Marine Management Organisation

Seascape assessment for the South Marine Plan Areas: technical report

June 2014

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LUC

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Contents

Figures

Tables

List of Acronyms

AONB	Area of Outstanding Natural Beauty
BGS	British Geological Survey
CCW	Countryside Council for Wales (now Natural Resources Wales)
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CPRE	Campaign to Protect Rural England
DEFRA	Department of Food and Rural Affairs
DEM	Digital Elevation Models
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
ESAS	European Seabirds at Sea
ESRI	Economic and Social Research Institute
FLAG	Fisheries Local Action Group
GIS	Geographic Information System
HSC	Historic Seascape Characterisation
IFCA	Inshore Fisheries and Conservation Association
JNCC	Joint Nature Conservation Committee
LA	Local Authority
LNP	Local Nature Partnerships
MCA	Marine Character Areas
MCZ	Marine Conservation Zone
MOD	Ministry of Defence
MPA	Marine Protected Area
MPS	Marine Policy Statement
NCA	National Character Area
NE	Natural England
NNR	National Nature Reserves
NOSTRA	Network Of STRAits
NRW	Natural Resources Wales
OS	Ordnance Survey
QHM	Queen's Harbour Master
RSPB	Royal Society for the Protection of Birds
RSUs	Regional Seascape Units
RYA	Royal Yachting Association
SAC	Special Areas of Conservation
SCA	Seascape Character Assessment
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SPAR	South Plan Analytical Report
SSSI	Site of Special Scientific Interest
UKHO	United Kingdom Hydrographic Office
VRM	Visual Resource Mapping
WWF	World Wildlife Fund
ZTV	Zones of Theoretical Visibility

Executive Summary

This technical report and accompanying seascape assessment for the South marine plan areas forms part of the evidence base to support the marine planning process.

The Marine Policy Statement (MPS) states that references to seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other. Seascape can therefore be considered an umbrella term that covers both the visual resource and marine character. The study comprises two complementary and linked elements: a character assessment; and a visual resource mapping (VRM) element. The findings from this study will inform the development of policies for the South marine plans.

The study area for this project covers the South Inshore (area 6) and South Offshore (area 7) marine plan areas, stretching along the coast - broadly from Dartmouth in Devon to Folkestone in Kent. Although the South Inshore marine plan area terminates at the mean high water mark, the study considers a wider coastal and terrestrial area beyond this - to encourage interactions across the land/sea interface.

The character assessment identifies a total of 14 marine character areas (MCAs) for the South marine plan areas. A separate document is available for each MCA, setting out its key characteristics and an overall description of character under the headings ‘natural influences’, ‘cultural/social influences’ and ‘aesthetic and perceptual qualities’.

The VRM element has developed and piloted an approach to mapping land-sea inter-visibility, focusing on the South marine plan areas. This approach has drawn on examples of visibility mapping undertaken elsewhere in the UK, considering, in its development, factors such as the position and elevation of the ‘viewer’, the curvature of the earth and climatic conditions. A map showing the relative visibility of the sea in the South marine plan areas has been produced, with reference to the MCAs. In addition, a map showing areas on land with the greatest views of the sea (relative to the study area as a whole) has been produced. MCA-specific maps are available and the underlying Geographic Information System (GIS) datasets have been provided to the MMO (and are available to view on the marine planning portal).

The following outputs have been produced from this seascape assessment:

- This technical report
- A set of descriptions and maps for the 14 marine character areas as well as VRM overview maps
- spatial data and metadata.

These are available on MMO’s website at
http://www.marinemanagement.org.uk/evidence/index.htm

1. Introduction

This work to undertake a seascape assessment for the South marine plan areas forms part of the evidence base to support marine planning in the region.

The Marine Policy Statement (MPS) states that references to seascape should be taken as meaning landscapes with views of the coast or seas, and coasts and the adjacent marine environment with cultural, historical and archaeological links with each other. ‘Seascape’ is therefore an umbrella term that covers both the visual resource and character.

The study comprises of two complementary and linked elements: a character assessment; and a visual resource mapping (VRM) element. The findings from this study will inform the development of policies for the South marine plans.

The study area for this project covers the South Inshore (area 6) and South Offshore (area 7) marine plan areas, stretching along the coast - broadly from Dartmouth in Devon to Folkestone in Kent. Although the South Inshore marine plan area terminates at the mean high water mark, the study considers a wider coastal and terrestrial area beyond this, as depicted in Figure 1. This acknowledges that gaining an understanding of the natural, cultural and perceptual (including visual) links between land and sea is essential in undertaking the seascape assessment.

1.1 Developing a seascape assessment for the South marine plan areas

Following the first strategic scale seascape assessment for the East Inshore and East Offshore marine plan areas (Natural England, 2012), the Marine Management Organisation (MMO) commissioned work to produce a seascape assessment for the South Inshore and South Offshore marine plan areas which included separate character and visual studies. This new approach to visual resource mapping (VRM) will be used in conjunction with Natural England’s “An approach to Seascape Character Assessment” (2012) for future seascape assessments undertaken to inform marine planning. Consideration will also be given to the appropriate mechanism to retrospectively apply the VRM approach to the East Inshore and East Offshore marine plan areas.

This project is one of many research projects which feed the wider evidence gathering for the South Plan Analytical Report (SPAR) and in turn the development of policy for the South Inshore and South Offshore marine plans.

To develop consistency across the wider terrestrial and coastal area other landscape and seacape assessments covering the marine plan areas and adjacent areas were considered. This supports the integration of marine and terrestrial planning regimes as described in the MPS.

A flow chart setting out the main stages of the project as a whole is included at Figure 2.

Figure 1: Study Area

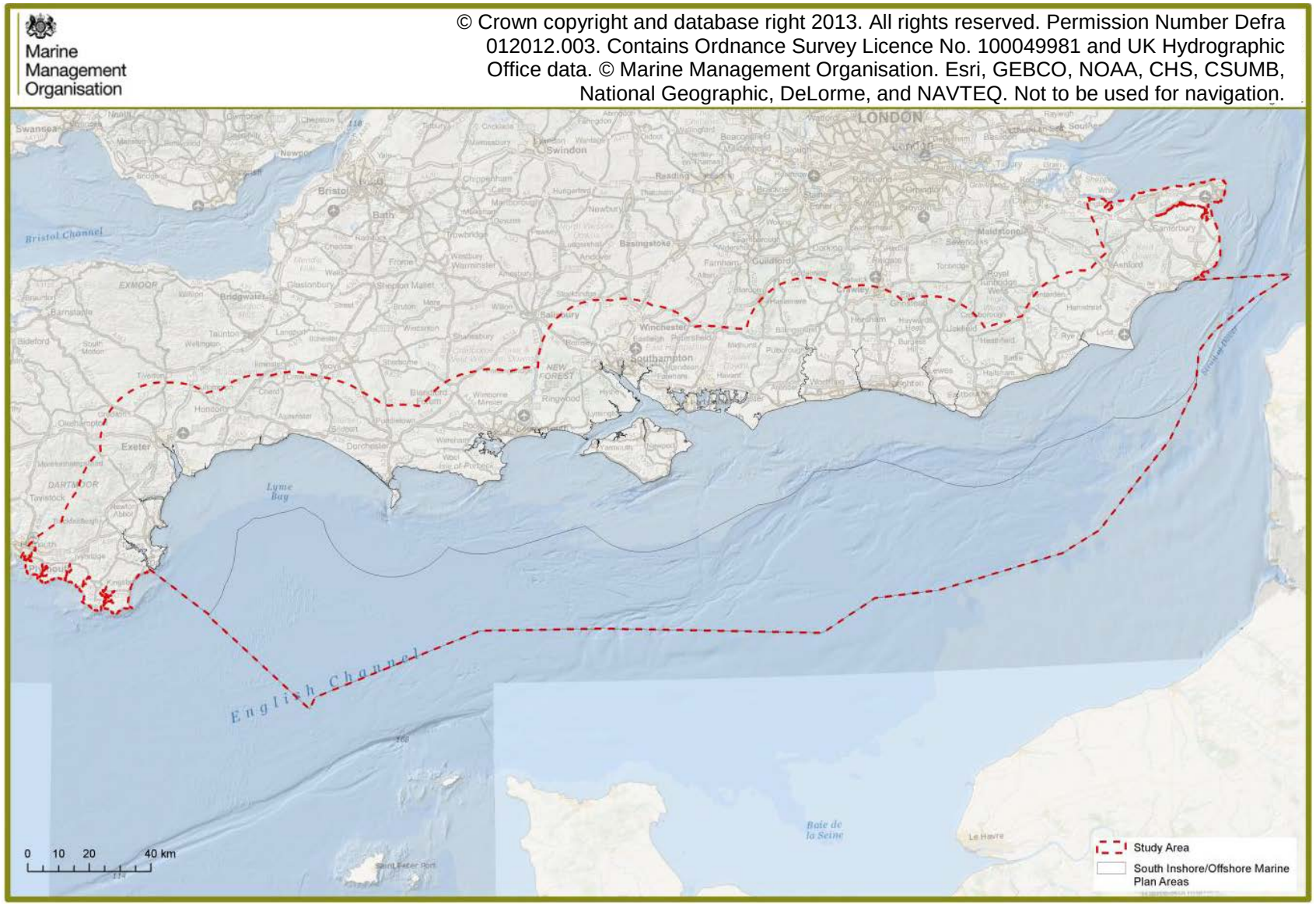
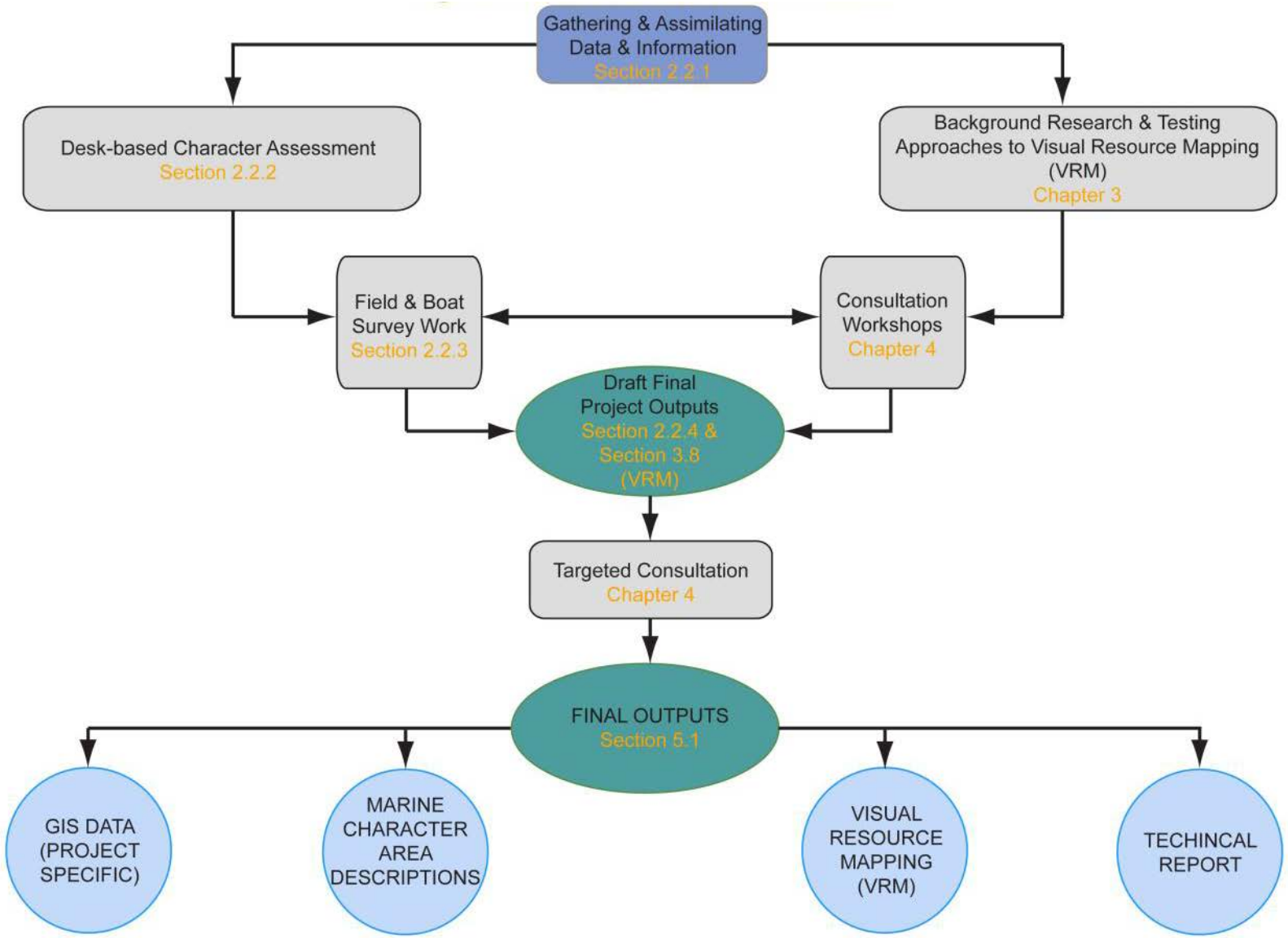


Figure 2: Project project flow chart.



2. Character Assessment

A summary of the background to the character assessment in terms of national best practice in the approach and work done elsewhere is presented in this section. The series of steps followed to produce the character assessment for the South is then detailed. Section 4 sets out the lessons learned from undertaking this character assessment for the benefit of future seascape assessments.

2.1 Background to the character assessment approach

2.1.1 National guidance documents

The method taken has paid particular attention to “An approach to Seascape Character Assessment” developed by Natural England (2012) and draws on existing best practice. It also recognises “Historic Seascape Characterisation” (HSC) developed by English Heritage. Lead officers from Natural England, English Heritage and the Department of Environment, Food and Rural Affairs (DEFRA) formed part of the project Steering Group to inform project development.

2.1.2 Definition of ‘seascape’

The character assessment and VRM elements of the project have been guided by the definition of ‘seascape’ as stated at the beginning of this report (HM Government, 2011, para 2.6.5.1). The character assessment has been developed from the mean high water mark out to the median line in the channel, however the study incorporates an understanding of the complex relationships with the adjacent coastline and land beyond which have played a fundamental part in both character assessment and VRM elements of the project (figure 1).

The various interactions between ‘people’ and ‘place’ which combine to influence character are depicted in the ‘seascape wheel’ (Natural England, 2012) shown in Figure 3. The structure provided by the wheel has provided a helpful framework for the character assessment, both in terms of organising and presenting the information that has informed and been generated from the work, and ensuring that complex relationships between different influences are acknowledged.

2.1.3 Character assessments undertaken at the strategic scale

This project has been undertaken at the strategic scale which benefits the production of the South marine plans within its evidence gathering phase. The MMO would encourage authorities to undertake more localised landscape and seascape studies and to consider this assessment to promote consistency.

Landscape character assessment has become standard practice in terrestrial planning, whilst seascape character assessment is a relatively new concept. However, both landscape and seascape character assessment methodologies embody a consistent approach founded on common principles that promote the integration of marine and terrestrial planning.

The East marine plans character assessment (Natural England 2012) identifies 10 character areas, shown in Figure 4 below, with accompanying key characteristics and descriptive text structured under the headings of ‘Physical influences’, ‘Cultural Influences’ and ‘Aesthetic and Perceptual Qualities’. The project report also includes a summary of

the methodology adopted, which aimed to be consistent with the Natural England document which was being finalised at the time.

Figure 3: The seascape wheel (Source: An Approach to Seascape Character Assessment (2012 NECR105, page 9) (copyright Natural England, 2011)).

