HISTORIC SEASCAPE CHARACTERISATION PROJECT

NEWPORT TO CLACTON (PROJECT NO: 5735)

PROJECT REPORT

SECTION 1: HSC METHOD IMPLEMENTATION

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Report Structure

The Project Report for 'Historic Seascape Characterisation: Newport to Clacton and Adjacent UK Controlled Waters' is divided into three sections for ease of use. The first section outlines the project's method implementation, the second section outlines an applications review and case studies, and the third section contains printed versions of the National and Regional HSC Character Type text descriptions for the East Anglian region..

This document comprises Section 1 of the Report 'Historic Seascape Characterisation: Newport to Clacton and Adjacent UK Controlled Waters': HSC Method Implementation.

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1 Introduction

1.1 Introduction

1.1.1 The Newport-Clacton Historic Seascape Characterisation (HSC) Project forms part of the second round of implementation of a national HSC methodology (Tapper 2008) to the England's coastal and marine zones. The project is one of four undertaken concurrently, focusing on different large areas of England's coasts and seas. The project was commissioned by English Heritage and funded by the Aggregates Levy Sustainability Fund (ALSF).

1.1.2 The process of Historic Landscape Characterisation (HLC) is well established across England. Extending the principles of Historic Characterisation to the coastal and marine zones was however challenging due to the differing conditions presented by these zones. As such the HSC Method was developed over the several stages of the 'England's Historic Seascapes Programme'. Thus included five `Pilot' studies undertaken in different areas of the UK. These projects included the Southwold to Clacton pilot carried out by Oxford Archaeology (OA) between 2006 and 2007. The results of these differing studies were consolidated into a nationally applicable methodology in the final stage of that Programme (Tapper 2008).

1.1.3 The HSC Method was initially applied to England's north east coasts and seas in the 'HSC: Demonstrating the Method' Project (Seazone 2009). In a second round of four HSC implementation projects, OA was invited to tender in 2009 and were appointed to apply the national methodology to the Newport to Clacton area, extending the earlier OA pilot area. The aim of the project was apply the national HSC Method to the project area, producing an accessible GIS structure and Character Type texts for the region and noting the relevance of HSC to future applications.

1.1.4 HSC takes a holistic view of the landscape or seascape which, among many other benefits, facilitates comparison with other comprehensive environmental databases, gives it greater meaning and connectivity with the landscape and seascape perceptions of others, and allows it to provide context for the often 'point-based' datasets available for the marine zone. The resulting product is designed to enable more culturally-informed management of the marine environment and raise public awareness of the historic cultural dimension of the sea.. It is anticipated that the resulting product can be used as a spatial planning tool, allowing the historic cultural character of the present to be understood and accounted for in sustainable management of the marine and coastal zones. This is particularly pertinent given the ongoing implementation of the Marine and Coastal Access Act 2009 which aims to establish a coherent policy of spatial planning in the marine zone.

1.1.5 Throughout this Report, 'landscape' is defined, in accordance with the European Landscape Convention, as: 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors'(Council of Europe 2000, Article 1). 'Seascape' is defined here as a subset of landscape which includes the sea, and/or areas of land whose character is perceived to be distinctly maritime.

1.1.6 This project complies with the Management of Research Projects in the Historic Environment (MoRPHE) guidelines (English Heritage 2006) and demonstrates the implementation of the national methodology over a diverse area. This section of the report is one of three and discusses the implementation of the national methodology. Section 2 is the Application Review and Case Studies and Section 3 is the compilation of national and regional character type texts.

2 Background

2.1 Historic Landscape and Historic Seascape Characterisation

2.1.1 The development of historic landscape characterisation is described in detail by Hooley (2011 and in press) and will not be reiterated here. In brief, characterisation developed from the mid 1990s onwards against a background of rapid change to the environment, issues of sustainability and the growth of spatial planning and GIS. Landscape, as a concept, gives a spatial framework of understanding accommodating more comprehensive planning and conservation requirements (Hooley in press). Landscape's linking of human activity and natural processes is also essential to addressing sustainability (ibid).

2.1.2 Characterisation produces mapping of typical characteristics on a landscape scale, providing comprehensive coverage which is inter operable with other datasets. This began with Landscape Character Assessment (LCA) and developed with the advent of Historic Landscape Characterisation (HLC) in 1994. The focus of characterisation on the typical moves away from the traditional historic environment approach of mapping the 'special' and the 'important'.

Historic Characterisation also considers time-depth in the present landscape.

2.1.3 Characterisation is designed to be a constructive and effective method for informing the management of change in the whole environment, whether historic or natural. It can provide frameworks for informed conservation and management at many levels and scales, from local to national, complementing rather than replacing methods of selective designation and protection but capable of giving context to designation decision-making too (English Heritage, 2008).

2.1.4 HLC and HSC are both based on a process of creating a comprehensive and generalised, largely neutral and descriptive, understanding of the cultural and historic character of an area or a topic. The approach involves bringing together existing, often unconnected, knowledge, normally at a high level of generalisation, to create a broad understanding of the essential characteristics of parts of the historic environment such as the townscape, the rural landscape, the military heritage, or coastal and marine seascapes (English Heritage, 2008).

2.1.5 Focusing at the scale of the landscape/seascape carries many particular advantages. Among these:

- it promotes new perspectives relating to the individual records of the historic environment,
- it enables and justifies a proactive approach focusing on historic processes and extending beyond the limits of sites already known,
- it corresponds with the scale of analysis already used by most agencies and spatial planners concerned with the natural environment, allowing the historic environment to take its place within an integrated approach to sustainable environmental management.

2.1.6 HLC has been applied across England's land area in a breadth of contexts, including county based HLC, urban HLC, AONBs and National Parks. To date HLC has been completed across over 75% of England's land area.

2.1.7 It is anticipated that the extension of historic characterisation principles to the coast and marine by HSC will be applied to meet rapidly developing management requirements for the coastal and marine environment across a range of government bodies.

2.2 Characterising the Marine Zone

2.2.1 Applying the principles of historic characterisation to landscape and seascape in the coastal and marine zones is however not a straightforward process for a number of reasons.

2.2.2 The marine zone is inherently different to the terrestrial zone for which characterisation is well-established. In particular the sea has a number of vertical layers namely the sea surface, water column, sea floor and sub-sea floor. The historic character of each level can vary in the same location and needs to be fully understood.

2.2.3 In addition the marine and inter-tidal zones are highly dynamic, constantly changing due to processes such as currents, tides and the movement of sediment.. In contrast the coastal land zone is more stable and these two environments overlap. This necessitates interoperability between HSC and HLC. There are also differences in the way we perceive 'landscape' from the way that we perceive 'seascape', the latter relying on a greater influence from cognitive inputs over sensory information.

2.2.4 The HSC methodology has had to accommodate all these issues in order to apply the principles of historic characterisation to 'seascape'.

2.2.5 The multi-level character of the sea is addressed by splitting the marine zone into the following levels (in the GIS): :

- Sea surface
- Water column
- Sea floor
- Sub-sea floor
- Previous HSC character (where information is available)

In addition, HSC is also assessed for the maritime perspective of coastal land.

