

Definition: automatically generated by GIS

Entry: auto generated by ArcGIS

Data: 2854531.742205

6.5 Character_Area layer attribute terminology

The Character_Area characterisation attributes used the same structure as the Characterisation_polygons except for the following:

| Attribute | Population method | Example of terminology |
|----------------|--|---|
| CHARACTER_AREA | Manual entry, derived from dominant character of Characterisation_polygons | Topographical location – each character area contains groups of polygons with similar attributes, ie ‘Markham’s Hole’ |
| IMPACT | Automated entry | Not applicable. Spatial concept with no impact |
| DATASOURCE | Automated entry | Not applicable. Polygons generated by MoLAS |

The only different attribute is the CHARACTER_AREA attribute:

Attribute name: CHARACTER_AREA

Definition: Topologically discrete location – each character area contains groups of polygons with similar attributes.

Entry: Generated through interpretation of the underlying Characterisation_polygons

Data:

| | |
|--|---------------------------------------|
| Alkborough to Barton Upon Humber coast | Leman |
| Amethyst East | Leman Ground |
| Amethyst West | Lynn |
| Barton to East Halton coast | Mablethorpe to Skegness coast |
| Bessemer gas field | Markham's Hole |
| Blacktoft to Hessle coast | New Sand Hole |
| Brigantine gas field | North Hewett |
| Burnham Flats | North Sea traffic route |
| Cleethorpes to Mablethorpe coast | North Sea transport route |
| Cromer Knoll | Off Easington |
| Docking Shoal | Off Ground |
| Dogger Bank | Ouse/Nene |
| Donna Nook | Outer Dogs Head |
| Dudgeon shoals | Outer Dowsing |
| East Halton to Immigham coast | Outer Dowsing navigation channel |
| Galleon | Outer Dowsing shoals |
| Haile Sand | Outer Humber Estuary |
| Haile Sand Flat | Outer Silver Pit |
| Hewett | Ower Bank |
| Hull coast | Protector Overfalls |
| Humber Estuary mouth | Race Bank & North Ridge |
| Humber Gateway | Race Bank Channel |
| Humber Mouth | Rough |
| Indefatigable | Saturn |
| Indefatigable Banks | Sheringham Shoal |
| Inner Dowsing | Silver Pit |
| Inner Humber Estuary | Skegness & Mablethorpe coastal waters |
| Isle of Axholme | Skegness to Wainfleet coast |

Sole Pit
Spurn Point
Sunk Island coast
The Binks
Theddlethorpe Overfalls
Triton Knoll
Valiant

Wainfleet Sand
Well Bank
Well Bank Flats
Well Hole
West Hole
West Sole
Withernsea to Spurn Point coast

7 Delivering the final product to NMR

Due to copyright limitations, associated with SeaZone and BGS data in particular, no data was directly reproduced from sources. Instead, all the characterisation polygons produced can be more accurately described as an amalgamation of data sources, which resulted in a new character shape derived from primary sources. Specifically, new polygon boundaries were created which took account of but did not equate with any pre-existing polygons.

Historic information obtained from local SMRs and HERs were also subject to ‘data release’ agreements. These stipulate that the information given should only be used for purposes of the Withernsea to Skegness pilot study project.

All data produced by this Seascapes project are free of any 3rd party licencing agreements and, on transfer to the NMR, are EH copyright.