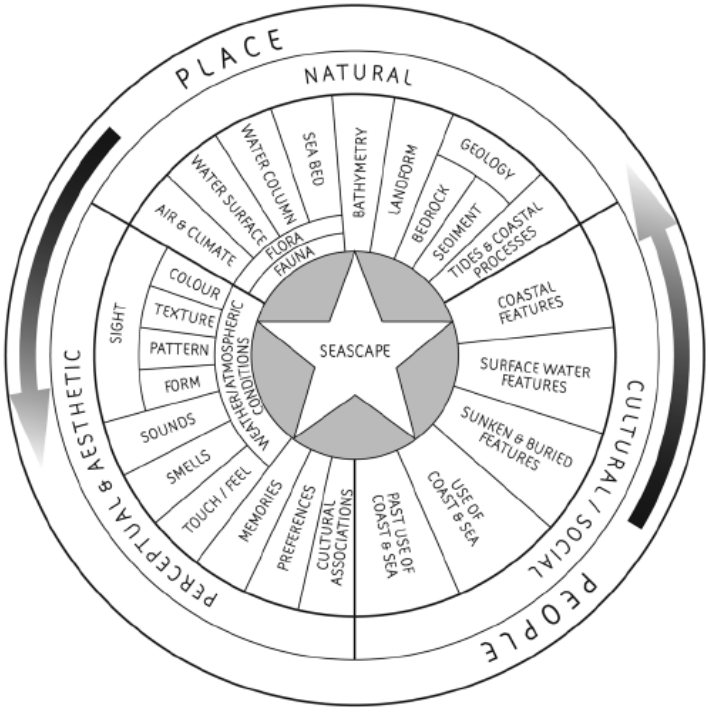
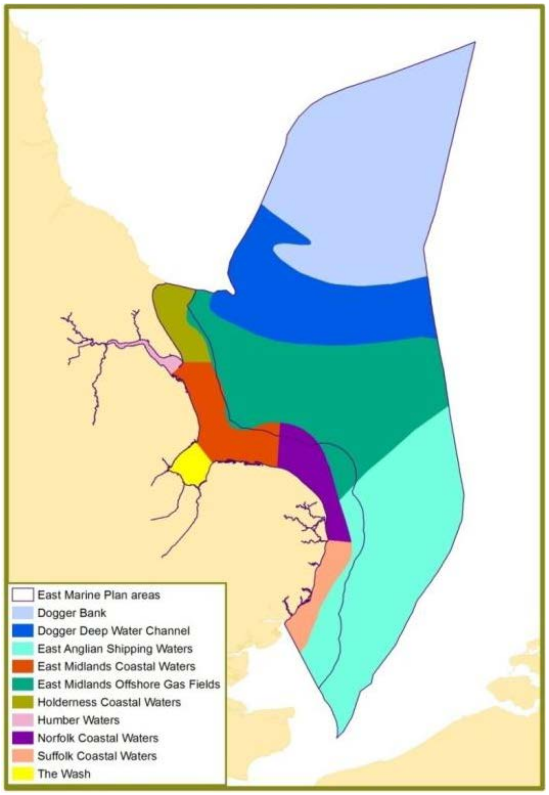


Figure 4: Character areas identified for the East marine plan areas (© Natural England 2014. Contains Ordnance Survey Data © Crown copyright and database right 2014).



Lessons learned from the first pilot study in the East, published in a report by the MMO in July 2012, have been applied to this work in the South. These are particularly in relation to stakeholder consultation and boat survey work.

2.1.4 Other character assessment work undertaken at different scales

A range of other seascape projects have been exploring methodological approaches and scales of assessment following the publication of the MPS. For example, Wales (led by Natural Resources Wales (NRW), formerly Countryside Council for Wales (CCW)) is beginning to roll out its own programme of strategic-scale seascape assessment, and has recently completed work in Pembrokeshire and Anglesey/Snowdonia.

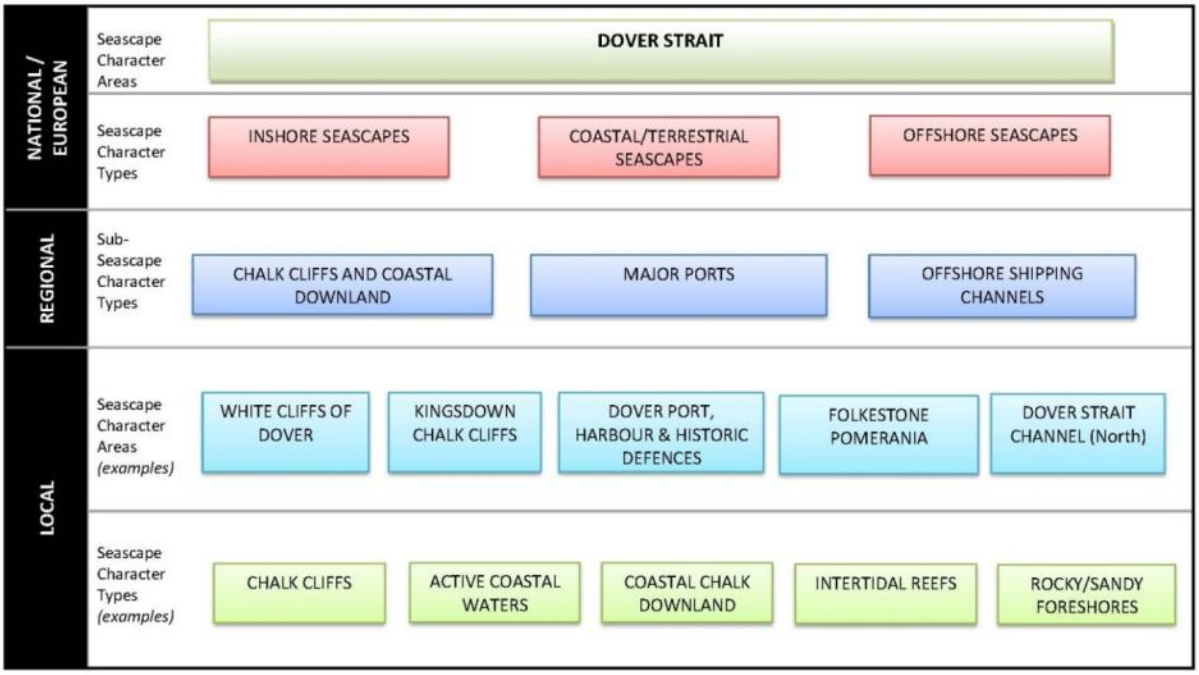
The Pilot Seascape Character Assessment (SCA) for Wales (LUC, 2012), was based on a study area of North West Anglesey, and was commissioned to test the principles of the Natural England approach document at a variety of scales. This early work culminated in a detailed stand-alone method document including a series of 'lessons learned' from testing the approach. These included recommendations on the following:

- The use of offshore and terrestrial GIS datasets and other information sources
- The importance of boat-based survey work and understanding character from the perspective of the sea and sea-users
- The consideration of all aspects of the 'seascapes wheel' in understanding and presenting information on character
- The production of a 'nested' hierarchy of character areas and character types at different scales – from local to national.

In England, local-level pilot seascape assessments have been undertaken in Dorset and the Dover Strait, both of which fall within the South marine plan areas. The Dorset landscape and seascape character assessment (LDA Design, 2010) was undertaken as part of a three year Interreg-funded Combining Sea and Coastal Planning in Europe (C-SCOPE Project). Covering the coastline between Durlston Head and Portland Bill and out to 12 nautical miles, the assessment identifies 12 landscape character types and 11 seascape character types. The method developed for this Dorset study influenced the approach document subsequently developed by Natural England in 2012. The boundaries of the seascape character types and information contained in the descriptions formed part of the evidence base for this work in the South plan areas.

Piloting "An Approach to Seascape Characterisation" in the Dover Strait (LUC, 2013), formed part of another Interreg-funded project – NOSTRA (Network Of STRAits). This project aimed to demonstrate how an assessment covering the marine, intertidal and coastal zones of a strait can provide an evidence base to contribute to sound marine planning and management. The work tested various scales of assessment (using both seascape character types and areas) and provided example character area descriptions. The work undertaken in the Dover Strait has been used as part of the evidence base for this study, seeking to ensure that the strategic-scale MCAs developed for the South fit at the top of the hierarchy developed for the pilot (see Figure 5 below). In addition, best practice and 'lessons learned' from the work in the Dover Strait were applied by LUC to this study in the South plan areas.

Figure 5: Character Assessment hierarchy developed for the Dover Strait.



2.2: Developing a character assessment for the South

The method developed for the character assessment for the South marine plan areas is set out under a series of key steps which are illustrated as part of the study flowchart and derived from Natural England's workflow diagram, shown in Figure 2.

At the outset it was agreed by the steering group that the assessment would identify strategic MCAs (as opposed to character types or both), for consistency with the assessment undertaken in the East. In addition, it was considered that the use of character areas at the strategic scale was a more meaningful way of presenting information for the purposes of marine planning. The use of the word 'marine', rather than 'seascape', reflects the definition of spatial units offshore beyond the mean high water mark. A definition for MCA for the purposes of this assessment, adapted from that provided for SCA in the Natural England approach document (2012), is included below.

Definition of Marine Character Areas (adapted from Natural England, 2012)
Each MCA has its own individual character and identity, even though it can share the same generic characteristics as other areas. The use of MCAs provides a good framework within which to draw out patterns of local distinctiveness and those factors influencing sense of place. They can be used to develop more tailored policies or strategies, reflecting the things that make a particular area different, distinctive or special. Character areas may also be more recognisable and identifiable for non-specialists (than character types).

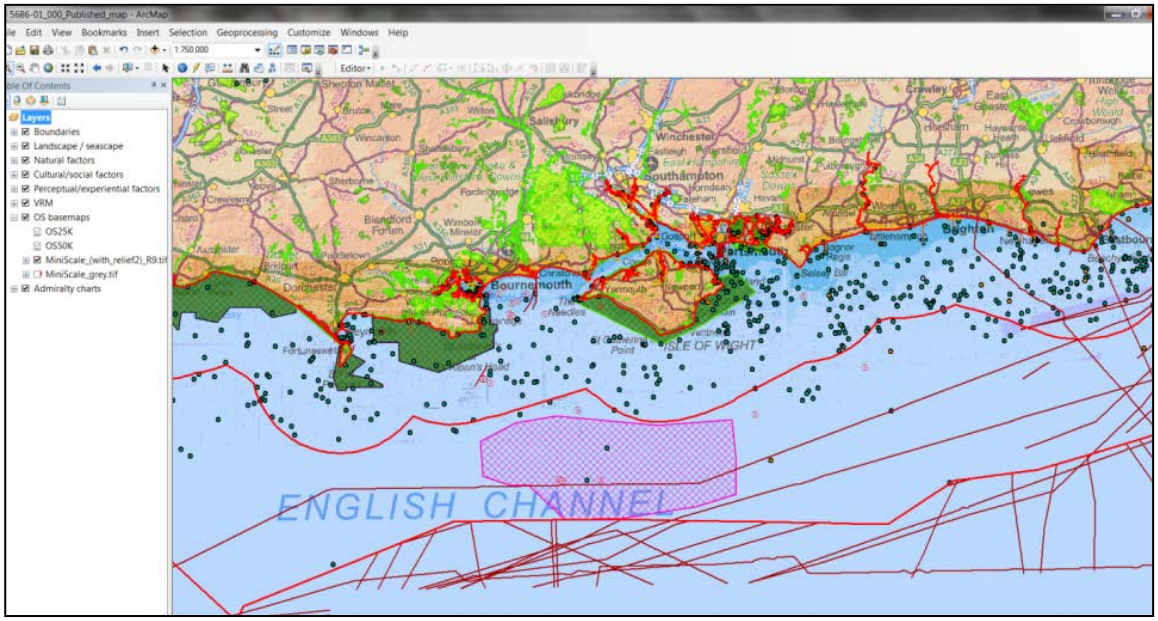
2.2.1 Gathering and assimilating data and information

A first stage in the development of the project involved gathering and assimilating the range of datasets (and literature /plans /strategies) available to inform the work, checking their relevance and understanding how they might best inform the character assessment. Spatial data was provided by a number of organisations, including MMO, and organised in a GIS database, structured according to the key themes of the 'seascape wheel' (Natural,

Cultural/Social and Perceptual/Aesthetic) as well as general layers such as for basemapping and administrative boundaries. Oceanwise marine raster charts and marine themes vector data provided the backdrop onto which numerous other GIS layers (geology, bathymetry, designated sites, etc.) were overlain. Particular attention was paid by the GIS specialist to aligning the coordinate systems of onshore and offshore datasets to ensure a seamless transition between the marine and terrestrial data, drawing on the experience of previous studies. A screenshot of the GIS mapping is provided in Figure 6 below and data list included at Annex 1.

Relevant literature and references were also collected. Of particular use in understanding sea conditions and interpretating information on marine navigation was the Shell Channel Pilot (Cunliffe, 2010). This was used to gain a further understanding of character from the perspective of the sea and sea users, along with an interpretation of information on sea conditions (e.g. tides and currents) and landmarks visible in views from the sea. A reference list is provided in section 5.

Figure 6: Screenshot of the GIS mapping.



2.2.2 Desk-based character assessment

Data and information relating to the different aspects of the ‘Seascape Wheel’ were interrogated in order to begin to identify dominant patterns relevant to character. This was used to inform the drafting of a first set of MCA boundaries which were further verified during the subsequent boat/field survey and consultation phases of the study. Aspects of key relevance to local character were identified, and a record kept of decisions made in relation to the MCA boundaries, which are summarised in the individual MCA description documents Figures 7 to 12 present a selection of mapped information that helped with this task. In addition, written sources of information were reviewed, including Natural England’s National Character Area (NCA) and Maritime Natural Area profiles, relevant Shoreline Management Plans, the Shell Coast Pilot and the JNCC regional Coastal Directories. Draft MCA boundaries were digitised in GIS with notes kept on the reasoning behind the boundaries drawn (including the use of other datasets as a guide for boundary lines). A draft set of key characteristics, comprising short bullet points, was also compiled drawing on the available information at this stage.

Figure 7: Bedrock geology.

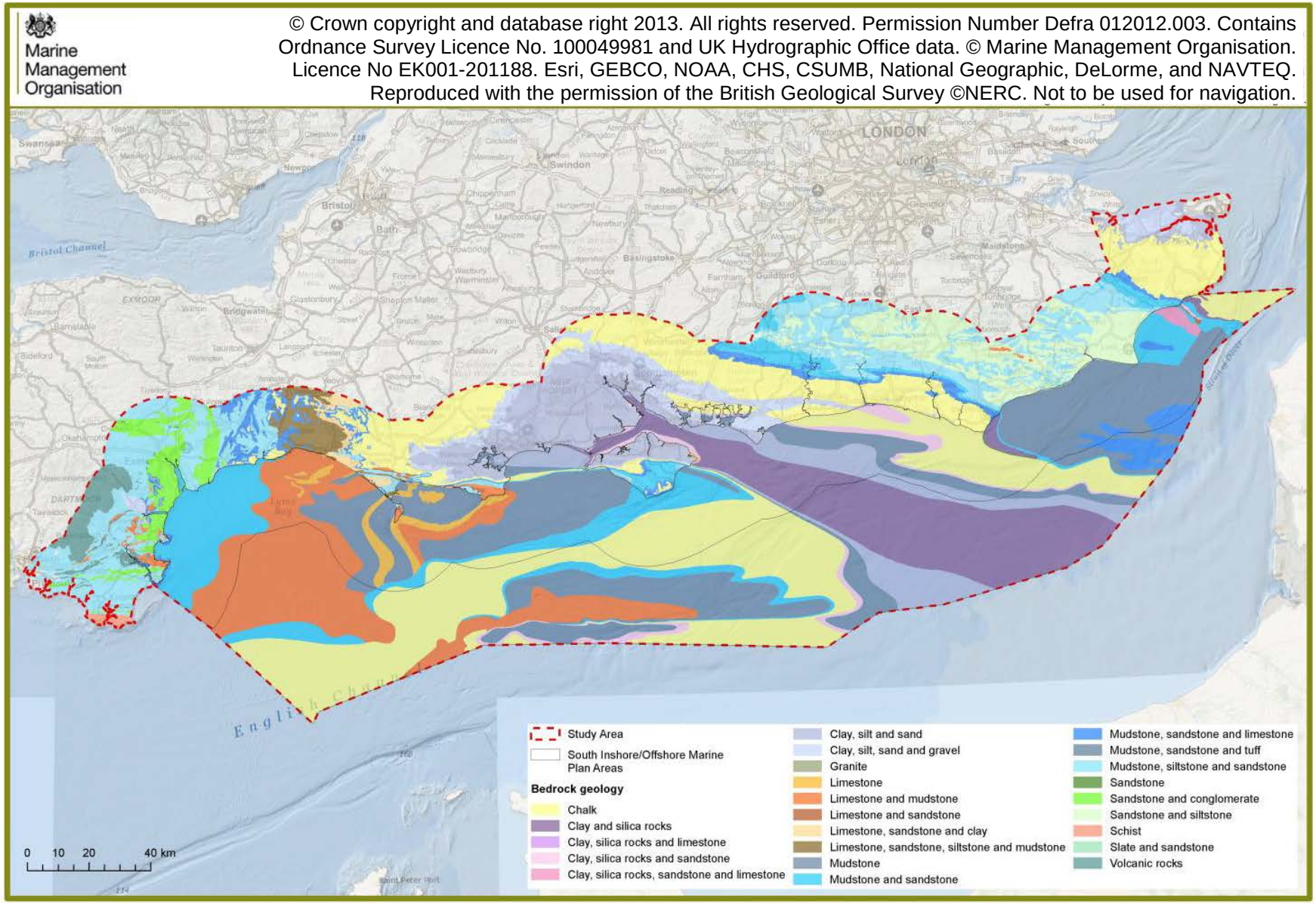


Figure 8: Bathymetry and elevation.