2.2.6 Each level is assessed for its HSC character. The differences between the terrestrial and marine environments in the available mapped boundary network within which to express HSC are dealt with through the application of a vector grid to the marine zone and the use of polygons in the terrestrial area. The extents of HSC character polygons are matched between HLC and HSC datasets where possible.

3 Aims and Objectives

3.1 Introduction

3.1.1 The HSC: Newport to Clacton Project Aims and Objectives as specified by English Heritage in their Project Brief (English Heritage 2009) are outlined below.

3.2 Project Aims

3.2.1 The project's overall aim is:

- *To carry out, using the national method for historic seascape characterisation (HSC), a GIS-based characterisation of a specified area of England's coastal and marine zones and adjacent waters to the limit of UK Controlled Waters.*

3.2.2 The project's more specific aims are:

- *To follow the national HSC method to create a GIS-based characterisation of the historic and archaeological dimension of present seascapes across the full extent of the project area, at a scale appropriate to national strategic level applications, in a manner and using a GIS compatible with other projects contributing to a national HSC database, thereby forming an exemplar for future HSC projects*

- *To ensure that application of HSC produces a GIS-database fully compliant with the principles of HLC, with the present and anticipated user-needs of English Heritage and with available standards for data content, management, inter-operability and accessibility developed to meet the implications of the Marine and Coastal Access Act*

- *To structure, inform and stimulate future research programmes and agendas relating to the coastal and marine historic environment*

- *To improve the awareness, understanding and appreciation of the historic dimension of the coastal and marine environment to its professional and non-professional users*

3.3 Project Objectives

3.3.1 The project's key objectives are:

- *To produce a GIS-based characterisation of the historic and archaeological dimension of the present seascapes across the full extent of the specified project area, using the established national HSC method, adopting at least a national perspective for its descriptions, and coordinating its marine HSC with a national data framework to be advised by English Heritage*

- *To analyse and interpret the project's HSC database to identify contexts and applications in the project area typifying those which the HSC approach is designed to inform, as noted in the national HSC Method Statement (Tapper 2008), with particular reference to English Heritage's curatorial responsibilities and influences for the sustainable management of change, the provisions of the Marine and Coastal Access Act, and UK commitments arising from the European Landscape Convention*

- *To document those HSC contexts and applications in the project area by description, including scenario examples as appropriate. Those contexts will include the role of HSC in informing the marine aggregates extraction licensing process.*

- *To document from the project area, by description and by case study, the close inter-relationships between historic and natural environment character and the advantages of inter-operability between historic and natural environment spatial datasets.*

- *To document from the project area the potential of the HSC for raising public awareness and understanding of the coastal and marine historic environment.*

- *To produce an Archive and a Project Report documenting all aspects of the project's application of the national HSC method. Included within the Project Report will be: a project method statement detailing the project's practical implementation of the national HSC methodology; documentation of the project area's contexts and applications, current and potential, which HSC can advantageously inform; the relationships between the project area's historic and natural environment character, and the potential of the project's HSC for raising public awareness and understanding of the coastal and marine historic environment.*

- *To detail in the Project Report's method statement the specific tasks and aspects of implementing the national HSC methodology across the project area, including records of the sources and data-sets supporting each stage of the characterisation and noting the inter-relationship between HSC and HLC where the latter has been undertaken within the project area, to meet the needs of transparency and to assist future updates against the initial benchmark characterisation*

- *To disseminate information on the progress and results of the project through the internet and through professional and popular publications and other media*

4 Study Area

4.1.1 The location of the proposed Study area is shown on Figure 1 of this document. The project area defined in the Project Brief (English Heritage 2009) encompasses the former HSC method development project Pilot area from Southwold to Clacton and extends that area to the north, as far as Newport in Norfolk.

4.1.2 The project area is subject to defined boundaries to the north and south and on its seaward side. Thus the north-eastern lateral extent is defined as a line extending eastward from the Norfolk coast near Newport at latitude 52°42’00", to the intersection with the UK Continental Shelf Limit at the Median Line with Dutch waters. The south-western lateral extent is defined as a line extending from the Essex coast at Jaywick at 51°46’30"N, 01°07’15"E, south eastwards to the point where the UK continental shelf limit at the Median Line meets the junction of French and Belgian waters. The seaward limit of the area is the limit of UK controlled waters, following the Median Line with Belgium and Holland as defined in the UK Continental Shelf Act 1964 and subsequently amended.

4.1.3 Landward the project area incorporates all land to the OS-mapped line of Mean High Water (MHW). However, as stated in the Brief, (English Heritage 2009) in accordance with national HSC methodology it continues landward to avoid any arbitrary truncation of HSC polygons and to accommodate inland areas which, when viewed from a maritime perspective can be shown to possess a distinctly maritime character

4.1.4 The project area incorporates estuaries covered within the previous Southwold to Clacton pilot area (Oxford Archaeology 2007) including the Alde, Ore, Deben, Orwell and Stour estuaries, to Normal Tidal Limits, as well Hamford Water. It also encompasses the River Blyth to Normal Tidal Limits, a feature previously on the periphery of the pilot study. In the extended area to the north the project area incorporates the River Yare which extends landward from Gorleston on sea and the tidal lake of Breydon water into which it flows. South of this the area includes Lowestoft harbour and the saltwater body of Lake Lothing.

4.1.5 The project area also includes terrestrial regions where such areas have a clear maritime element. Areas include the resort and maritime industrial hubs of Great Yarmouth and Lowestoft, Felixstowe and Harwich, as well as Clacton-on-Sea and the Naze area. These areas have particular HSC relevance from their harbours and ports, the sea fishing industry, maritime leisure and navigation, as outlined below.

5 Methodology .

5.1 Introduction

5.1.1 The project was undertaken in accordance with MoRPHE guidelines (English Heritage 2006) over a period of 14 months. A revised working draft of the HSC Method Statement (Seazone 2010), building on the practical experience from the initial HSC implementation project (SeaZone 2009), was used as the basis for applying the national HSC methodology and close communication with staff from the English Heritage Characterisation Team was maintained through the means of regular Steering Group meetings and an ongoing email correspondence.

5.1.2 As detailed in the Project Brief (English Heritage 2009) the method was initially applied to a trial area based along the northern part of the project area's coastline, specifically the area to seaward and landward from Newport to near Hopton-on-Sea (See Figure 1). The trial area included coastal, inter-tidal and offshore areas and included the Broads area as agreed at the first Project Board meeting.

5.1.3 Following completion of the trial area, characterisation began on the entire project area. The tasks that were undertaken during this phase are discussed under the following sub-headings, as described in the national HSC Method Statement (Tapper 2008, Tapper 2010). Each has been described, and any necessary variations have been discussed.

- Data Collation
- Data Preparation
- GIS development
- Database development
- Character Assessment
- Development of Character-type Text Description

5.1.4 The conclusion focuses on challenges that were encountered while undertaking that work, and provides an overall summary of the project.

5.1.5 A project wide bibliography is supplied as Section 7 of this report and a list of acronyms and abbreviations (and their definitions) is supplied as Section 8.