8 Bibliography

- Aalen, F. H. A. Approaches to the Study and Management of the Landscape in Aalen, F. H. A. (ed) 1996, *Landscape Study and Management*, Trinity College Dublin and Office of Public Works, Dublin.
- Aldred, O. and Fairclough, G. , 2002, *Historic Landscape Characterisation Taking Stock of the Method*, English Heritage.
- BMAPA & English Heritage, 2003, *Marine Aggregates Dredging and the Historic Environment guidance note*. British Marine Aggregate Producers Association and English Heritage, London.
- Brown, A. G. and Quine, T. A. (ed) 1999, *Fluvial Processes and Environmental Change*, Wiley, Chichester.
- CEFAS, 1999, *Integrated mapping of the UK marine and coastal zone - the way forward; Report of a workshop held at CEFAS Lowestoft Laboratory 17-18 June 1999*, Lowestoft.
- Clark, J. Darlington, J and Fairclough, G. 2004, *Using Historic Landscape Characterisation*, English Heritage.
- CoastNET, 2003, *Spatial Planning in the Coastal and Marine Environment: Next Steps to Action, Conference Briefing*, 1 October 2003, SOAS, University of London.
- Dean, R. G. and Dalrymple, R. A. 2002, *Coastal Processes with Engineering Solutions*, Cambridge University Press.
- DEFRA, 2001, *Shoreline Management Plans A guide for coastal defence authorities*, DEFRA
- DEFRA, 2002, *Safeguarding our Seas*, DEFRA.
- Department of the Environment, 1972, *Out of Sight, Out of Mind*, HMSO.
- E-Government Unit, 2004, *UK GEMINI Standard Version 1.0- A Geospatial Metadata Interoperability Initiative*, Cabinet Office.
- English Heritage, 1996, *England's Coastal Heritage*, English Heritage.
- English Heritage, 1997, *Archaeology Division Research Agenda*, April 1997
- English Heritage, 1999, *A Brief for Rapid Coastal Zone Assessment Surveys*, Release 2, February 1999
- English Heritage, 2002, Coastal Defence: caring for our coastal heritage. *Conservation Bulletin*, 42.
- English Heritage, 2002, *Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England*.
- English Heritage, 2003, *Coastal Defence and the Historic Environment English Heritage Guidance*.
- English Heritage, 2004, *Guidelines for English Heritage projects involving GIS*.
- Fairclough, G. (ed.), 1999, *Historic Landscape Characterisation: Papers presented at an English Heritage seminar, 11 December 1998*, English Heritage.
- Fairclough, G., 1999, Historic Landscape Characterisation: theory, objectives and connections in Fairclough, G. (ed.), 1999, *Historic Landscape Characterisation: Papers presented at an English Heritage seminar, 11 December 1998*, English Heritage.
- Fulford, M., Champion, T. and Long, A., 1997, *England's Coastal Heritage: a survey for English Heritage and the RCHME*, English Heritage
- Hill, M., Briggs, J., Minto, P., Bagnall, D., Foley, K., Williams, A., 2001, *Guide to best Practice in Seascape Assessment*. Maritime Ireland/Wales INTERREG Report NO. 5. The Marine Institute, Dublin.
- Muckelroy, K., 1977, Historic wreck sites in Britain and their environments in *International Journal of Nautical Archaeology and Underwater Exploration* (1977), 6.1:47-57. Museum of London Archaeology Service, 2004, *Chichester Harbour Area of Outstanding*

Natural Beauty: An archaeological research framework.

RCHME, 1998, MIDAS A Manual and Data Standard for Monument Inventories, RCHME, Swindon

Swanwick, C. 2002, *Landscape Character Assessment Guidance for England and Scotland*, Countryside Agency and Scottish Natural Heritage.

Throckmorton, P., 1987 (ed) *The Sea Remembers: Ships and Archaeology*, London.

Westerdahl, C., 1991, The maritime cultural landscape in *International Journal of Nautical Archaeology* (1991), 21: 5-14.

Westerdahl, C., 1994, Maritime Cultures and ship types: brief comments on the significance of maritime archaeology in *International Journal of Nautical Archaeology* (1994), 23.4: 265-270.

Williams, J. and Brown, N. (eds), 1999, *An Archaeological Research Framework for Greater Thames Estuary*, Essex County Council, Kent County Council and English Heritage.

Wessex Archaeology 2006, *England's Historic Seascapes, Historic Environment Characterisation in England's Intertidal and Marine Zones: Method Statement*, Report ref.: 58370.05.