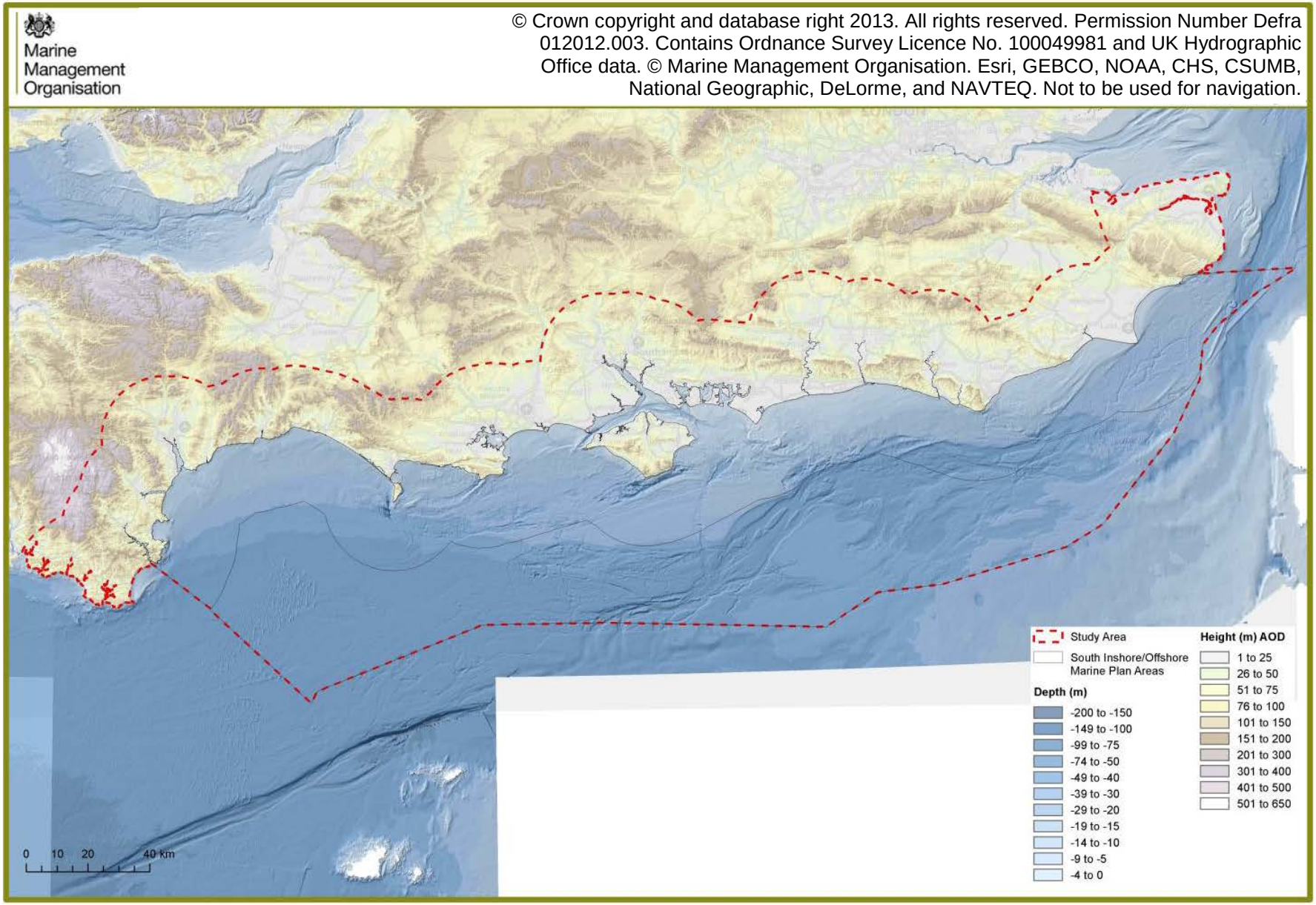


Figure 9: Biodiversity.

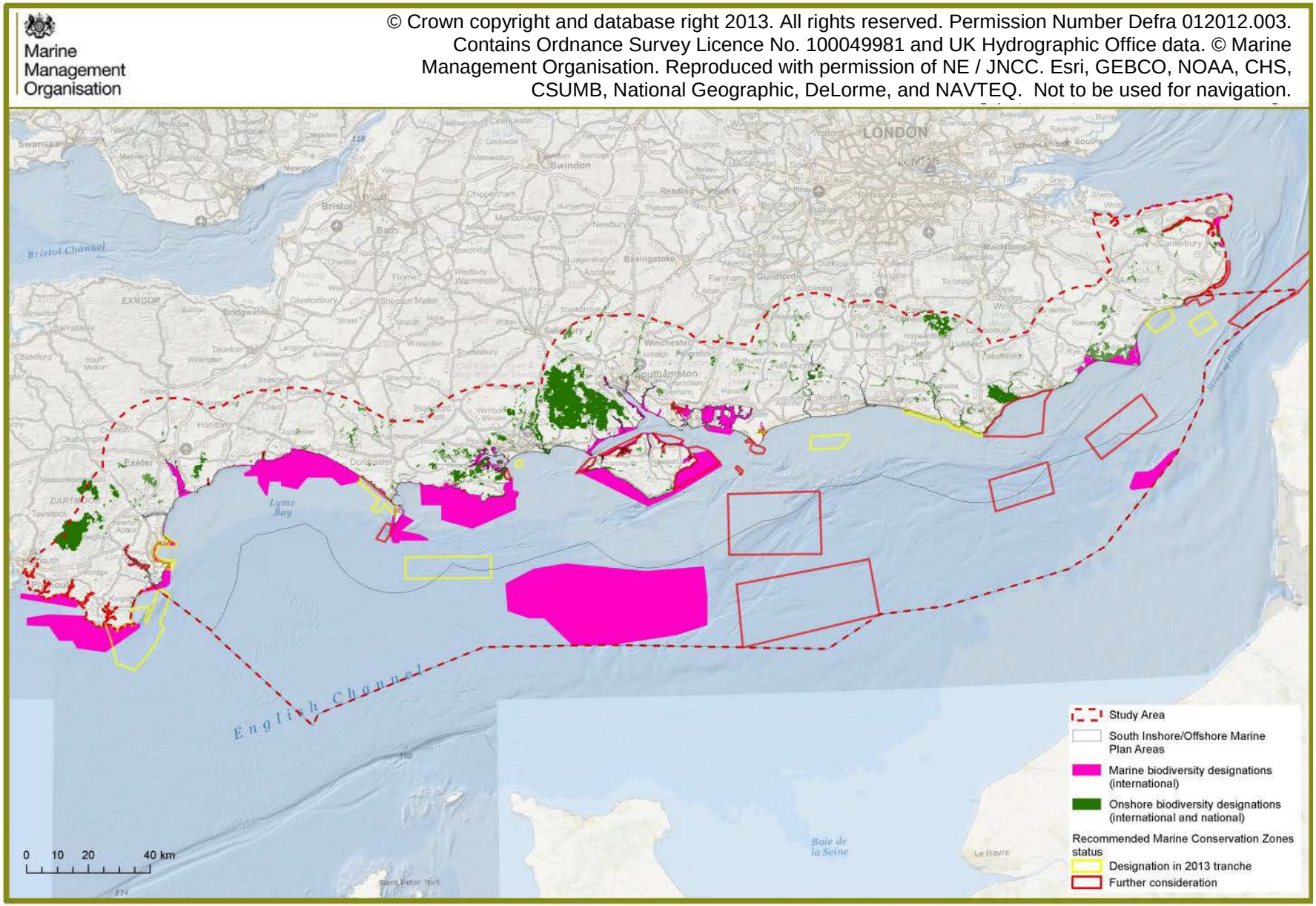


Figure 10: Cultural heritage.

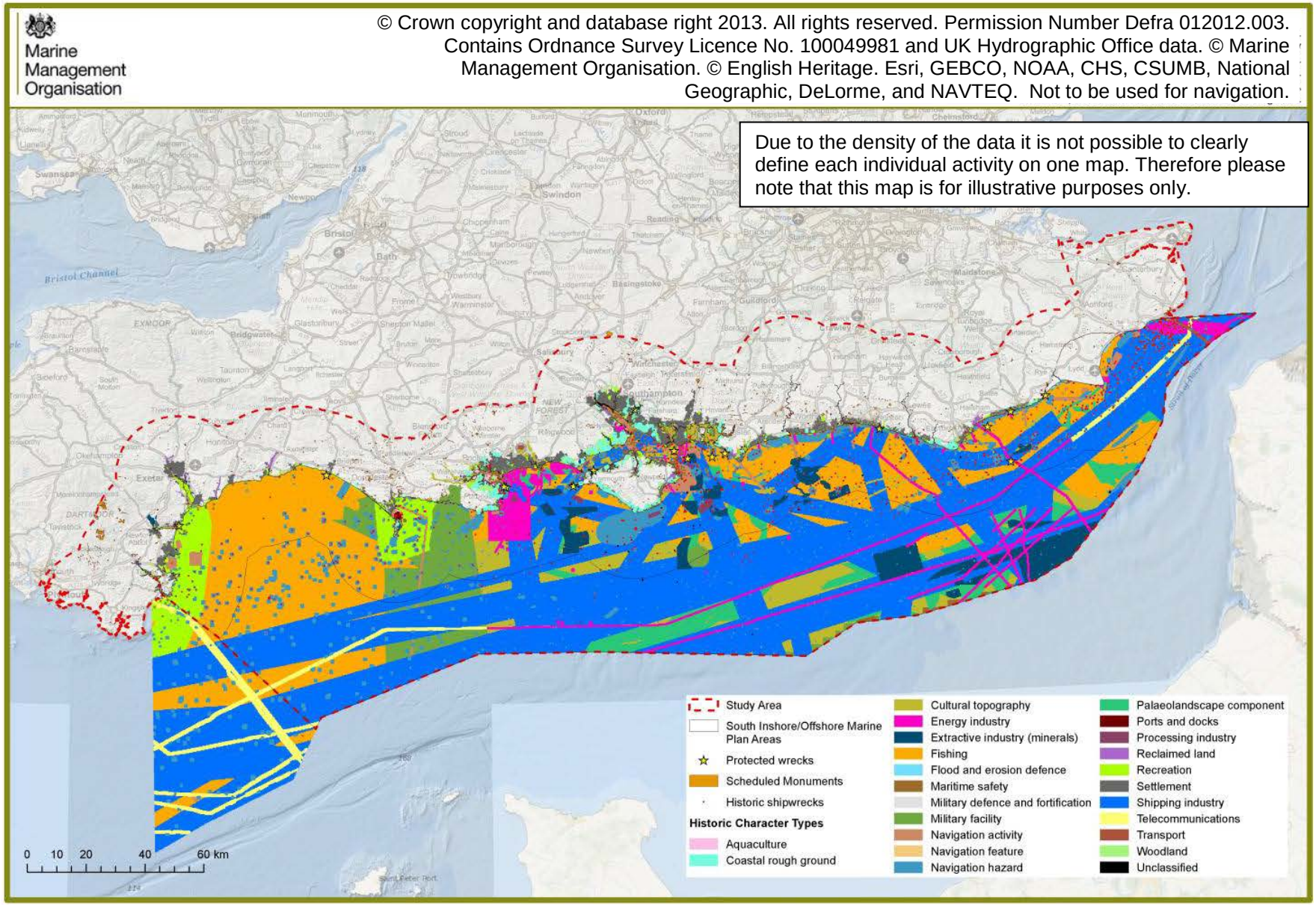


Figure 11: Activity.

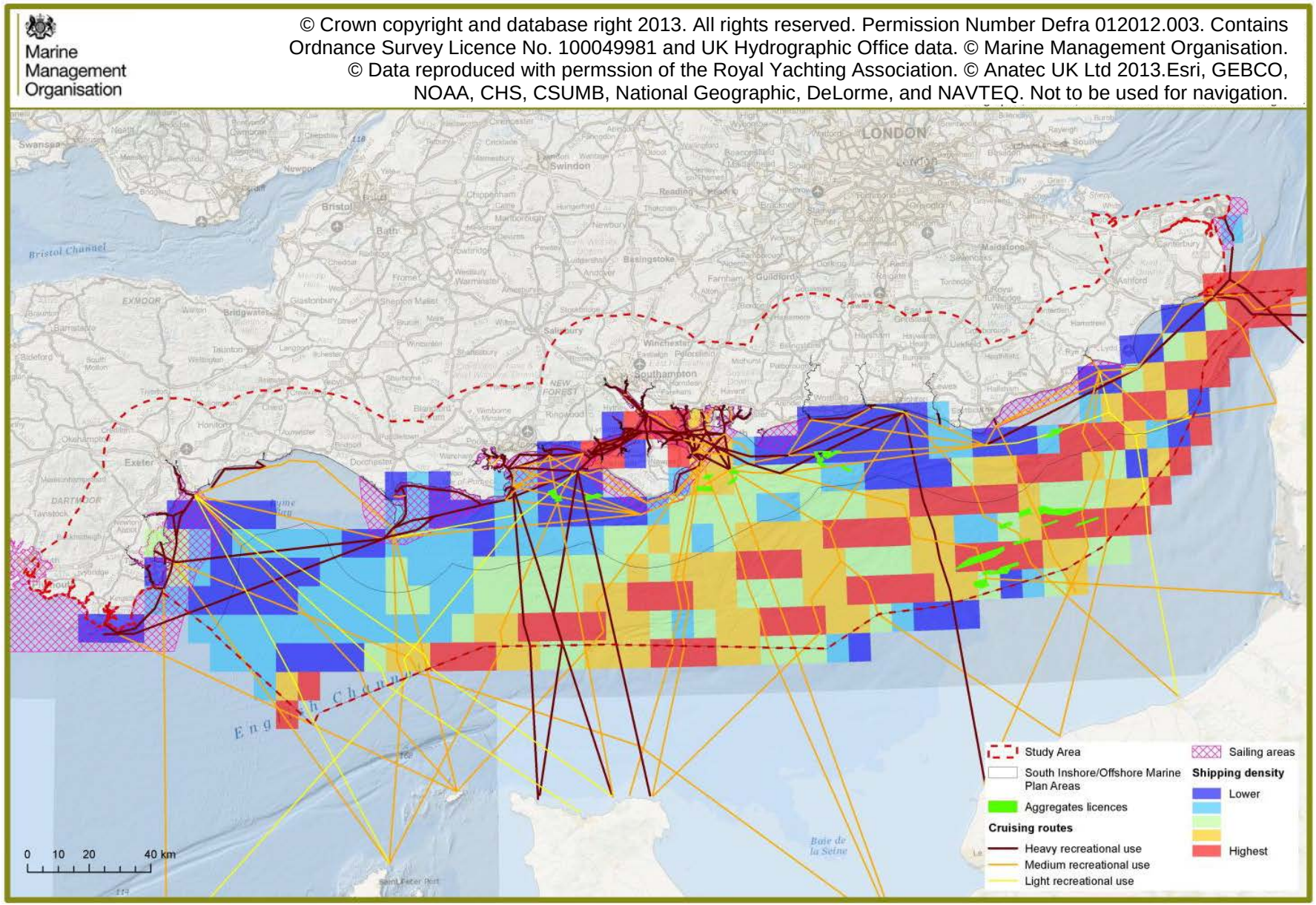
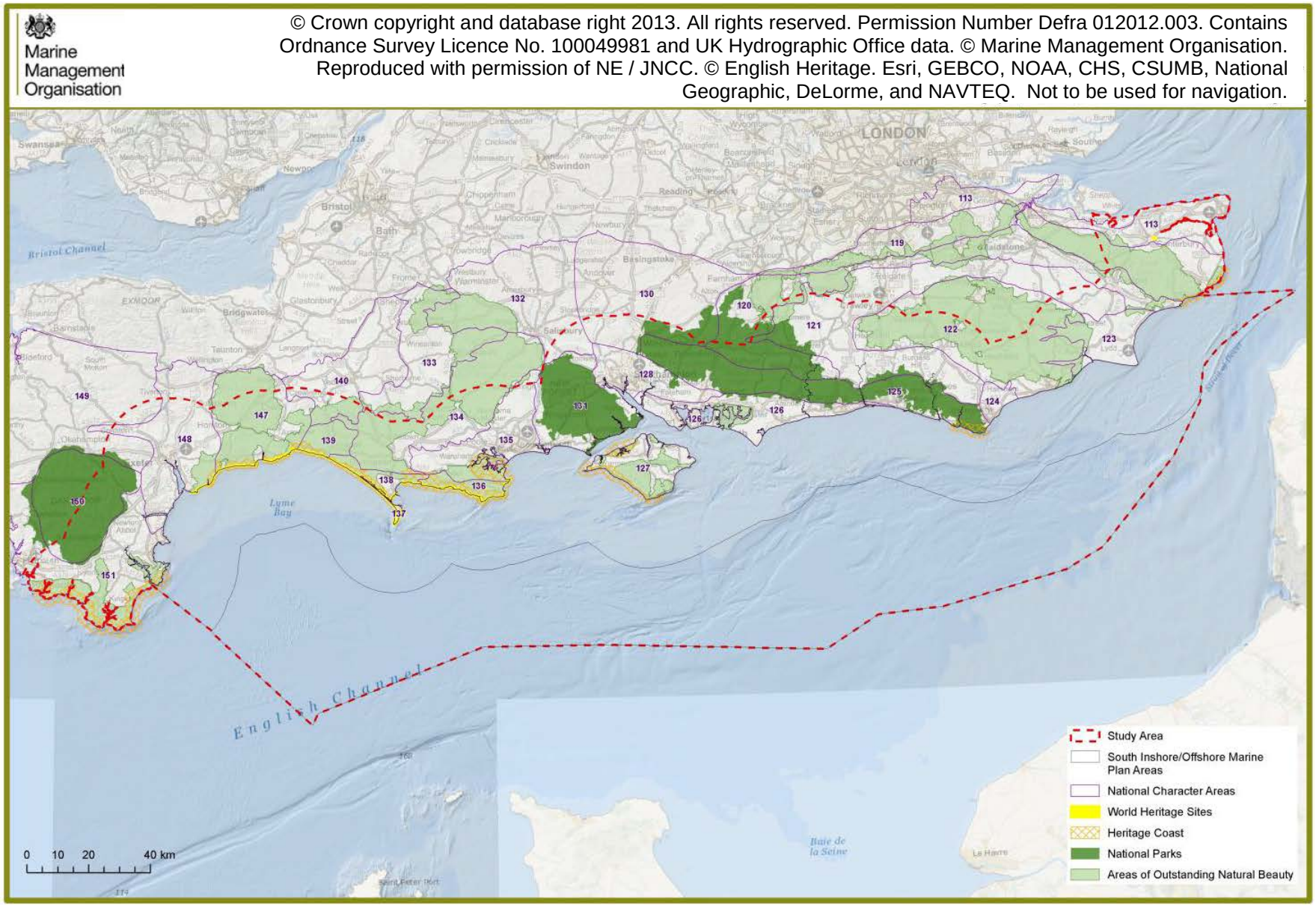