5.2 Data Collation

5.2.1 The datasets chosen for this project followed the core and supplementary datasets defined in the HSC Method Statement (Tapper 2008, Tapper 2010) and included guidance and additions from the Demonstrating the Method (Seazone 2009, Seazone 2010) where they were scoped to be relevant. Emphasis was placed upon those core datasets: ones which have consistent national coverage and those which are available digitally.

5.2.2 The information used to produce Character Type text descriptions was based on an initial strategy of desk-based assessment and added to through a program of targeted fieldwork.

5.2.3 Following the guidance outlined in HSC Method Statement and Demonstrating the Method project report data requirements were:

- Sources are relevant and consistent
- Core dataset coverage is national (or at least regional)
- Sources are treated in a consistent manner and even-handed way, following the clearly-stated workflow in the HSC Method Statement; and are used to reflect time-depth and past change
- Standard terminology is used to maintain clarity, meeting MIDAS Heritage/INSCRIPTION requirements
- Consistent assessment and capture of historic seascape character is deployed
- Common 'perception scale(s)' are established – that is, the scale at which characterisation is expected to be read and applied

5.2.4 Data limitations such as limited coverage and accuracy were considered during collation of data and construction of the GIS. As had been noted previously (Seazone 2009, 15) marine data and particularly archaeological data tends to be concentrated in the coastal and inter-tidal areas. Levels of accuracy and degrees of bias were issues with data sources.

5.2.5 A list of core data sets (Table 1) was produced for the project, based on those identified in the HSC National Method and subsequent Demonstrating the Method projects. These data sets had national coverage. Where relevant a comment has been provided in the table to note the relevance, accessibility or usefulness of these sources.

Source	Format	Location	Notes
Modern Admiralty Charts	Digital	UKHO (SeaZone Solutions Ltd)	Source of navigational features and daymarks and for compilation of character texts.
Historic Admiralty Charts and Surveys	Digital and hard copy	Seazone Solutions/ /Local Museums, Libraries and Record Offices	Source of navigational features, daymarks, historic shipping features and for compilation of historic character texts
Modern Ordnance Survey maps	Digital	English Heritage	OS MasterMap was the initial source for the Inter-tidal and Coastal characterisations. OS 1:25000 Mapping was used to the MasterMap data as well as provide the scale to which the polygons would be produced.
Historic Ordnance Survey maps (1st and 2nd OS Editions)	Digital	English Heritage	Used to refine the temporal definition of the coastal zone where appropriate.
SeaZone Hydrospatial	Digital	UKHO (SeaZone Solutions Ltd)	Used in the initial characterisation of many of the marine sub-types as the dataset combines many sources (including Sea Areas, Obstructions, Navigational Charts,

			Geology, Administrative Zones).
Adjacent County Terrestrial HLC data	Digital	Local Authority	Used to apply characterisation to the geographically defined MasterMap data for the Inter-tidal and Coastal zones.
Modern Aerial Photos	Digital	Local Authority, Online mapping resources (Google Earth, Bing Maps)	Used as a means of ground-truthing when using the Modern OS and HLC data
Fisheries data (offshore, inshore and coastal fishing effort and pressures) *	Digital	CEFAS (outside 6nm), SeaFiisheries Committees (within 6nm), JNCC, Anatec, Kingfisher charts, NMR, Misc. fishing charts	General fishing areas were initially defined through the determination of dominant fish types caught (Anatec, ICES data) and their rough locations, combined with preferred depths. These areas were further refined through historical charts, and Cefas technical report 116 (giving information about catch habits & methods per port).

Table 1: Core Data Sources

5.2.6 Supplementary data sources included datasets with regional or local coverage, point data and data not currently available in digital format. This set of sources may not be applicable to all areas of HSC but allowed the HSC to be fine-tuned for the regional characterisation. These data sets are listed in Table 2. Where relevant a comment has been provided in the table to note the relevance, accessibility or usefulness of these sources.

Source	**Format**	**Location**	**Notes**
HER/SMR/NMR data (including RCZAs)	Digital/hard copy	Local Authorities, EH, NMR	Used to help define wrecks and previous character types for the Coastal zone.
Offshore Industry	Digital	Kingfisher charts, Crown Estates	Kingfisher charts were used for pipeline and submarine cable routes and Crown Estate data provided the latest windfarm information.

Palaeoenvironmental data (sea level index points, submergence models)	Hard copy/digital	Various (eg. North Sea Palaeolandscapes Project, EH & Uni. of Birmingham)	Elements of this were useful particularly the Wessex Archaeology – 'Seabed Prehistory' reports
Shipping data	Digital	Wessex Archaeology, *England's Shipping: Year 1* and 2, refs: 51552.03 and ref: 51552.05 Anatec UK Ltd, *Navigational Hazards Project:*	Used to define shipping routes and navigation areas. The coarse DfT data was combined with Anatec AIS and Navigational Charts and literary sources.
Documentary Sources, Images, Art, etc	Hard copy, digital	Various locations	Used in the compilation of the Character texts and useful as a background data set during the refinement of the GIS.

Table 2: Supplementary Data Sources

5.2.7 Documentary sources played a vital role in the production of the regional Character Type texts and also provided context to the spatial datasets. The desk-based research undertaken during the Southwold-Clacton pilot project proved invaluable as a basis for this project. This was added to where possible with study of more recent sources and examination of sources covering the extended area.

5.2.8 Data collation was begun in the initial stage of the project and continued throughout its duration as and when new material presented itself.

5.2.9 Field Survey and Archival Research

5.2.10 Programmes of both archival research and field survey were carried out. The archival research, carried out in August 2010, concentrated upon examination of sources which were both not available digitally and which had not been consulted as part of OA's survey of the smaller study area in 2005. Sources consulted included Norfolk Records Office, Lowestoft Maritime Museum and Orfordness Museum.

5.2.11 The field survey was carried out in late August and early September 2010. It involved a drive-through survey of the entire study area with focused visits to key locations. The survey included two boat trips, entailing waterborne visits to The Broads and to Walton Backwaters, both of which were otherwise inaccessible.

5.3 Data Preparation

5.3.1 Overall data was managed and processed in accordance with the national HSC Method Statement (Tapper 2008, Tapper 2010). The established workflow was to create a GIS project for each of the Broad Character Types, within which each of the related Sub-character Types were analysed. In this section we review some of the datasets which required extra preparation, noting the issues that may arise for future projects.

5.3.2 *Preparation of datasets*

5.3.3 In terms of the marine datasets, the Seazone Hydrospatial data, supplied under license by English Heritage, was applicable to many of the characterisation layers, combining as it does information about industry, bathymetry, environment, marine use and wrecks (amongst others). It also contained digitised versions of the navigation charts which, in previous projects had needed to be accessed as a separate raster product. Overall the data required little preparation, although it was necessary to download the layer guide from the Seazone website as this was not provided by EH and the data was cumbersome to navigate without it. It was also found that this data was lacking in areas such as fishing information even though these layers were mentioned in the guide. This does suggest however that such information may be incorporated at a later date.

5.3.4 The core Coastal Zone dataset of the Ordnance Survey MasterMap data was supplied on disk in a compressed .gz format containing propriety .gml files. Preparation of MasterMap data into GIS compatible data is therefore dependent on the software suite available to the assessors. For this project the software suite used was ArcGIS and the currently established means of converting MasterMap data in the software is through the use of the ESRI Productivity Suite extension. Use of this extension requires a license which our project did not have. For this project this problem was initially solved through the use of a 30 day trial of the extension, allowing the files to be processed. The output of this was a series of geodatabases compatible with the GIS that allowed the data to be queried based on topography and layers such as 'Foreshore' or 'Heath' to be extracted. A problem arose when one of the geodatabases was found to be corrupt, and needed re-processing after the 30 day trial. It was necessary to find an alternative conversion method. Within ArcGIS this could be done through the Data-Interoperability extension (the precursor to the Productivity Suite), although again this relied on the license level of the software. In the interests of software agnosticism for future HSC projects non-ArcGIS converters were sought, with varying results. Edina Digimap's InterpOSe and Edonica's MMImporter converters again require a license for use so may not be used, whilst other Open Source converters such as the OSM2MIF from the Oxford Bodleian Library required conversion steps and do not always produce the same quality of attribute table making it more difficult to query the data, although it must be noted that the quality of the free converters have improved even over the lifespan of this project.

5.3.5 Once extracted, it was found to be necessary to split the resulting files into smaller parcels, otherwise the files significantly slowed the GIS, making each screen redraw a time consuming process. It is understood though that such issues are dependent on the specifications of the machine and primarily in this case the areas being mapped. The scale of the MasterMap data (1:1250 - 1:10,000 dependent on location) meant areas such as the Norfolk Broads which are replete with small waterways meant data dense with polygons.

5.3.6 The small scale of the MasterMap data and the topographical nature of the data meant the resulting polygons often needed to be merged to fit the 1:25,000 scale of the Coastal Zone and characterised beyond the standard physical descriptions that the data provides.

5.3.7 The Historic Landscape Characterisation (HLC) datasets for the individual authorities provided the bulk of the polygon refinement for the Coastal analysis. Each HLC had features queried out when needed, and the geometries copied and re-attributed in accordance to the methodology. However it was quickly apparent that the variable grain and structure of the individual HSCs can affect the speed and accuracy of this workflow. In this case the study area was split over three counties, meaning three distinct HLC datasets. Each had variable attribute fields and HLC definitions, meaning no one query was applicable for all datasets. The variations in the attributes were further compounded by the quality of recording (the fluctuating use of capitals or misspelling) and the level of detail recorded, especially in the Inter-tidal zone. Where one would record salt marsh, or mudflats, another would record them all as merely Inter-tidal. Using such datasets underlines the importance of the conformity established in the HSC methodology.

5.4 GIS and Database Development

5.4.1 All the processing and analysis was undertaken with ArcGIS 9.3.1 and Windows XP, running on an AMD Athlon 64 X2 5600+ processor with 3GB of RAM.

5.4.2 The initial GIS projects were set-up following the HSC Method Statement (Tapper 2008) and the workflow was created based on the experience written in the 'Demonstrating the Method' report (Seazone 2009) Prior to the final data collation several ArcGIS .mxd projects were created, each named after an HSC Character Type, or several related Types. All the projects destined for marine data and analysis were Projected into the WSG84 / UTM Zone 31N CRS, whilst the landward project were set-up under the British National Grid Projection.

5.4.3 A shapefile of the study area was obtained from English Heritage. This provided the seaward extents of the HSC up to the MLW line. Upon further review of this coastline it was decided that it was too coarse along the MLW, so it was appended and updated with one derived from the supplied OS MasterMap data. Once the trial area was finalised the geometry was extracted from the larger study area and exported into a separate shapefile.

5.4.4 Once the 250m analysis grid was obtained from Seazone a spatial query was run, selecting all the cells that intersected the study area and removing those that did not. In the final stages of analysis this grid would be clipped to the finished landward shapefile, allowing the two to be merged without overlap. Next the coastline was buffered to 5 kilometre as a guide to the extent of the coastal analysis. This buffer served two purposes; first it offered a visual guide as to how far inland 5km was to give a sense of scale to the assessors, and second it provided an area to limit the initial spatial data queries for those datasets that covered far too wide an extent (such as the HER). No data was truncated by this line and characterisation took place beyond when necessary .

5.5 Character Assessment

5.5.1 The characterisation followed the methodology as outlined in Tapper 2008, Tapper 2010, and using experience from Seazone 2010. The project takes a multi-modal approach to characterisation, using a 'Character Type' hierarchy based on the previous HSC pilot projects, the 'Demonstrating the Method' project, and further refined during the lifespan of the current projects. The 'Character Type' hierarchy relates the Character Sub-types (upon which the HSC analysis is based) to more general 'Character Types' and 'Broad Character Types'. Once the significant data is prepared character assessment follows the workflow established in the Method Statement. The data is combined into a single data layer and characterised through the processes of 1) Descriptive attribution (the creation of intermediate source layers based on descriptive criteria at the character sub-type level), proceeded by 2) Prescriptive classification (attribute analysis of the descriptive layers in order to determine the population of the Character Type 'hierarchy' and character predominance).

5.5.2 There are notable differences between the way HSC methodology and HLC methodologies are applied. In particular these differences relate to the creation of a temporal 'depth' to the characterisation, and the differing procedures required to blend the Coastal and Marine zones within the assessment.

5.5.3 Time depth is reflected in the character assessment through the differentiation between present HSC (reflected in Coastal and Conflated attributes and within each marine tier) and previous HSC within the attributes, and the recording of a benchmark period reflecting the origin of the activity represented for each of the tiers and the conflated character groups. All HSC polygons were given a confidence rating as specified in the Method Statement (Tapper 2008, Tapper 2010).

5.5.4 To aid the characterisation, and to display the multiple environmental types that are covered within an HSC, the assessment delineates four location Zones; Coastal, Inter-tidal, Inshore Marine and Offshore Marine. Coastal (above MHW) and Inter-tidal (between MLW and MHW) polygons include areas which possess a distinctively maritime character such as quays and prominent features which act as marine daymarks. OS MasterMap was used to define a base layer and merged and re-attributed as applicable. Where HLC had already been completed for these areas these polygons were re-used where possible, otherwise new polygons were created. The final output for these zones is a contiguous polygon layer similar in geometry to terrestrial HLCs.