Figure 12: Landscape and character designations.



The early classification of MCAs was shared with the steering group. Comments and suggestions made were documented and taken account of in preparation for field verification and stakeholder workshops undertaken in the subsequent project stages.

2.2.3 Field and boat survey work (in parallel to consultation workshops)

Once the desk-based classification was complete, a series of boat-based surveys were undertaken to collect further information to supplement the desk-based assessment, take photographs, and experience first-hand the sea conditions of the MCAs and relationships with the surrounding coastline. The boat-based surveys focused on the inshore and coastal waters of the study area (within marine plan area 6), recognising that influences on character tangible from the sea surface (as gauged through boat survey) are more apparent where land/sea interactions are taking place. This was also one of the key lessons learned from the pilot work undertaken in the East and previous boat-based work conducted by LUC to inform other character assessments. It is important to note that, although not visited during boat survey work, information and data relating to the offshore areas (including cognitive-influenced perceptions) was gathered and interrogated during the desk-based and consultation phases of the study.

Local skippers, indentified through web search, were contacted in the early stages of the project to help compile a programme of boat surveys across the study area. The knowledge of the skippers (who often run recreational charters and fishing trips) helped determine the timings and logistics of the survey work, aiming for a maximum of seven hours at sea in any one day, returning to the same port of departure. Good visibility and favourable sea conditions, taking account of tidal patterns, were a pre-requisite for all boat surveys, with trips confirmed 24 hours in advance with the skippers. Fortunately the boat survey work for the project coincided with an extended period of calm and clear conditions in July/August 2013, meaning that no scheduled surveys needed to be cancelled due to prevailing conditions. However, it is fully recognised that the character and perceptions of the marine area vary greatly according to changes in weather and sea conditions, which is reflected in the individual MCA descriptions.

A total of 10 boat surveys were undertaken to inform the study, from the following ports of departure (west to east):

- Lyme Regis (two survey days to cover Lyme Bay from Dartmouth to Portland Bill)
- Portland (one survey day to cover Portland Bill and Weymouth Bay to Kimmeridge)
- Poole (one survey day to cover Poole Bay to Hurst Spit and back to Kimmeridge)
- Kayhaven (one survey day for western Solent/Isle of Wight)
- Itchenor (one survey day for Chichester Harbour, Solent and Selsey Bill)
- Brighton (one survey day to cover Brighton to Newhaven, Beachy Head and Eastbourne)
- Folkestone (one survey day to cover Folkestone, Hythe, Dungeness to Fairlight and part of the Channel).

Prior to departure, a planned route for each boat survey was discussed with the skipper, taking into account the timings of the tides – particularly important for surveys in the Solent and Poole Harbour where double tides occur. Whilst on the boat, a survey sheet was completed for each MCA visited (see Annex 2) with a separate record kept of any photographs taken using a digital SLR camera. In addition to the boat-based surveys, observations from the coast were taken where time allowed before and after the boat surveys.

The survey work was essential to verify the draft MCA boundaries, record information on key views and landmarks, heighten understanding of sea conditions and uses and gather information on perceptual qualities, through first-hand experience of being at sea.

2.2.4 Stakeholder consultation workshops

A list of organisations consulted for this study is provided in Annex 4. Six stakeholder workshops were held across the South marine plan areas in June and July 2013 to inform this study at the first draft stage, with group sessions at each workshop used to discuss MCA boundaries, names, key characteristics and the VRM. Both the MMO and LUC gave presentations at the beginning of the workshops to explain the background to the study and approach taken to both the character assessment and VRM elements. The six workshops held were:

- 26 June – Representatives of the Protected Landscapes, London
- 27 June – The Solent Forum, Winchester
- 2 July – Dorset Coastal Forum, Dorchester
- 3 July – Devon Maritime Forum, Exmouth
- 5 July – Sussex Coastal Forum, Shoreham by Sea
- 19 July – NOSTRA/Kent County Council, Dover.

A summary of the comments received at the above workshops is provided in Annex 3. The comments made were taken account of in the development of the spatial classification and naming of the MCAs, as well as providing useful information to feed into the accompanying descriptions. Feedback on the approach taken to the VRM, and workshop discussions on its potential applications, were also taken on board in the further development of the VRM element.

2.2.5 Further consultation on draft final project outputs

At the draft final stage of the study, the attendees and invitees of the above workshops were invited by email to take part in a web-based consultation. They were asked the following questions:

1. Do the key characteristics for the MCAs provide a good overall summary of their character?
2. Can you suggest additional or more relevant, key characteristics?
3. Should any of the key characteristics be removed or reworded?
4. How might you use the VRM?

To provide comments on the above questions, participants were given access, via the marine planning portal, to a map of the MCAs, list of draft key characteristics, the overview VRM maps, a summary of the approach taken to develop the VRM and the workshop presentations given by LUC and MMO (for further background on the project).

The consultation ran from 27 August 2013 to 15 September 2013, with participants invited to submit their views to the MMO via email.

2.2.6 Draft final character assessment and descriptions

Following the field and boat survey work, and taking account of the comments from the workshops, the spatial classification of MCAs was amended (boundaries and names) and shared with the project steering group via teleconference. Once further comments were

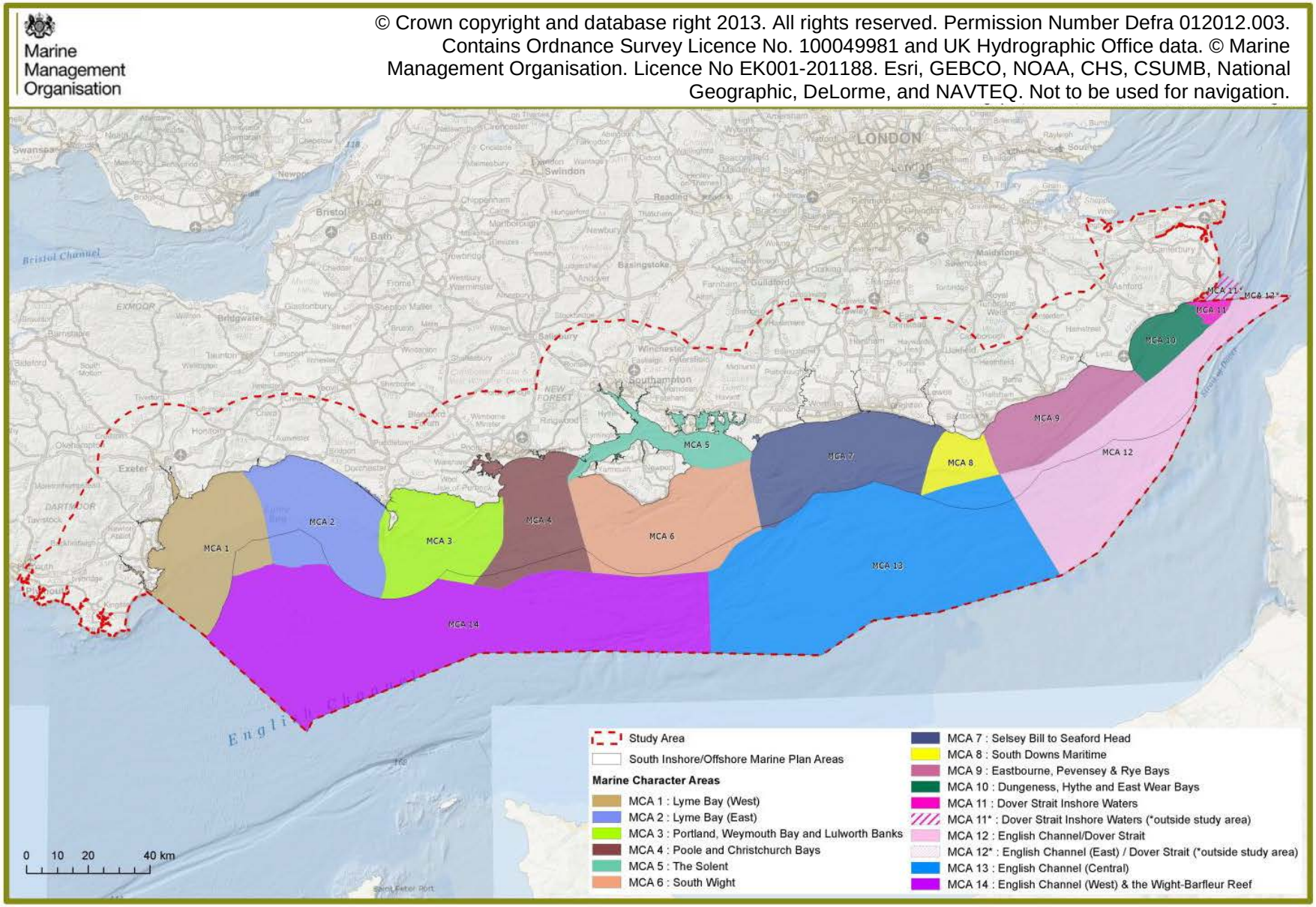
received from the Steering Group, draft final boundaries were digitised, largely following the medium-scale admiralty charts as a scale reference. The resultant classification of 14 MCAs is shown in Figure 13.

Each MCA has its own separate description, colour-coded to match the map at Figure 13. These are available as separate documents structured as follows:

- **A location map of the MCA and representative photographs** (forming the front cover of each description)
- **Snapshot of the MCA:**
    - Location and boundaries
    - Overall character (summary)
    - Adjacent National Character Areas (for those MCAs abutting the coast)
    - Adjacent nationally protected landscapes
- **Key characteristics**
- **Description of character**
    - Natural influences
    - Cultural/social influences
    - Aesthetic and perceptual qualities
- **Visual Resource Mapping for the MCA**
    - MCA-specific results of the Visual Resource Mapping (described in Chapter 3 of this report).

The description templates are designed to present the information in a clear and logical format, with photographs breaking up the text and colour used to provide a link back to the map.

Figure 13: Marine Character Areas.



3. Developing a Method to Map the Visual Resource

3.1 Background to the Visual Resource Mapping (VRM)

The aim of this element of the seascape assessment was to develop an objective method of assessing the visual resource that the sea provides within the South marine plan areas. This seeks in particular to account for the definition of 'seascape', as set out in the UK MPS, which states that "…references to seascape should be taken as meaning landscapes with **views of the coast or seas, and coasts and the adjacent marine environment**…"

The work also sought to develop and test an approach that could be applied to future marine plan areas in England as marine planning is rolled out across the country**. It is important to emphasise that the VRM does not include any judgements of the quality (or 'amenity') of views or viewpoints included in the mapping.** Through discussions with the project steering group, the following guiding principles for the development of the VRM for the South were agreed:

- The VRM should be evidence-based
- It should provide an understanding of the 'baseline' visual resource (not development scenarios)
- It should have a practical application for marine planning
- It needs to be objective rather than subjective (i.e. with no judgment of the quality of views or viewpoints)
- The method should be able to be replicated in other marine plan areas
- The approach should be informed by previous work, but not constrained by it
- It should not be over complicated
- The mapping should share a common spatial framework with the character assessment (i.e. use of the MCAs as units for presenting the results)

3.2 Purpose and structure of this section

This section sets out the background to developing the methodology for the VRM in the South, along with a step-by-step guide to enable its replication elsewhere (e.g. in other marine plan areas). An examination of the limitations of the mapping and potential refinements that could be applied / explored in the future is provided in section 4.
The chapter is set out in the following sections:

- **Summary review of existing approaches and best practice** – including how these helped shape the development of the VRM
- **Parameters to take into consideration** – including elevation, distance, curvature of the earth, atmospheric conditions
- **Generating the Visual Resource Mapping** – including a description of the GIS parameters used and caveats to bear in mind
- **Tools required to generate the VRM** – relating to the use of GIS
- **A description of the mapped outputs** generated from the VRM processes
- **Interpretation of the results** of the VRM
- **GIS data outputs and the digital resource** – explanation of the outputs generated from this study

- **Application** – how the results of the VRM will help inform marine planning.

Please note that this chapter includes some technical descriptions of the GIS tools and processes used in generating the VRM. This is to enable repetition of the method developed in this study by GIS technicians who will be familiar with the terminology used.

3.3 Review of existing approaches and best practice

Research into different existing approaches that could be taken to develop the VRM was undertaken at the outset of the method development, in order to identify the main issues associated with mapping land-sea intervisibility and the practical application of mapped outputs to inform the marine planning process.

Table 1 below provides a summary of the documents reviewed and the main points of relevance from each in terms of the development of the VRM methodology. A more detailed description of each approach is included at Annex 5 to show how existing work has shaped and guided the development of this methodology. This focuses on work that has been undertaken to date in Wales and Scotland.

It should be noted that much of the work that has been undertaken to-date has been in response to potential development scenarios. In turn these have focussed on providing an indication of the sensitivity (and capacity) of the marine area to development, which is not the aim of the VRM developed for this study.

Table 1: Summary of review of existing approaches and best practice and points of relevance in developing the VRM.

Document	Points of relevance
Hill *et al.* (2001). Guide to best practice in seascape assessment. Prepared by the Countryside Council for Wales, University College, Dublin and Brady Shipman Martin as part of a Maritime Ireland/Wales INTERREG project.	•GIS viewshed[1] mapping is an established method for exploring intervisibility between land and sea. •Although the seascape units were defined by visibility criteria only, they went on to form the basic units for more detailed characterisation. •The seascape units extended to a standard distance offshore and onshore. Whilst 10km is appropriate in this instance, this distance needs to be tested for other locations.
Briggs, J. and White, S. (2009). Welsh seascapes and their sensitivity to offshore developments: Method Report. Bangor: Countryside Council for Wales.	•Overview maps showing land with sea views and sea surface visibility are a useful tool to understand the visual relationship between land and sea. •In the Welsh context, the most extensive views of the sea are within 10km of the coastline. •Overview maps require careful interpretation as not all areas that are

[1] A viewshed is a map that identifies areas that are visible from specified locations. Viewshed tools are common to most GIS software.