5.5.5 For the Inshore Marine (MLW to the 12 nautical mile limit of UK territorial waters) and Offshore Marine (beyond the 12 nautical mile limit) a further processing step is required. A vector based grid was created to provide a data frame within which to capture the assessment of marine HSC. This grid was provided by Seazone Hydrospatial Ltd and was co-ordinated with the other HSC projects feeding into the national HSC database, as it is important that all share the same orientation and will therefore correspond when gaps in the national coverage are filled in the future. During processing the polygonal data layers are further 'filtered' and spatially joined to this grid in order to provide a standardised resolution of 250m for the marine data. The marine aspect of the GIS corresponds with the multi-level character of the sea, and comprises levels for the 'sub-sea floor' (Figure 2), 'sea floor' (Figure 3), 'water column' (Figure 4) and 'sea surface' (Figure 5). Character and dominance assessment took place at each individual level and finally at an overall 'Conflated' layer which displays the Marine dominance (based upon all the layers) and the Coastal HSC (Figure 6). What is assessed as the dominant character is essentially the judgement of the assessor but, as guided by the HSC Method Statement, it is informed by evidence for directly observable anthropogenic activity, impact-orientated activities and confidence in interpretation.

5.5.6 Once processed as above the resulting shapefile contained the following attribute structure, as prescribed in the revised Method Statement (Tapper 2010).

Attribute Name	Alias	Description and guidance, terminology	Population Method	Format	Width
PolygonID	PolygonID	Unique reference number for HSC polygon/grid cell	Automated by GIS software	numeric	10
NAME	Name	Name of area or topographic identifier, local or popular name	manual	string	100
CC_BDTY	Coastal and Conflated Broad Character Type	Broad Character Type (present, dominant; national strategic level). Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	automated	string	100
CC_TY	Coastal and Conflated Character Type	Character type (present, dominant; regional level). Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	automated	string	100
CC_SBTY	Coastal and Conflated Sub Character Type	Sub-character type (present, dominant; local level). Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	manual	string	100

Attribute Name	Alias	Description and guidance, terminology	Population Method	Format	Width
CC_PRD,	Coastal and Conflated HSC Period	Benchmark period of origin of the area represented in the polygon or cell. Recorded for present historic character. Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	manual	string	50
CC_SRC	Coastal and Conflated HSC Source	Sources used to identify present and previous historic character. Attribute values to record supplier, date, precise GIS file name. To include reference to the scale of original data used. Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	manual	string	250
CC_CNF	Coastal and Conflated HSC Confidence	Degree of certainty/confidence of HSC interpretation of present historic character. Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	manual	string	25
CC_NTS	Coastal and Conflated HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250
CC_LINK	Coastal and Conflated HSC Link	URL hyperlink to **Character Type** texts . Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	manual	string	250
SBFLR_SBTY,	Sub sea-floor HSC sub- type	Present and dominant historic character of the sea-bed (recorded at sub-character, character and broad character levels)	manual	string	100
SBFLR_TY	Sub sea-floor HSC type		manual	string	100
SBFLR_BDTY	Sub sea-floor HSC broad-type		manual	string	100
SBFLR_PRD	Sub-sea floor HSC Period	Benchmark period of origin of the area represented in the polygon cell.	manual	string	50
SBFLR_SRC	Sub-sea floor HSC Source	Sources used to identify historic character. Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	manual	string	250
SBFLR_CNF	Sub-sea floor HSC Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	manual	string	25
SBFLR_NTS	Sub-sea floor HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250

Attribute Name	Alias	Description and guidance, terminology	Population Method	Format	Width
SBFLR_LINK	Sub-sea floor HSC Link	URL hyperlink to **Character Type** texts	manual	string	250
SFLR_SBTY,	Sea-floor HSC sub- type	Present and dominant historic character of the sea-floor (recorded at sub-character, character and broad character levels)	manual	string	100
SFLR_TY,	Sea-floor HSC type		manual	string	100
SFLR_BDTY	Sea-floor HSC broad- type		manual	string	100
SFLR_PRD	Sea-floor HSC Period	Benchmark period of origin of the area represented in the polygon cell.	manual	string	50
SFLR_SRC	Sea-floor HSC Source	Sources used to identify historic character. Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	manual	string	250
SFLR_CNF	Sea-floor HSC Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	manual	string	25
SFLR_NTS	Sea-floor HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250
SFLR_LINK	Sea-floor HSC Link	URL hyperlink to **Character Type** texts	manual	string	250
WTRCL_SBTY	Water Column HSC sub- type	Present and dominant historic character of the water-column (recorded at sub-character, character and broad character levels)	manual	string	100
WTRCL_TY	Water Column HSC type		manual	string	100
WTRCL_BDTY	Water Column HSC broad-type		manual	string	100
WTRCL_PRD	Water Column HSC Period	Benchmark period of origin of the area represented in the polygon cell.	manual	string	50
WTRCL_SRC	Water Column HSC Source	Sources used to identify historic character. Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	manual	string	250
WTRCL_CNF	Water Column HSC Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	manual	string	25
WTRCL_NTS	Water Column HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250
WTRCL_LINK	Water Column HSC Link	URL hyperlink to **Character Type** texts.	manual	string	250

Attribute Name	**Alias**	**Description and guidance, terminology**	**Population Method**	**Format**	**Width**
SSRFC_SBTY,	Sea-surface HSC sub- type	Present and dominant historic character of the sea-surface (recorded at sub-character, character and broad character levels)	manual	string	100
SSRFC_TY,	Sea-surface HSC type		manual	string	100
SSRFC_BDTY	Sea-surface HSC broad-type		manual	string	100
SSRFC_PRD	Sea-surface HSC Period	Benchmark period of origin of the area represented in the polygon. Recorded for present historic character levels and previous historic character	manual	string	50
SSRFC_SRC	Sea-surface HSC Source	Sources used to identify historic character. Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	manual	string	250
SSRFC_CNF	Sea-surface HSC Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	manual	string	25
SSRFC_NTS	Sea-surface HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250
SSRFC_LINK	Sea-surface HSC Link	URL hyperlink to **Character Type** texts	manual	string	250
PRVS_SBTY1, 2 etc	Previous HSC Type (1-∞)	Previous historic character for which evidence is available. Recorded for multiple time-slices on basis of source dataset.	manual	string	100
PRVS_PRD1, 2 etc	Previous HSC Period	Benchmark period of origin of the area represented in the polygon. Recorded for present historic character levels and previous historic character	manual	string	50
PRVS_SRC1, 2 etc	Previous HSC Source	Sources used to identify previous historic character. Attribute values to record Supplier, Date, precise GIS file name. To include reference to the scale of original data used.	manual	string	250
PRVS_CNF1, 2 etc	Previous HSC Confidence	Degree of certainty/confidence of HSC interpretation of previous historic character.	manual	string	25
PRVS_NTS1, 2 etc	Previous HSC Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	manual	string	250
PRVS_LINK1, 2 etc	Previous HSC Link	URL hyperlink to **Character Type** texts	manual	string	250
CA1, CA2 etc	Character Area (1-∞)	Unique character area	manual	string	100

Attribute Name	Alias	Description and guidance, terminology	Population Method	Format	Width
LCTN	Location	General location (eg. Offshore marine, inshore marine, estuary, coast etc)	manual	string	50
AREA	Shape_Area	Area in map units (usually metres square) covered by polygon.	automated	string	9.9
CELL_SZ	Cell/grid size	Size of grid used for marine zone (eg. 100mx100m, 500mx500m etc)	manual	numeric	5
CRT_DT	Creation Date	Date of dataset /polygon creation/completion	manual	string	10
CRTR	Creator	Name of the person/organisation who compiled the HSC	automated	string	250

Table 3: Structure of GIS

5.5.7 The collation and processing of the data sources to allow the initial assessment and attribution followed the methods stated in Tapper (2008, Tapper 2010) and filtered these through the grid created by the 'Demonstrating the Method' (Seazone 2009) report. A summary of the processes and any variances from the method or issues encountered by the project , organised by their Broad Character Types. are given below.