Document	Points of relevance
	expected to show very high intervisibility show as the darkest reds. This is because the visibility scale is relative to the whole of Wales and although an area can have high intervisibility, it will not be the darkest shade of red if there are other areas with higher intervisibility.
LUC (2011). Welsh Seascapes and their Sensitivity to Tidal Stream Development. Bangor: Countryside Council for Wales.	•Although attempts were made to use the regional seascape units as the spatial units for this study, they were found to be too strategic •The study showed that it would be useful to have spatial units that were based on areas of similar character rather than units that had shared intervisibility only.
LUC (2012). Pilot Seascape Character Assessment for Wales. Bangor: Countryside Council for Wales.	•It is difficult and inappropriate to nest visibility-derived seascape units and character areas/types within the same hierarchy. •Intervisibility mapping is a useful tool to explore the extent to which the sea influences the character of the hinterland.
Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).	•In some cases there may be a need to extend the visibility mapping beyond the 24 kilometres set out in the best practice guidance (2001) •Whilst meteorological effects on visibility should not be ignored, the effects can be extremely complex and variable and are difficult to incorporate into the GIS visibility mapping •Assessing a development scenario can be used to assess sensitivity of the seascape units, but this is different to the requirement of the VRM – which is to assess the baseline situation.

3.4 Parameters to take into consideration

All of the above research as well as discussions with the steering group and workshop attendees highlighted that the following parameters needed careful consideration in developing the VRM. Each parameter is discussed in turn in this section.

- Elevation of the viewer and curvature of the earth
- Who is the viewer and what is being viewed?
- Atmospheric conditions
- Visual barriers
- Scale and spatial framework.

3.4.1 Elevation of the viewer and curvature of the earth

The curvature of the earth imposes a limit on the distances from which an object can be seen. Ignoring the effect of atmospheric refraction (discussed later in this section), the distance to the horizon from an observer close to the earth's surface is calculated using the following equation: $d \approx 3.57\sqrt{h}$ where ***d*** is distance in kilometres and ***h*** is height above ground level in metres.[2]

So, for an observer standing on the ground with a height (h) of 2 metres, the horizon is at an approximate distance of 5 kilometres. For an observer of 2 metres in height, standing on an elevated surface (e.g. a hill) of 98 metres (making a total of 100 metres above ground level), the horizon is at an approximate distance of 36 kilometres.

To demonstrate this important principle, a point along the south coast has been selected which is at sea level (i.e. 0 m above ground level). A viewer has been inserted at this point and a zone of theoretical visibility (ZTV) has been generated to test the extent of visibility of the ground/sea surface from this location.

The elevation of the viewer has been artificially raised to a variety of elevations to demonstrate the effect that elevation has on viewer distance. The buffers on the map at Figure 14 indicate the distance from the viewer.

This figure also demonstrates another important parameter – visibility of objects above the horizon. In these examples, the model evaluates 360˚ views from the viewpoint and when looking in an easterly direction, the viewer will see the Isle of Wight. In all cases, although visibility of the sea surface terminates at a distance calculated roughly by the above horizon formula, there are elevated locations on the Isle of Wight which the viewer is able to see that fall beyond that distance.

The above formula is adjusted as follows when considering an object above the horizon: $d \approx 3.57(\sqrt{h1}+\sqrt{h2})$ where ***d*** is in kilometres and ***h1*** is the height of the observer in metres and ***h2*** is the height of the object in metres.

So, an observer standing on the ground with a height (h1) of 2 metres looking out towards the Isle of Wight will be able to see landform on the Isle of Wight if it is sufficiently elevated. In the case of the Needles, according to the above formula, a viewer at the location shown above (approximately 25 kilometres from the Needles) should be able to see parts of the Needles that are elevated above 31 metres.

[2] http://mintaka.sdsu.edu/GF/explain/atmos_refr/dip.html

Figure 14: The effect of viewer elevation on distance to the horizon.

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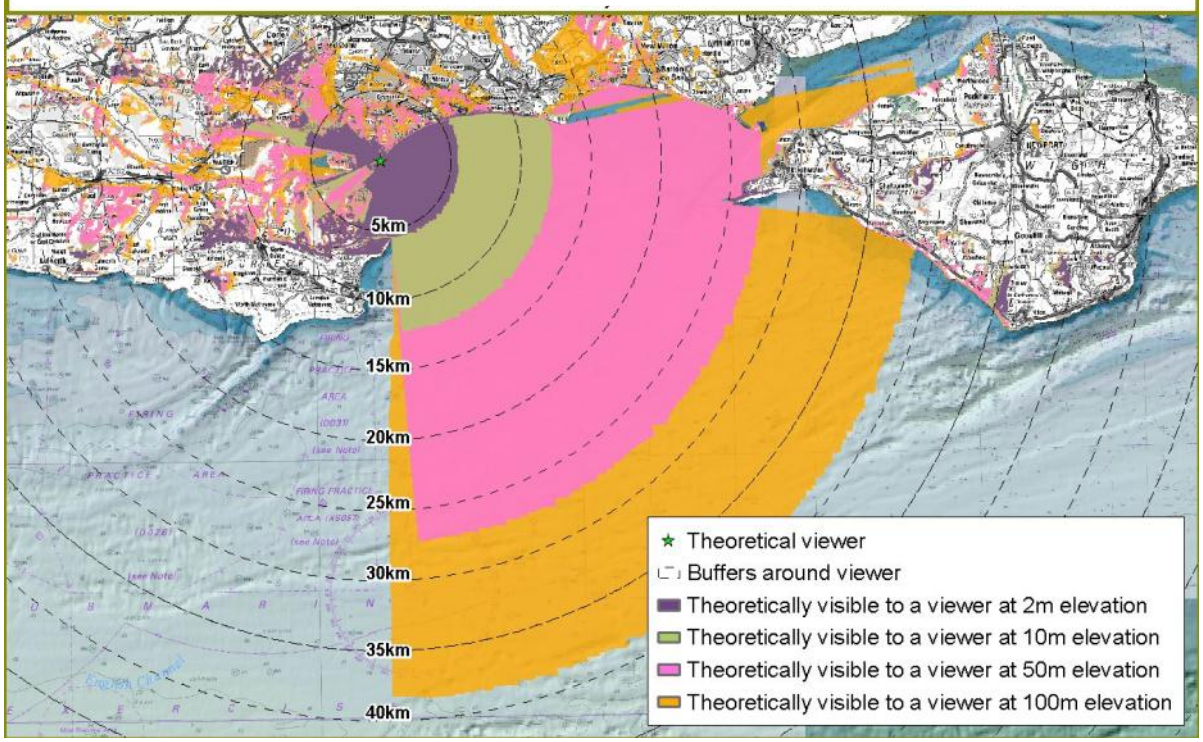


3.4.2 Who is the viewer and what is being viewed?

Section 3.6.1 described the potential distances that a viewer can see the sea surface from at various elevations inland, and the effect of raising either the viewer or the object being viewed. In the context of this work developing the VRM, it was important to ascertain who is doing the viewing and what is being evaluated in their views.

The brief for the VRM approach, as summarised at the start of this chapter, specified that an evaluation be undertaken of the baseline visual resource that the sea provides. Therefore, a method has been developed to evaluate views of the sea surface rather than a development scenario (such as large offshore turbines or smaller tidal power devices). As such, the 'object being viewed' (i.e. the sea surface itself) is at an elevation of 0 metres above sea level[3]. Additionally, for the purposes of this study, and in line with other guidance[4], a standard viewer height of 2 metres above ground level has been used.

This is an important point to bear in mind, as views to France from points along the Dover coastline are well known and recognised as being part of their character. The VRM therefore focuses on views of the sea surface, not distant horizons formed by land elevated above it (e.g. France). Similarly, tall structures, such as wind turbines, which rise above the sea surface will be seen from greater distances.

3.4.3 Atmospheric conditions

Whilst the formulas described above and GIS visibility mapping can model the theoretical visibility from a point, it is important to note that atmospheric conditions will affect visibility and could result in a deviation from the theoretical formula for calculating horizon

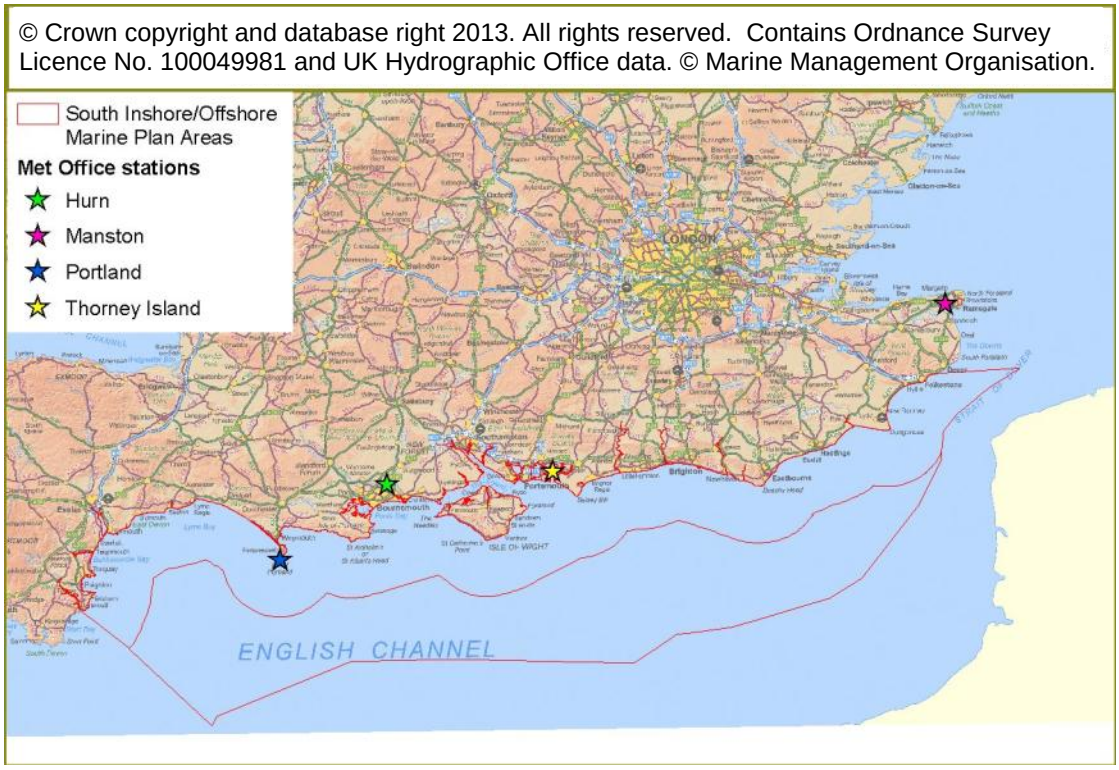
[3] For the purposes of this study, sea level is taken to be 0m rather than considering variations in tides.
[4] Visual Representation of Windfarms: Good Practice Guidance, SNH 2006

distances. As atmospheric conditions vary from season to season, month to month and indeed hour to hour, it was important for this to be considered in the VRM approach. The Met Office defines visibility as '*the greatest distance at which an object can be seen and recognised in daylight, or at night could be seen if the general illumination were raised to a daylight level*'[5]. For meteorological purposes it is necessary that visibility observations give a measure of the transparency of the atmosphere. The assessment of visibility in daylight is generally based on the observation of suitable objects at known distances.

At automated weather stations the visibility is measured with an instrument known as a 'visiometer'. This measures the clarity of the atmosphere by shining a light onto a small volume of air. The amount of light scattered is recorded and this gives a measure of the opacity of the air–the more light that is scattered, the greater the opacity. The visiometer measures the meteorological optical range, which is the distance required to reduce the intensity of the light beam to 5% of its original strength. Clearly, the visibility reported by a visiometer is very local and is not a measurement integrated over the vicinity of the station. Visibility is noted in kilometres, decametres or metres and is measured on site and is not sensitive to ambient lighting. The instrument provides a spot reading of visibility not lowest visibility, hence does not detect distant fog banks.

Visibility data can be purchased from the Met Office for a number of stations in the UK. Data for a ten year period can be obtained to provide average visibility readings by month and averaged over a 12 month period, costing in the region of £400 per station. For the purposes of developing this methodology, data was only purchased for one of the four stations that have visibility observation data in or near to the South marine plan areas. These stations are shown in Figure 15. The station that was chosen was for Thorney Island as it was central within the study area, close to the coast and almost at sea level.

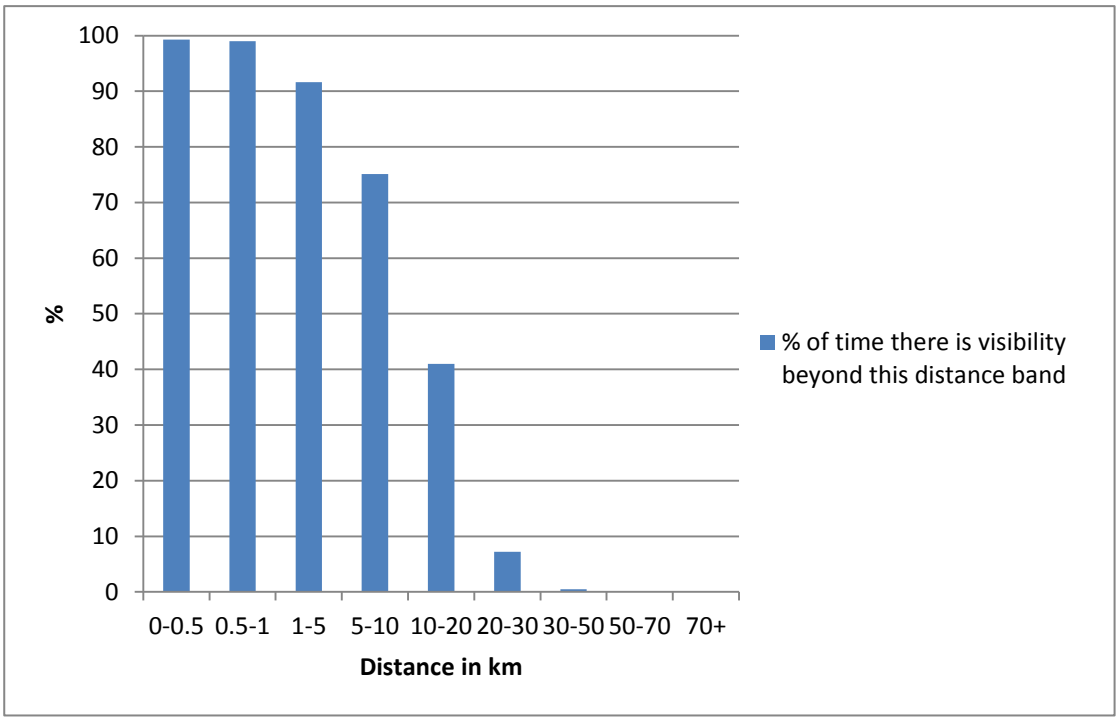
Figure 15: Local Met office stations with visibility observation data.



[5] Met Office Observers Handbook

The Met Office data for Thorney Island shows a 10 year average of the frequency of observations at measured distances from the station. This data has been analysed and Figure 16 below illustrates the results.

Figure 16: Results of analysis of Met Office data for Thorney Island.



Using this station data as a proxy for the rest of the coastline within the South marine plan areas, a series of buffers around the coast were generated to be coincident with these measured distances. In Figure 17, shading has been used to illustrate the diminishing frequency of visibility offshore. A summary of the results is as follows:

- Locations within 10-20km of the coastline are not likely to be visible for at least 25% of the time
- Locations within 20-30km of the coastline are not likely to be visible for at least 59% of the time
- Locations within 30-50km of the coastline are not likely to be visible for at least 93% of the time
- Visibility beyond 50km is very unlikely.

It needs to be noted that for this pilot study, visibility data from just one central Met Office station (Thorney Island) was obtained due to the available budget. In other marine plan areas, such as the South West, the local climatic conditions are likely to vary sufficiently to warrant the collection of data from multiple stations within the study area to generate a more balanced set of results.

It was agreed that this data should not be built into the GIS model and should rather be viewed as an additional layer of information alongside the VRM, and therefore should be borne in mind when interpreting the results.

An additional factor to consider is atmospheric refraction. This is the deviation (or bending) of light through the atmosphere due to the variation in air pressure and density, humidity,

temperature and elevation. This factor is taken into consideration in the GIS tools used to map viewsheds described in section 3.7.

Figure 17: Mapped Met Office data for Thorney Island demonstrating the effects of climatic conditions on visibility.

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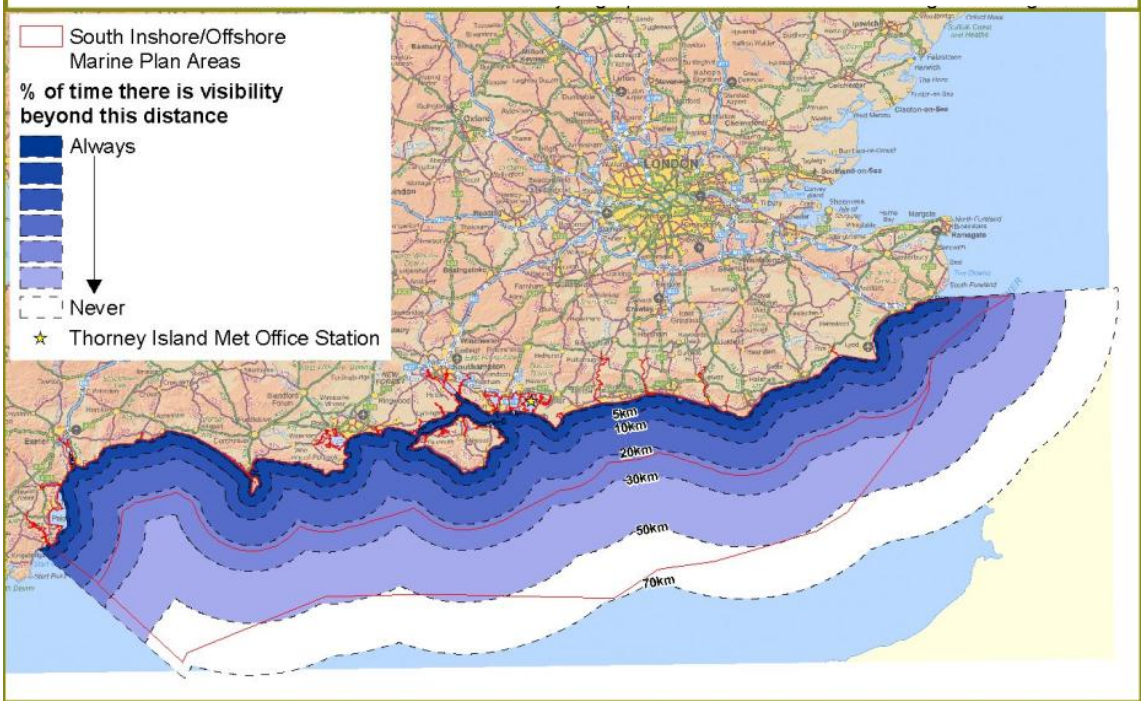

3.4.4 Visual barriers

Views from the shoreline are often unimpeded by visual barriers such as buildings, trees, hedges and other tall vegetation. Moving further inland introduces the possibility of views being disrupted by one or more of the above factors. In order to model views and visibility in GIS, a 3D model of the terrain needs to be used. There are many digital elevation models (DEM) available and the choice of which DEM to use needs consideration.

A DEM can be a digital terrain model (DTM) or a digital surface model (DSM). A DTM model represents the bare ground surface without any surface features such as vegetation and buildings. A DSM represents the earth's surface with surface objects such as vegetation and buildings included. Additionally, the resolution of a DEM can vary greatly from a few centimetres to many metres. As a rule of thumb, the higher the resolution of the data, the more expensive it will be. For the purposes of this study, given the scale of the study area, purchasing DSM data was prohibitive. It was therefore decided that the modelling would be undertaken using freely available 1:50 000 scale Ordnance Survey (OS) DTM data. OS landform panorama data has a 50 metre resolution which was seen as sufficient when working at a strategic scale[6]. By using a bareground elevation surface

[6] Midway through the study, the OS released a new 50m resolution DTM dataset (Terrain50) which was tested as well. In OS Terrain 50, the mean high and mean low water lines have been assigned constant height values, based on the average for each tile from information sourced from tide tables. These values have been continued offshore up to the tile edge to ensure consistency. Inevitably, this means that there is a small discrete step from the tidal area between adjacent tiles. This step change in values created

model such as the OS data, the results will be an over-representation of views, as many could in reality be blocked by surface features not included in the model. This needs to be borne in mind when interpreting the VRM results – that they represent a general, strategic-scale pattern of visibility. The resolution of the DEM will affect the processing time and computational power required to run the viewshed models in GIS and at this strategic scale, using a DSM would have been prohibitive in terms of both costs and processing resources required to run it.

3.4.5 Spatial framework

The Welsh and Scottish seascape work summarised in Table 1 resulted in the delineation of seascape units that were made up of a length of coastline, an onshore area and an offshore area.

Through discussions with the steering group, it was decided that delineating seascape units based on visibility alone as well as having MCAs would be overcomplicated. It was agreed that it was preferable for the VRM to be linked into the spatial framework of the MCA. This helps to streamline the process and provide a more thorough understanding of the visual relationship of each MCA with its surrounding land and vice versa. The results of the VRM are also able to be included within the MCA descriptions, providing a 'one stop shop' for information on both character and land-sea intervisibility for each unit.

3.5 Tools required to generate the visual resource mapping

3.5.1 Data and software

Viewshed analysis was used to identify the following within the study area:

- land with sea views
- sea to sea views
- sea visibility from land
- land to land views (not relevant in this study, and therefore not pursued further).

ESRI ArcMap with spatial analyst xxtension software was used as the tool to explore intervisibility in more detail. It should be noted that other GIS software was not tested as part of this study. The viewshed tool in particular was used to generate zones of theoretical visibility from a number of different 'viewer perspectives'.

A brief explanation of the viewshed tool is useful to understand what is possible and the various user defined parameters that can be selected to shape the analysis.

3.5.2 How does viewshed tool work?

ESRI spatial analyst's viewshed tool identifies the cells in an input raster[7] that can be seen from one or more observation points or lines. Each cell in the output raster receives a value that indicates how many observer points can be seen from each location. If you have only one observer point, each cell that can see that observer point is given a value of one. Cells that cannot see the observer point are given a value of zero.

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inconsistencies in the viewshed results for the inshore region and it was felt that unless the data were smoothed or altered, this would create unnecessary 'noise' in the results.

[7] A raster is a data format consisting of a grid of cells where each cell contains a value representing information. The cell size of the raster is the spatial resolution.

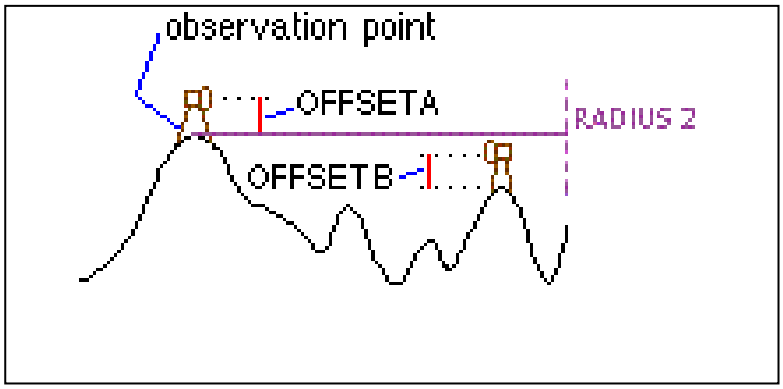
The visibility of each cell centre is determined by comparing the altitude angle to the cell centre with the altitude angle to the local horizon. The local horizon is computed by considering the intervening terrain between the point of observation and the current cell centre. If the point lies above the local horizon, it is considered visible.
The following elements are required to run a viewshed:

- a Digital Elevation Model
- observation points (A)
- cells (locations on the DEM) to be considered for visibility (B).

There are many characteristics of the viewshed that can be controlled – the relevant ones are described below and illustrated in Figure 18 below:

- OFFSET A: The vertical distance in surface units (metres) to be added to the elevation of the observation points at (A)
- OFFSET B: The vertical distance in surface units (metres) to add to the elevation of each cell as it is considered for visibility (B)
- RADIUS 2: The outer radius that limits the search distance when identifying areas visible from each observation point - ultimately applying a distance limit beyond which visibility is assumed to be nil.

Figure 18: Parameters that can be controlled in the Viewshed Tool.



The viewshed tool additionally allows for the inclusion or exclusion of earth curvature and atmospheric refraction in the calculation. For small distances, these can be excluded, but it is important that these options are included in viewshed mapping at the strategic scale provided by this study.

3.5.3 Selection of observation points

Selection of observation points is an important consideration. Visual impact assessments will normally select viewing locations or viewpoints based on the quality or value of the view experienced from that location. In order to remain completely objective for the purposes of this study, viewers/observation points for this assessment remained free of any judgement of the quality of the view, acting merely as a location from which visibility is assessed.

To this end, a grid of points both onshore and offshore has been generated at 500m intervals. On the sea surface, the grid of points extends throughout the South Inshore and

South Offshore marine plan areas. On land, the grid of points extends 20km inland from the High Water Mark within the Study Area.

If the observation points are people (viewers), then the viewshed identifies locations on the surrounding surface where an object or objects (with an OFFSET B = the object height) can be seen by people (at specific observation points with a height of =OFFSET A).
If the observation point is the object (a location with OFFSET A = height of the object), then the viewshed will identify all locations on the surrounding surface where a viewer (with OFFSET B = height of the viewer) can see the object.

3.5.4 Applying limits to visibility

The RADIUS 2 parameter can be applied in order to apply a theoretical limit to visibility. As discussed earlier (3.6.1), a horizon at a distance of 35 kilometres implies a viewer at approximately 100 metres elevation. Whilst there are locations onshore where a viewer would have an elevation above this level, their contribution to the overall visibility patterns are low and the assessment is not diminished by applying a theoretical limit on visibility of 35km. This also reduces the processing resources required significantly (from days to hours).

3.5.5 Computing resources required

The computing resources required depend on the resolution of the DEM, the size of the study area being evaluated for visibility and the number of observer points that are being used. For this study in the South, initial modelling work tested a spatial resolution of 1km, which was subsequently refined to 500m and finally 50m for the detailed mapping discussed later. Applying a visibility limit (Radius 2) of 35km reduces processing time significantly.

3.6 Description of the overview Visual Resource maps

In line with both the Welsh and Scottish studies summarised in Table 1 and Annex 5, some preliminary mapping work was done using a coarse resolution of 1km x 1km to start exploring the parameters, concepts and local flavour of the maps. No landward or seaward limits were applied to the analysis (although the analysis ran to the edges of the topographical data (DEM) input into the model). It was through this initial piloting that two main mapped outputs started to emerge. The overview maps were subsequently re-run at 500m resolution. These maps are discussed in more detail below.

3.6.1 Land with sea views

Figure 20 maps areas of land in terms of their views of the sea surface. Observation points were placed on the sea surface (with an OFFSET A value of 0m), and set at an OFFSET B value of 2m (see Figure 19). A viewshed calculation therefore identified (for every location on the DEM) where a viewer at 2m height above ground level would see the observation points (i.e. the sea surface). This generates a raster layer where the higher the value of the raster cell, the greater the number of observation points it can see and therefore, the greater the extent of sea views. Table 2 below sets out the parameters that have been applied to this mapping.

Figure 19: Observer points located in the sea.

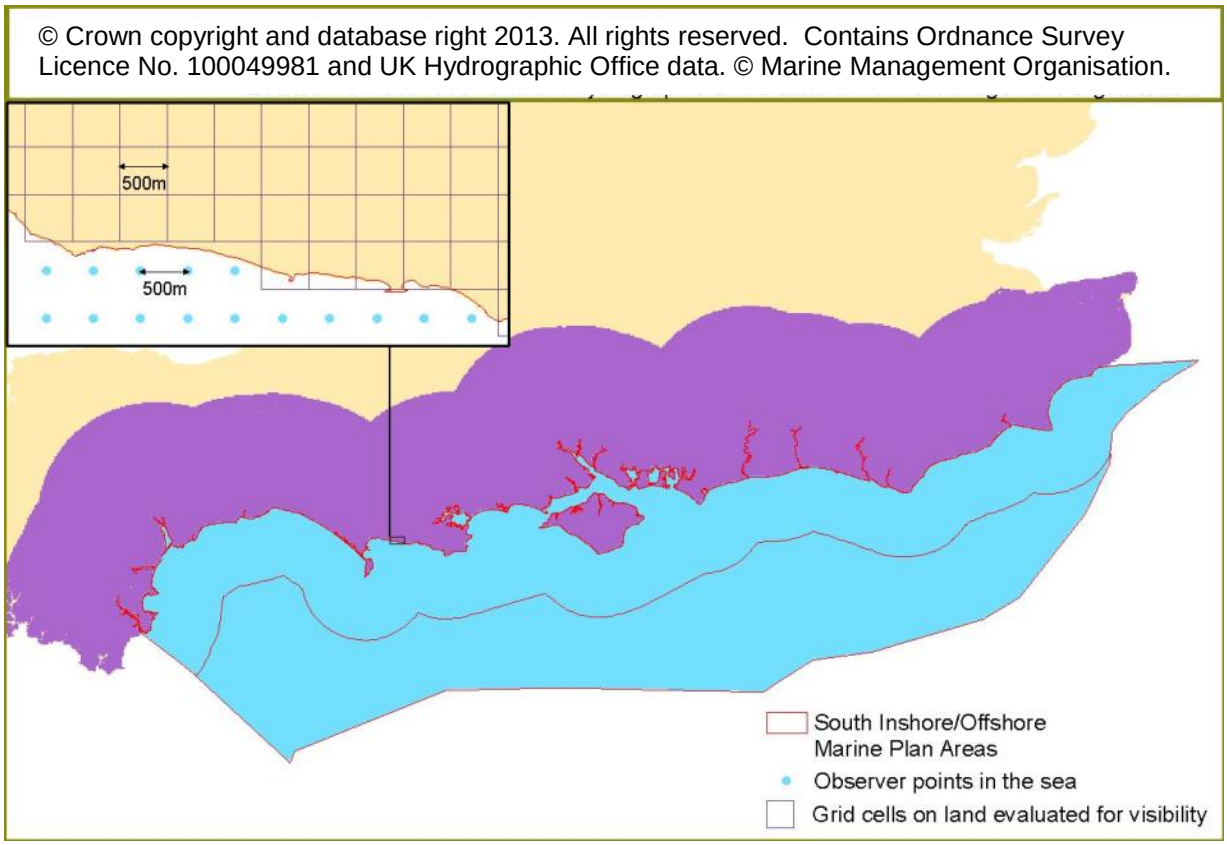
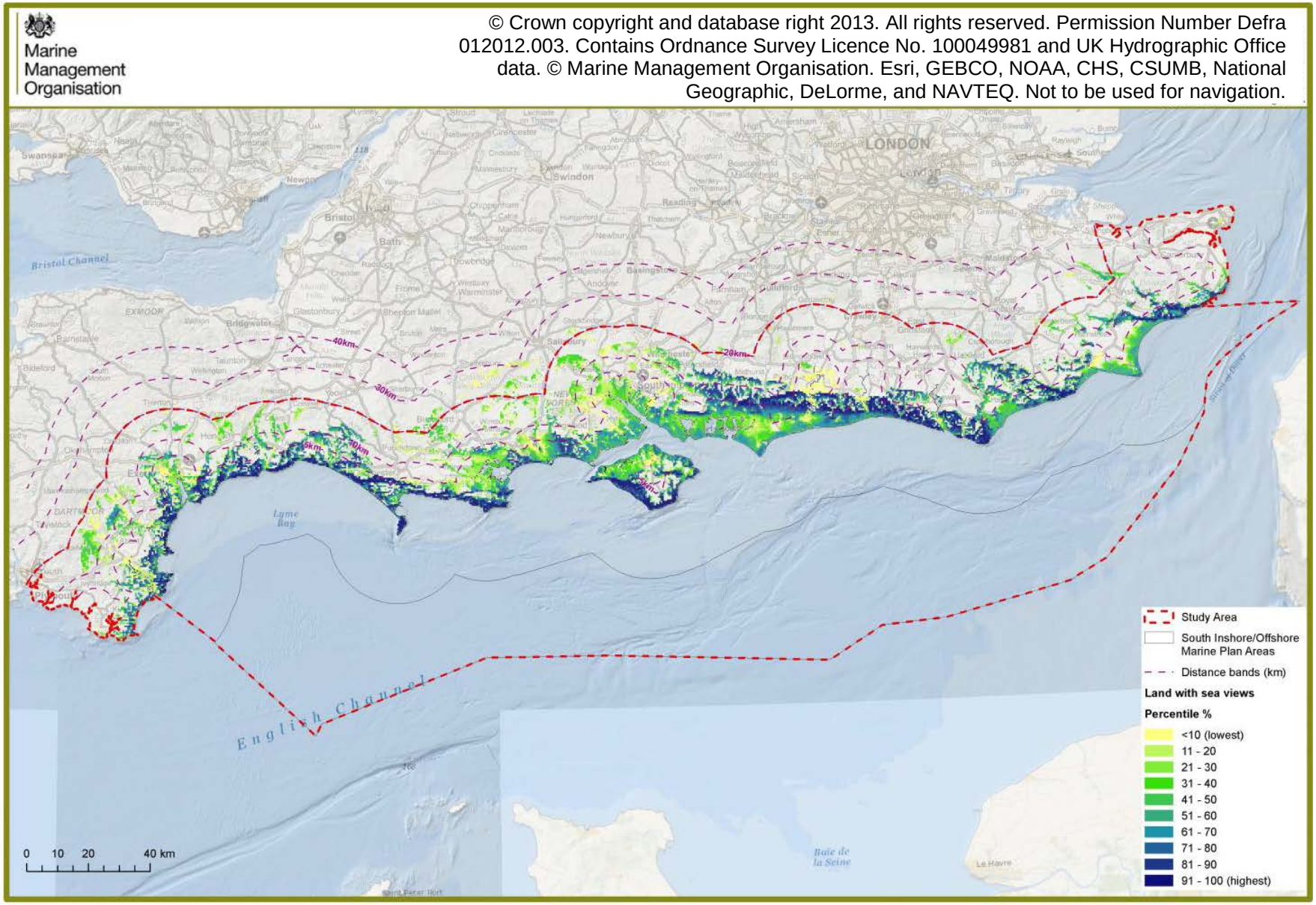


Table 2: Parameters used in generating the land with sea views overview maps.