Navigation

5.5.8 The majority of the Navigation subtypes could be extracted from the Seazone Hydrospatial data, complemented by Navigational Charts and the BMAPA and ALSF datasets, and processed accordingly. During processing however there were three workflows of note.

5.5.9 For those layers which involved the conversion of points to polygons derived from densities, focused in particular around the conversion of wreck points, we found insufficient detailing in the full geoprocessing steps in both Tapper 2010 and the 'Demonstrating the Method' report (Seazone 2009) . Whilst is understandable that in order to maintain a level of software agnosticism specific processing steps cannot be used, any small variations in this processing can lead to significantly different density coverages. Ultimately part of this issue was superseded by a wrecks layer being provided by Seazone, yet we could not re-produce the layer with the given instructions which must be noted (see conclusion for more on this discussion).

5.5.10 Navigation routes/areas were not found to be sufficiently represented within any single dataset. As such these were created through a combination of Anatec shipping density data, refined with sailing routes, DfT density and AIS data and observed ship tracks mapping produced for the Greater Gabbard Wind farm. Whilst most of the datasets were simple to process, again the density related data required a subjective decision to be made. In these cases a decision had to be made as to which values were considered significant in terms of the analysis, as changing these values greatly affected the resulting Character Sub-type coverages. Whilst subjectivity is a core part of characterisation, multiple projects using the same data and feeding into the same infrastructure could show a lack of conformity because of these variances.

5.5.11 The difference between a church steeple on the coast and a navigational Daymark is one of perception. To this end the final selection was based on those features specifically named and located on the Crown copyright Navigational Charts.

5.5.12 The Navigation Character Type has one of the broadest range of subtypes in this HSC area. As such it affects a significant portion of the marine aspect in the study. This also reflects the number of ports and harbours along the coast, as well as the busy waters off this stretch of coast.

Industry

5.5.13 Again the primary source for the marine layers was the Seazone Hydrospatial data, informing Suib-character Types including aggregate dredging areas, hydrocarbon installations, renewable energy installations, and submarine cables and pipelines. These were refined with the Kingfisher chart, the BMAPA datasets and literary sources when required. Most of the layers were processed according to the established methodologies and required no extra steps in their assessment. Notable exceptions to this were the Commercial shipping routes and Hydrocarbon installation (wind) Character Sub-types.

5.5.14 The Commercial shipping routes required the processing of multiple data sources. The initial areas were defined through the extraction of the high shipping traffic densities supplied by the Department for Transport (DfT). These were then refined through the use of Navigation Charts, traffic separation data in the Seazone Hydrospatial dataset, and finalised by the utilising the IMO ship routing data and the Anatec AIS (Automatic Identification System).

5.5.15 The role of wind farms within the study area is one of increasing presence and expansion. The Seazone Hydrospatial data contained the main licensed areas for the windfarms, and in the case of the Scroby Sands Windfarm the position of the individual masts and associated structures. The decision to include and use the licensed areas for the two future Gabbard windfarms comes from their current state of construction. With the foundations being laid there is a strong presence of construction vessels and platforms throughout the licensed areas. The construction of these sites will be important to monitor in future HSC updates,. The location of the mast locations will need to be refined and associated attendant development (such as the planned powerline connecting with Sizewell) will need to be mapped.

Fishing

5.5.16 Fishing was the most problematic character type. The workflow for the fishing types included a wide range of data including Anatec Surveillance Data, CEFAS Pressure Map & Technical report, Seazone Hydrospatial, ICES, Albert Close Fishing Chart, and various literary sources.

5.5.17 By its very nature specific fishing locations and data are very vague. The primary Anatec and ICES data regarding catch types are based on the ICES grid. These were deemed too coarse to be of use for the analysis, so a more complex workflow was developed. First, the general fishing areas were loosely defined through the determination of dominant fish types caught using Anatec and ICES data. This dominance was established by quantity. This gave a rough location per fish type, which was combined with Seazone Bathymetry in order to extract large areas based on preferred depths. These fishing areas were then organised by fishing methods based on species, and combined with the CEFAS Pressure Map, which shows trawling impact, and technical report 116, which gives information about catch habits and methods per port for the coastline. This finally produced a series of polygons based on the preferred fishing type.

5.5.18 The fishing industry is obviously one of the most widespread activities throughout the marine environment and has left a clear cultural imprint on coastal and marine character. Yet conversely its very character means it is perhaps the hardest to truly represent in HSC. The majority of fishing practices (especially in open water) are mobile in both a spatial and temporal sense. The vagaries of fishing locales can in some way be represented by the fuzzy nature of the grid in the HSC, but the use of a more generic Sub-type 'Fishing grounds' is necessary to acknowledge the seasonal nature of the industry Whether or not an area should be classed as a general fishing ground was based on the number of fishing Sub-types present in that location. If more then half of the fishing methods were present then it was allocated as such.

Ports and docks

5.5.19 These subtypes mostly related to the coastal aspect of the HSC and as such were initially queried through the HLCs. To refine those HLCs' coverage to reflect the maritime perspective of HSC, the work-flow was focused around the modern OS mapping (including MasterMap) coupled with HER information which provided the locations for historical docks and quays. Whilst many of these features were included in the query, they were not all included due to the threshold of depiction in the HSC. Where applicable the harbour and port entrances were mapped following Navigational Charts and alternative literary sources.

Coastal Infrastructure

5.5.20 The majority of these subtypes were provided by the county HLCs as either 'Sea' or 'Flood' defences. The terminology was interchangeable between the different datasets with regard to the defensive walls along the numerous rivers and in the Broads. In terms of the overall project, Flood defences was prescribed to those defences that did not directly face the sea.

5.5.21 It can be questioned whether the wetland's defensive walls and ditches should be included because of their scale. Yet the role they play, and the constant concern over their maintenance suggest they are an important feature to the people within these environments and offer a level of presence and physicality above the 'Reclaimed land' Sub-type of which they are part. of the reclamation.

Communications

5.5.22 The most prominent marine communications features are the submarine telecommunications cables, which were extracted from the Seazone Hydrospatial and expanded with the Kingfisher Chart for the region. These were then processed as per the methodology by applying a 250m buffer around the polyline dataset.

Military

5.5.23 The 'military' Character Types provided the most prevalent applications of Previous HSC.

5.5.24 Among the marine features, the Seazone Hydrospatial data was used to define the current military practice areas and ordnance dumping areas. This was expanded through the use of old mine-laying plans to map out areas of defensive and offensive minefields that were created during the 1940s.

5.5.25 The coastal features were gathered by querying the NMR and HER datasets for the relevant counties. Due to the scale of many sites often the smaller features would already be included in a larger more general polygon showing the extents of the wider military defences. It was these that were included within the analysis. These features were also compared to the HLC records in order to ascertain extant features and what their current role may be.