Parameter	Value
Observation point height	0m
Height above ground level added to each cell considered for visibility	2m
Resolution of DEM and resultant output	500m
Grid spacing between observation points	500m
Theoretical limit to visibility	35km
Location of observation points	Spread across the South marine plan areas (Figure 19)

The colouring of the pixels/cells in Figure 20 represents the extent of the views – dark blue indicates relatively high views and yellow indicates relatively low views. The data has been classified into percentiles in order to highlight those areas on land that have the most extensive views of the sea surface in the marine plan areas. The darker blues indicate locations within the highest percentile of views of the sea and the yellows indicate locations that have views of the sea, but they are not very extensive relative to other locations.

Figure 20: Land with sea views (overview).



3.6.2 Sea that is visible from land

Figure 22 maps areas of sea surface in terms of their visibility from land. Observation points were placed on land (see Figure 21) above the HWM at 500m intervals and up to 20km inland. These represent theoretical viewers with an OFFSET A value of 2m above ground level. The OFFSET B value was set to 0m, and the viewshed analysis was run. The resultant raster grid showed a count of the number of observation points on land that each grid cell in the sea can 'see'. Put another way, this means that grid cells with high values in the sea can be seen by many viewers on land and are therefore more 'visible' to viewers on land. Table 3 sets out the parameters that have been applied to this mapping.

Figure 21: Observer points on land.

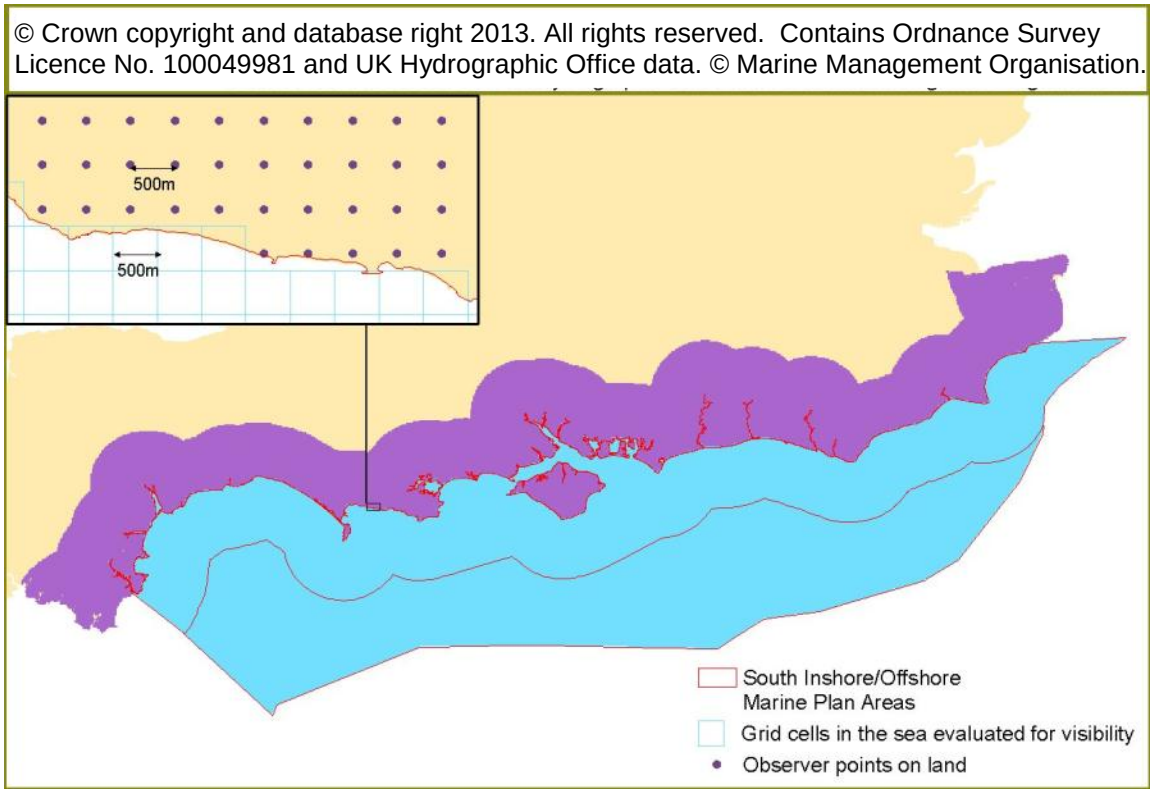
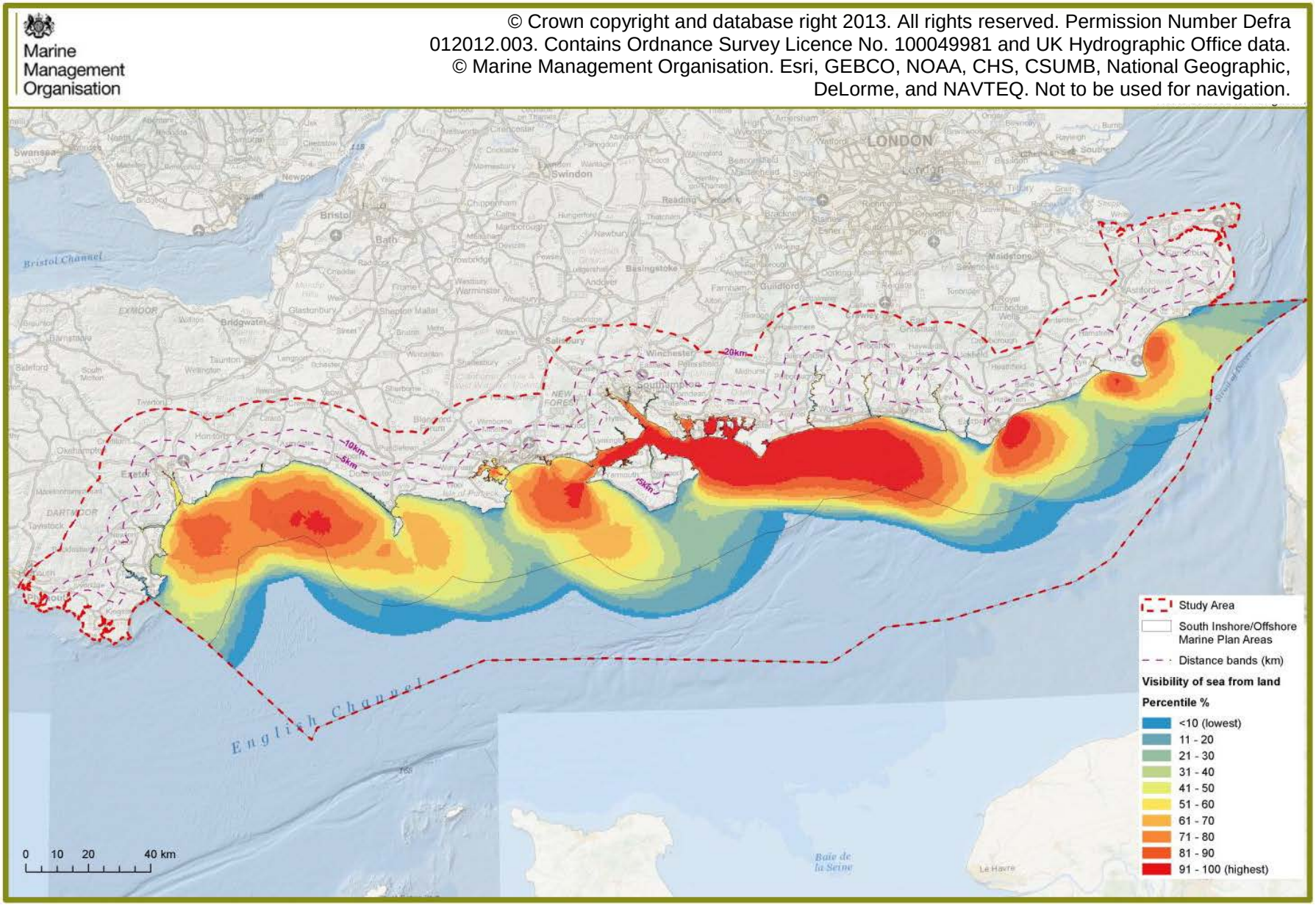


Table 3: Parameters used in generating the Sea Visibility overview maps.

Parameter	Value
Observation point height	2m
Height above ground level added to each cell considered for visibility	0m
Resolution of DEM and resultant output	500m
Grid spacing between observation points	500m
Theoretical limit to visibility	35km
Location of observation points	Located above High Water Mark (HWM) up to 20km inland (Figure 21)

The data has been classified into percentiles in order to highlight those locations on the sea surface within the marine plan areas that are most visible from land. The darker reds indicate locations on the sea surface that can be seen from the most locations on land within the study area, and the darker blues indicate parts of the sea surface that are visible from the least number of locations on land.

Figure 22: Visibility of sea (overview).



3.7 More detailed mapping of sea that is visible from land

In order to explore the overview map of sea that is visible from land at a more detailed level, observation points on land were banded into the following distances inland (as shown in Figure 23):

- 0-1km above the HWM
- 1-5km above the HWM
- 5-10km above the HWM
- 10-20km above the HWM.

The analysis was rerun using the same parameters as the overview map with the exception of the DEM and resultant output resolution which was 50m (see Table 4 below).

Figure 23: Observer points located on land at various distances from the High Water Mark.

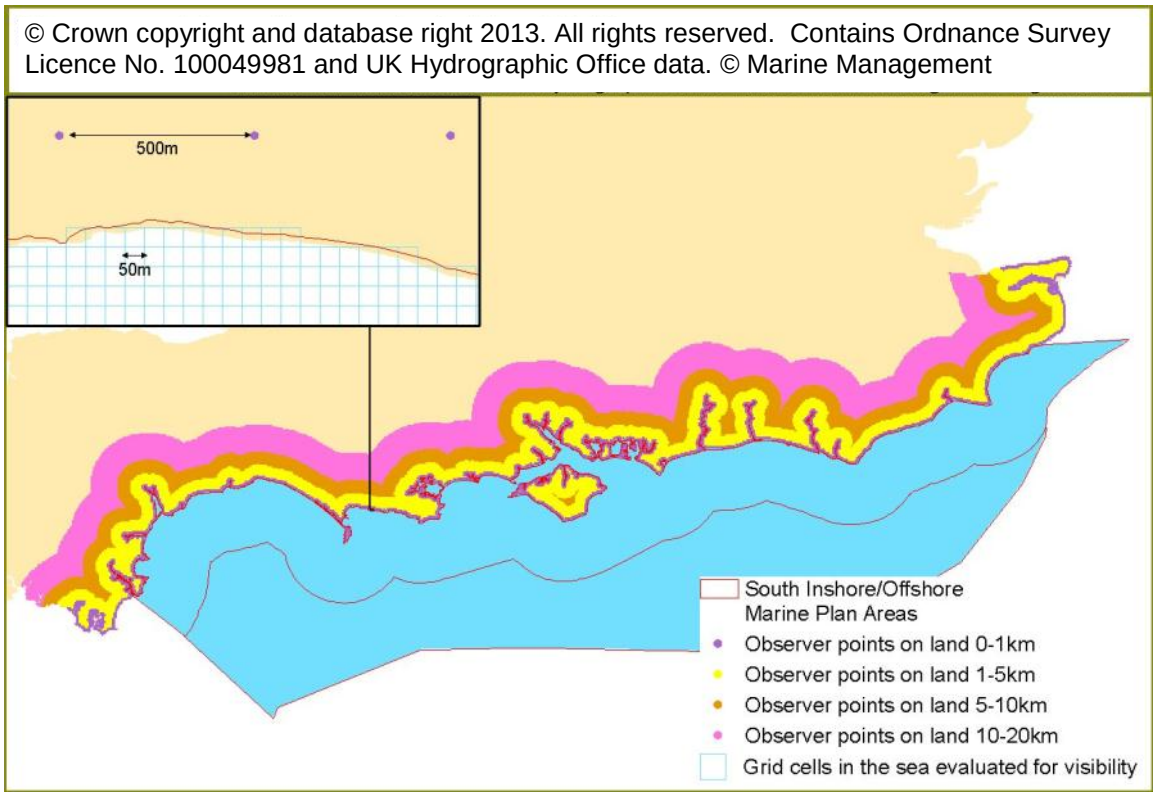


Table 4: Parameters used to generate the detailed sea visibility maps.

Parameter	Value
Observation point height	2m
Height above ground level added to each cell considered for visibility	0m
Resolution of DEM and resultant output	50m
Grid spacing between observation points	500m
Theoretical limit to visibility	35km
Location of observation points	Located above HWM in bands related to distance offshore (as shown in Figure 23)

This data has been collated into a single mapped layer with multiple attributes that can be queried in GIS. For each 50m x 50m grid cell on land, the following attributes (set out in Table 5) can be queried.

Table 5: Attributes available for each 50x50m grid cell in the sea.

Attribute	Description
Location	Easting/Northing
0-1km value	Number of observer points within the 0-1km band that can be seen from this location
0-1km percentile	Percentile rank of the 0-1km value
1-5km value	Number of observer points within the 1-5km band that can be seen from this location
1-5km percentile	Percentile rank of the 1-5km value
5-10km value	Number of observer points within the 5-10km band that can be seen from this location
5-10km percentile	Percentile rank of the 5-10km value
10-20km value	Number of observer points within the 10-20km band that can be seen from this location
10-20km percentile	Percentile rank of the 10-20km value
Total: 0-20km value	Number of all observer points (0-20km) that can be seen from this location
Total: 0-20km percentile	Percentile rank of the total value (0-20km)

A Total count column has been added which represents the aggregation of all the MCA analyses. The resultant map is the same as if the overview map had been run with a DEM of 50m. It is this detailed data that has been used to generate Figures 24 and 25.

3.7.1 Visual resource mapping at the Marine Character Area scale

In order to add some localised intelligence to the overview maps, further GIS analysis was undertaken using the spatial framework provided by the 14 Marine Character Areas, as described below. Individual mapped outputs are also included at the end of each MCA document.

3.7.2 Land to sea views

Whilst the overview maps shown at Figures 24 and 25 provide a general picture of the locations on land which have sea views, further mapping was undertaken to explore which locations on land have views of each of the Marine Character Areas. For each MCA, viewshed analysis has been undertaken to examine which locations on land can see it, as shown in Figure 26.

Figure 24: Land with sea views (west).