5.5.26 Overall there are a significant number of features along the coastline, demonstrating the major defensive role that the East coast played during the World Wars.

Settlement

5.5.27 Where applicable, the urban extents were extracted from the HLC datasets with the remainder digitised from the 1:25,000 modern OS mapping.

5.5.28 Settlements were included in HSC on the basis of their maritime character. Within this project area that sift provided three distinct types; namely:

- larger towns/cities that had existing docks,
- coastal seaside towns,
- smaller villages/hamlets, many of which exist within the wetland environments of the broads and have a strong connection to the waterways.

Recreation

5.5.29 Recreation activities are prominent across the project area, taking into account the numerous coastal towns and activities, as well as the wetland recreation deep into the broads.

5.5.30 Seazone Hydrospatial and the Anatec supplied RYA sailing and racing data were used to define offshore areas of leisure activity. The coastal activity was identified at the broad scale using Seazone Hydrospatial and HLC data for recreational/leisure subtypes such as golf courses or marinas, and areas of foreshore that may relate to a leisure beach. Polygons were either merged from MasterMap data or extracted from the HLCs where appropriate. Overall it was found that the HLC was often very vague in their characterisations to suit the marine focused HSC, attributing large areas as simply 'Recreational' or 'Leisure'. As such as a manual search was undertaken using the 1:25,000 mapping and Aerial photography to ground-truth. any resulting geometry was either extracted from the HLC datasets, MasterMap or re-digitised.

5.5.31 One subtype of note within the study was in the selection of wildlife watching areas. Across the coastal land there are significant numbers of Nature Reserves and SSSIs. It was decided that the dominance of these areas for wildlife watching outweighed any other environmental characteristic (although within these areas can be other less dominant character types). These areas were initially subtracted from the Seazone Hydrospatial data, and then refined by OS mapping and external research to complete the layer.

Cultural Topography

5.5.32 The Marine Sub-Character Types of cultural topography were primarily extracted from the Seazone Hydrospatial dataset. In particular the geological layers were simplified into Coarse/Medium/Fine sediment types based on their dominant attributes (i.e. Gravelly-Sand versus Sandy-Gravel). These datasets were further refined with the BMAPA Hazards in order to identify sandbanks. The Character Type texts make clear the cultural dimension implied by their inclusion in HSC.

5.5.33 The Inter-tidal Sub-Character Types were established via an initial extraction of OS MasterMap data and HLC data. Where possible these were further refined using Natural England data to further identify mudflats. Due to the previously stated discrepancies in the HLC data it was ultimately necessary to assess the Inter-tidal zone manually using the 1:25000 mapping and aerial photos when necessary. Overall the nature of the Broadland riverscapes meant there were considerable amounts of inter-tidal locales in the study area, including Nature Reserves such as

Hamford Waters in the south.

5.5.34 The Coastal Sub-Character Types were again initially extracted through the OS MasterMap and HLC data. In this work-flow these were expanded using the Natural England data to identify landscape elements such as cliffs, dunes, and heathland. These were either used to re-attribute existing HLC data, or to alter the geometry as necessary. Again, these features were required to be reviewed manually using existing mapping in order to identify missing or poorly attributed data.

5.5.35 Selected features of the palaeolandscape Sub-Character Types were identified using as an initial base reports from Wessex Archaeology and the Thames REC. These offer insights and maps from which the polygons could be derived. Despite the paucity of specific information the rest of the area was known to have been an estuarine palaeolandscape, and was thus characterised with the more general 'Palaeolandscape component' Sub-type.

Woodland, Enclosed Land and Unimproved Grazing

5.5.36 These Sub-types were extracted from the HLC datasets, and refined with OS mapping when necessary. The Reclamation of land within the study area is one of the more prevalent Sub-types across the Coastal zone.

5.6 Data Processing and Prescriptive Classification

5.6.1 Once the polygon layers were re-attributed and finalised for each of the Sub-character Types they were then placed within their respective ArcGIS projects and assigned a preliminary dominance based on their position in the table of contents. In accordance to the HSC methodology each of the layers were then processed in the following manner.

Processing the Inshore and Offshore Marine Zones

5.6.2 Each of the Sub-Character Types layers were first joined to the HSC Grid. This was accomplished through right-clicking on the Grid shapefile and the using the following process:

- [Joins and Relates] > [Joins...] > Join data from another layer based on spatial location;
- Select the a sub-type layer to join;
- Select the Radio button 'Each polygon will be given the attributes of the polygon...';
- Export the shapefile and repeat for each subsequent layer

5.6.3 The individually gridded layers next needed to be merged by dominance, filtered to the layers relevant for each marine level. This was accomplished using the UPDATE geoprocessing tools within the ArcGIS Toolbox. The UPDATE tool computes a geometric intersection between two layers, meaning it merges the geometry and attributes of one layer with those of an update layer, with the update layer dominating when they intersect. As the geometries were grids this process merely updated the attributes as the geometry is identical from one layer to the next. This was chosen instead of the UNION tool at this stage as it was found to produce tidier results in terms of the attribute table, as UNION appends or concatenates the updated attributes to the table instead of replacing them, requiring later editing. In both situations the final shapefiles needed to be re-assessed for dominance yet UPDATE was found to be the quicker tool for these gridded layers.

5.6.4 Due to the tool only allowing one layer to update another at any time ArcGIS Model Builder was used to iterate the process. The model applied the UPDATE process and then used the output as the next layer to be updated automatically. The update layers were selected in order of the initial dominance selection in order from least to most. The benefits of this are the process was automated, and each of the intermediary layers were temporary. The output of this was a single gridded shapefile containing all the layers for that project and marine level.

5.6.5 The final stage was the understanding that the updates within this process were based on general dominance rules. As such the final layers then needed to be re-assessed for specific changes in dominance with the attributes updated accordingly.

5.6.6 At this stage each of the Marine levels has a number of shapefiles containing a grid of dominant Character Sub-types in the relevant Broad Character type.These shapefiles needed to be merged again in order to create the final marine level shapefiles. At this stage it was decided to use the

UNION tool in order to allow the selection of dominance via the attribute table, and with a finer control over the sub-type layers. A model was created again to iterate the initial stages of this process.

5.6.7 Finally the shapefiles were checked in the GIS for any visual anomalies in the dominance selections and compared against the default grid shapefile in order to identify NULL grid cells where the underlying data needed to be expanded.

5.6.8 Once complete for all the Marine levels, each of the tables from the shapefiles were again joined to the master grid based on the CELL_ID and re-exported as a single grid with multiple attributes for each of the layers. Next the attributes were checked and the dataset was dissolved, simplifying the dataset. Lastly the Conflated Character was manually assessed and attributed.

Processing the Coastal and Inter-tidal Zones

5.6.9 The processing of the coastal layers differed from that of the marine layers in that they did not need to be joined within a grid system, eliminating that stage of the processing. Therefore the initial stages of the processing were the creation of the UPDATE model the same as the Marine layers. Tests of the UNION process with some of the datasets created incredibly messy datasets with thousands of slivers and gaps in the data. Furthermore the number appended attributes became extremely unwieldy in some cases.

5.6.10 In this case it was understood that the UPDATE process would replace the geometries of the less dominating features. Yet as the smaller geometries tended to be the more physical characteristics which dominated this was not a found to be a significant issue.

5.6.11 Once the model was finished the data was dissolved in order to simplify the dataset. Finally, a manual review of the data allowed any sliver, gaps and dominance anomalies to be rectified. This process was followed to create both the Present and Previous datasets.

5.6.12 As per the marine levels, the coastal data was now simplified enough for the sub-types to be merged through the UNION process. Once completed the resulting Present and Previous shapefiles were re-assessed for dominance, based on a visual look at the geometries, and amended in the table. Any remaining issues and additions were also resolved during this phase. The Previous data was then Unioned to the Present dataset, and the geometries checked one last time.

5.6.13 Once finished, the data was dissolved to further simplify the dataset and the attribute table was checked over.

Merging and attributing the datasets

5.6.14 The final processing of the dataset was to use the UPDATE tool to update the marine dataset with the coastal dataset, which clipped the marine grid to the outline of the coast and updated the attribute table.

5.6.15 Finally the remaining fields (such as the links and broader character types) were joined from an external table based on the Sub-Character Types and the fields automatically filled in. The fields were then re-organised and checked one last time before the final file was exported.

5.7 Development of Character Type Text Descriptions

5.7.1 Character Type text descriptions are a crucial element of any HSC study. These provide broader context to the GIS and are non-technical summaries designed to be understood and used by a range of specialists and the general public.

5.7.2 For all the HSC Implementation Projects, English Heritage has decided to produce both national and regional perspective texts for each Character Type. For this stage of the project, 'national' texts were generated by the two other current HSC projects and circulated to all for updates reflecting regional variations in each of the project areas. Those national texts were then returned to English Heritage Characterisation Team for further editing and finalisation and the finalised version will be incorporated into all the concurrent HSC Project Reports. In addition a set of texts were produced by this project for the East Anglian region, which can be updated by future work extending HSC coverage north to encompass the rest of that region. .

5.7.3 In order to incorporate these texts within the GIS the '*_LINK' field is used to direct the user to a .DOC file related to each Character Type. This Hyperlink text contains further links to both National and Regional texts for that Character Type. This extra step is necessary due to the GIS only having the ability to link to a document via just one of its attribute fields (as specified in the shapefile properties). If other software packages are used this process may vary.

5.7.4 A text-based description was produced for each Character Type using the structure outlined in the HSC Method Statement. That produced the following sub-headings for all texts:

- Introduction: defining/distinguishing attributes
- Historical processes; components, features and variability
- Values and perceptions
- Research, amenity and education
- Condition and forces for change
- Rarity and vulnerability
- Bibliography

5.7.5 The information obtained for the Southwold-Clacton pilot studied proved invaluable in this process, although that pilot study considered unique 'Character Areas' rather than recurrent 'Character Types' therefore the texts were significantly different. The texts have been illustrated using images taken by the project team members and those sourced from elsewhere, and are labelled accordingly. All necessary copyright permissions have been obtained.

5.7.6 The regional character texts will be added to the database along with the updated national texts.In their current format the texts can easily be exported to html format and added to a dedicated website.

6 Results and Conclusions

6.1 Applying the HSC Method

6.1.1 This project was part of a wider process to implement the HSC Method Statement to a number of different areas along the English coastline. As such it followed the HSC Method Statement as a generic guide to create the Newport to Clacton HSC whilst recognizing that the HSC Method Statement also had to remain flexible enough to relate to other HSC applications where necessary. Consequently it was also necessary for this project to find solutions to specific issues which arose during its HSC process.

6.1.2 Two key areas can be identified where interpretation of the Method Statement was required, these are as follows:

- Using the vector grid in the marine area
- Processing of specific sources eg point data for wrecks

6.1.3 Throughout the project the HSC methodology was generally sound, and could be applied with success to the study area. However there were several issues that arose which seem pertinent to discuss with regards to moving the project forward on a national scale.

6.2 **U***sing the vector grid*

6.2.1 It quickly became obvious (even within the trial implementation put forward by Seazone) that the project would involve stages where the user would work with large digital datasets. This was most apparent in any processes involving the grid. In this project the grid contained over 172000 individual features, which could lead to slow redraws when running processes or moving around the map. A solution to this was found in processing the grid, when necessary, in three parts, before merging these parts at the end. Whilst not much more then an inconvenience in this sense, it should be noted that these issues may occur again during the maintenance and upgrading of the datasets. Whilst the primary computer processing this data for OA was not of an unreasonable specification, but by no means state of the art, many institutions which may be involved with updating an HSC may be running older hardware.

6.3 Processing the data

6.3.1 Another issue arose with regards to the level of detail within the processing procedures outlined in the HSC methodologies. In particular the variables associated with geoprocessing within a GIS package. In particular this problem arose during the interpolation of point data into a continuous surface, such as Wreck data. Whilst the selected tool and basic parameters are supplied within the document (Seazone 2009 31). the conversion from raster back to vector is based on the value ranges, and it is unclear what should be converted and what should be excluded. Within geoprocessing even a single variable can affect the overall distribution, and the final product. This also doesn't take into account the variation between GIS packages which may be used during future updates. Whilst it is impossible to predict which packages will be used in the future, unless we lock the project into a proprietary Geodatabase format which goes against the project aim for software agnosticism, one solution may be to provide a clearer technical glossary within the project, designed specifically to outline the geoprocessing decisions (rather then the specific tools) where these variables may exist. Whilst there are not too many of these decisions, they can significantly change the output of a dataset, and that region's HSC.

6.3.2 Overall, bar the issues raised, the creation of the HSC GIS largely followed the established guidelines.

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8 Abbreviations and Acronyms

AIS: Automatic Identification System

ALSF: Aggregate Levy Sustainability Fund.

AONB: Area of Outstanding Natural Beauty.

BGS – British Geological Survey

BMAPA: British Marine Aggregate Producers Association

CEFAS: Centre for Environment, Fisheries and Agricultural Science

CRS: Co-ordinate Reference System.

Defra – Department for the Environment, Food and Rural Affairs

DfT: Department for Transport

EH – English Heritage

ESRI – Environmental Systems Research Institute

EU: European Union

GIS - Geographic Information System

HER: Historic Environment Record

HLC: Historic Landscape Characterisation

HSC: Historic Seascape Characterisation

HTML: Hyper Text Mark Up Language
ICES: International Council for Exploration of the Sea

JNCC: Joint Nature Conservation Committee

LCA: Landscape Character Assessment

MHW: Mean High Water

MLW: Mean Low Water

NMR: National Monuments Record

OS: Ordnance Survey.

OSGB36 – Ordnance Survey Great Britain 1936, the geographic datum of British National Grid

REC – Regional Environmental Characterisation

RYA: Royal Yachting Association

SMR: Sites and Monuments Record

UKHO: United Kingdom Hydrographic Office

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