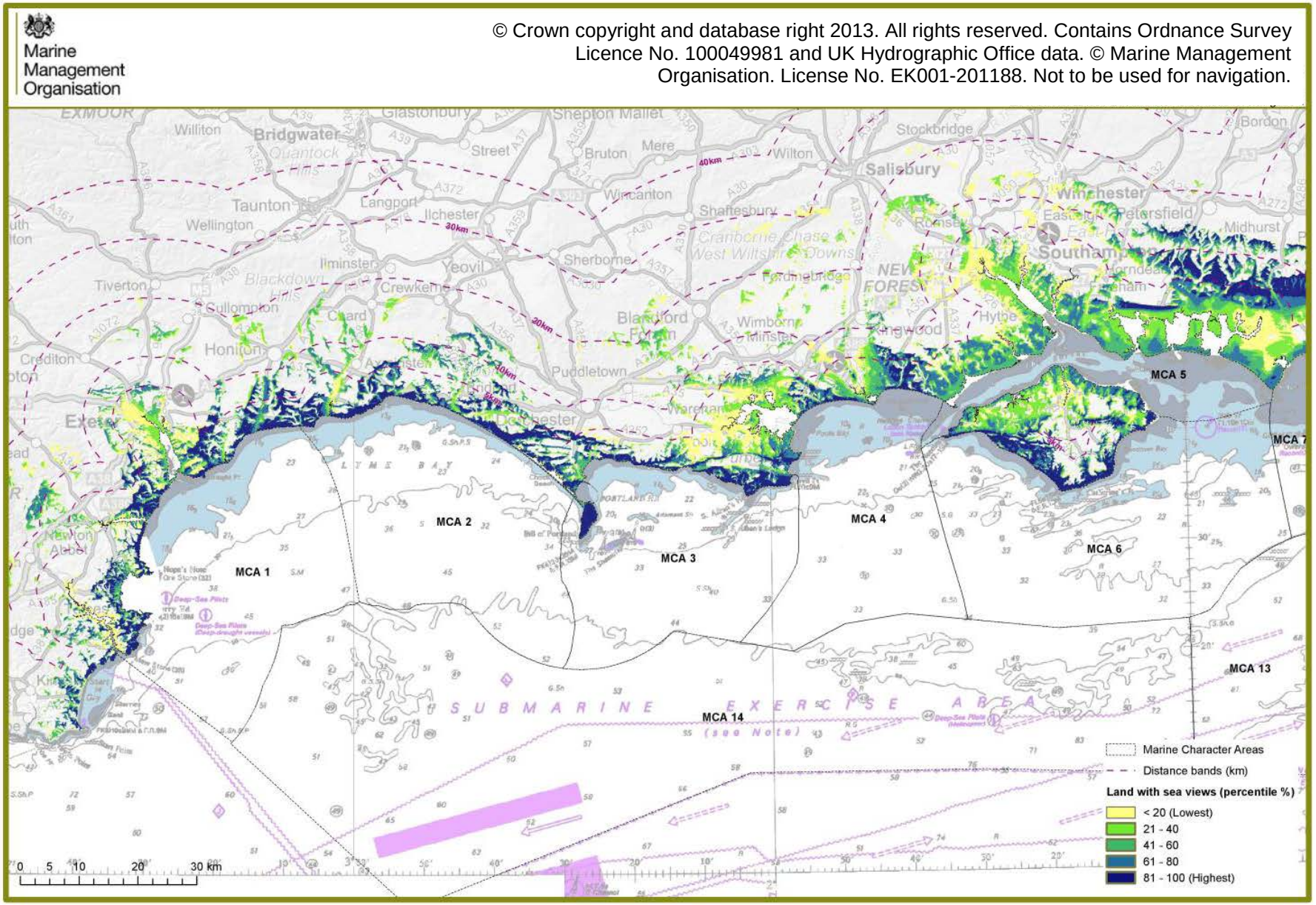


Figure 25: Land with sea views (east).

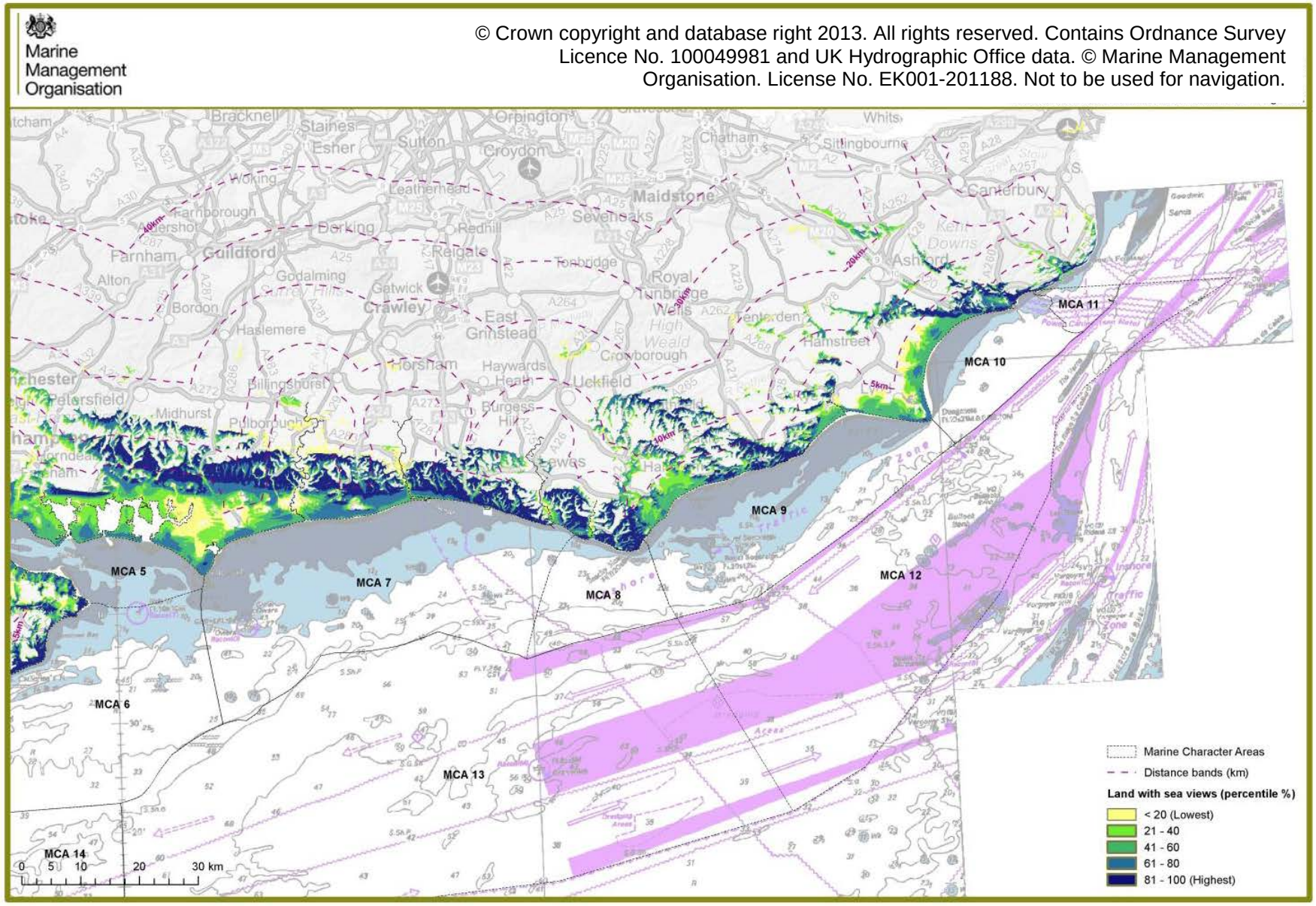
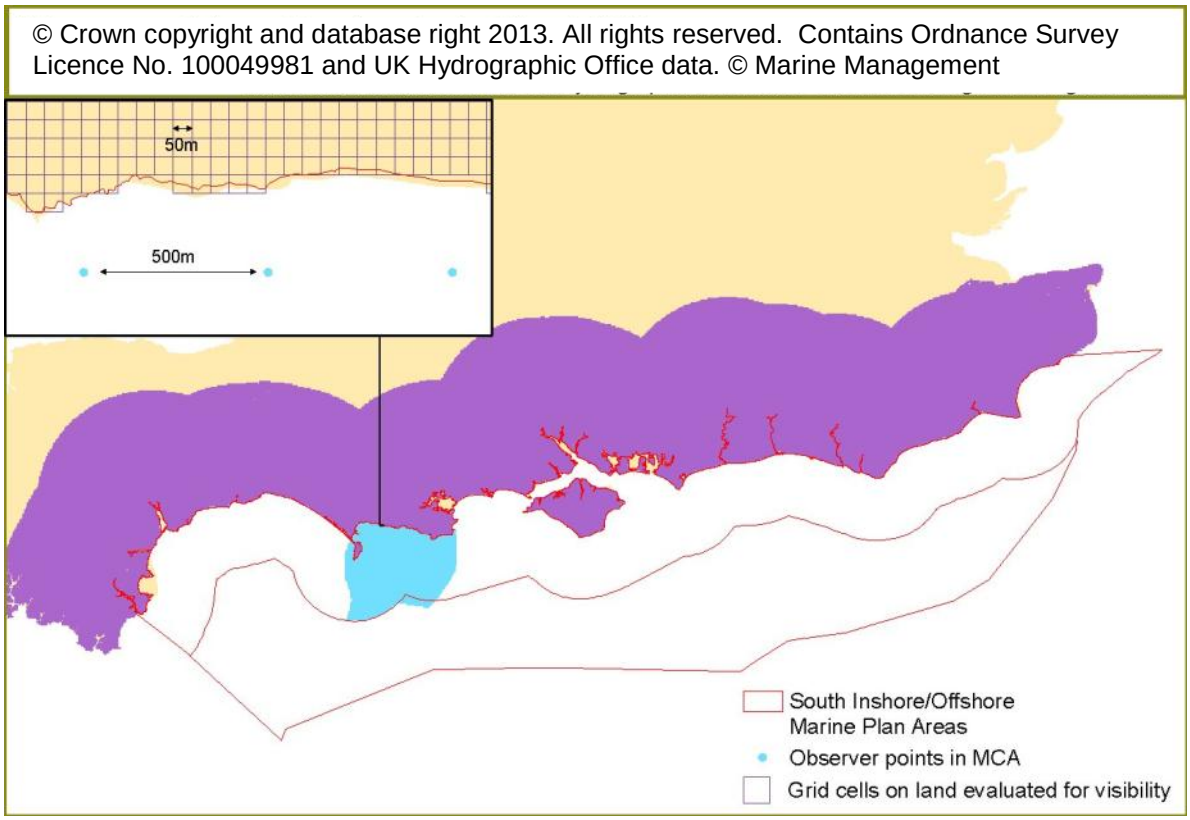


Figure 26: Observer points located in each MCA.



The data has been classified into percentiles to identify where on land the most extensive views (i.e. top 20 percent) of each MCA can be found. This analysis has been undertaken at a finer resolution using a 50m DEM. It is also possible to establish the percentage of each MCA that can be seen from each location on land. The following parameters set out in Table 6 have been used to generate the finer grained data at the MCA level.

Table 6: Parameters used in generating Land with Sea Views maps at MCA level.

Parameter	Value
Observation point height	0m
Height above ground level added to each cell considered for visibility	2m
Resolution of DEM and resultant output	50m
Grid spacing between observation points	500m
Theoretical limit to visibility	35km
Location of observation points	Spread throughout each MCA as illustrated in Figure 26

This data has been collated into a single mapped layer with multiple attributes that can be queried in GIS. For each 50m x 50m grid cell on land, the following attributes (Table 7) can be queried:

Table 7: Attributes available for each 50x50m grid cell on land.

Attribute	Description
Location	Easting/Northing
MCA1 value	The number of observer points that can be seen from this location
MCA1 percentile	The percentile rank of the MCA1 value
Percent of MCA1 visible	The percentage of MCA1 that is visible from each location
Above 3 fields repeated for each MCA	N/A see above three fields
Total value	Total number of observer points that can be seen in all MCAs from this location
Total percentile	The percentile rank of the total value

A Total count column has been added which represents the aggregation of all the MCA analyses. The resultant map is the same as if the overview map had been run with a DEM of 50m. It is this finer resolution data that has been used in Figures 27 and 28.

3.7.3 Sea to sea views

The DEM covers areas of both land and sea and therefore, for locations in the sea, the calculation described above will also evaluate visibility of the observation points from the sea surrounding the MCA. It adds a theoretical viewer to the sea surface (perhaps the viewing height of a surfer or recreational boat user), evaluating the number of observation points within each MCA it can see.

Whilst this data is available, it was not found to be particularly useful for the purposes of this study, as it showed for each MCA that there is visibility of each MCA (from the surrounding sea) up to approximately 5km from the boundary of the MCA. This is the expected distance based on the 'horizon calculation' (i.e. for a viewer at 2m height, the horizon will be approximately 5km away).

3.7.4 Sea that is visible from land

The detailed analysis of sea that is visible from land based on viewers located at various distances from the High Water Mark (as described at the beginning of section 3.9) has additionally been presented at MCA scale in the MCA descriptions. These maps provide a better understanding of where the most extensive views of the MCA can be found on land (e.g. do viewers immediately adjacent to the coast (0-1km from the High Water Mark) have more extensive views of an MCA than those further inland?).

Figure 27: Visibility of the sea from land (west).

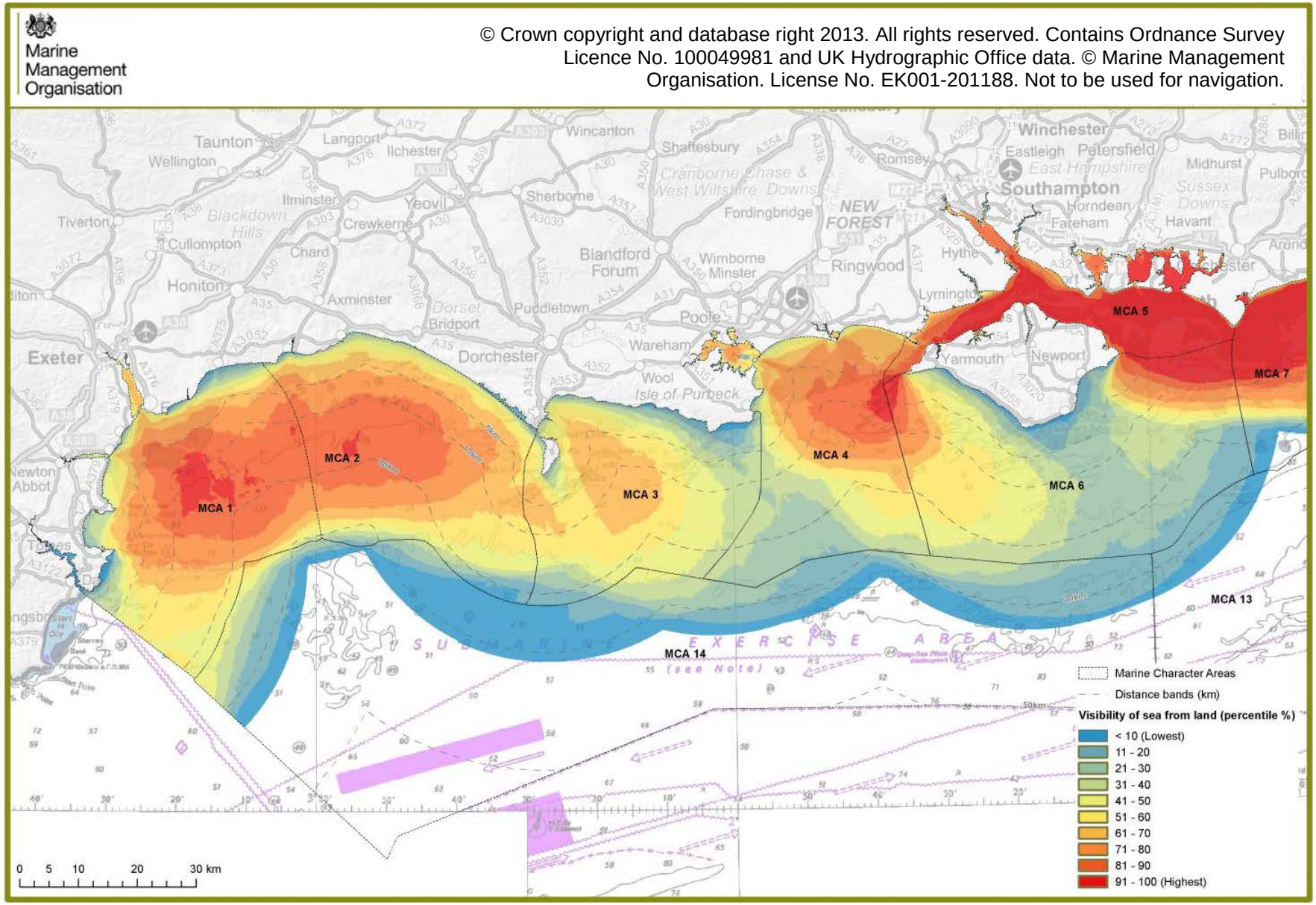
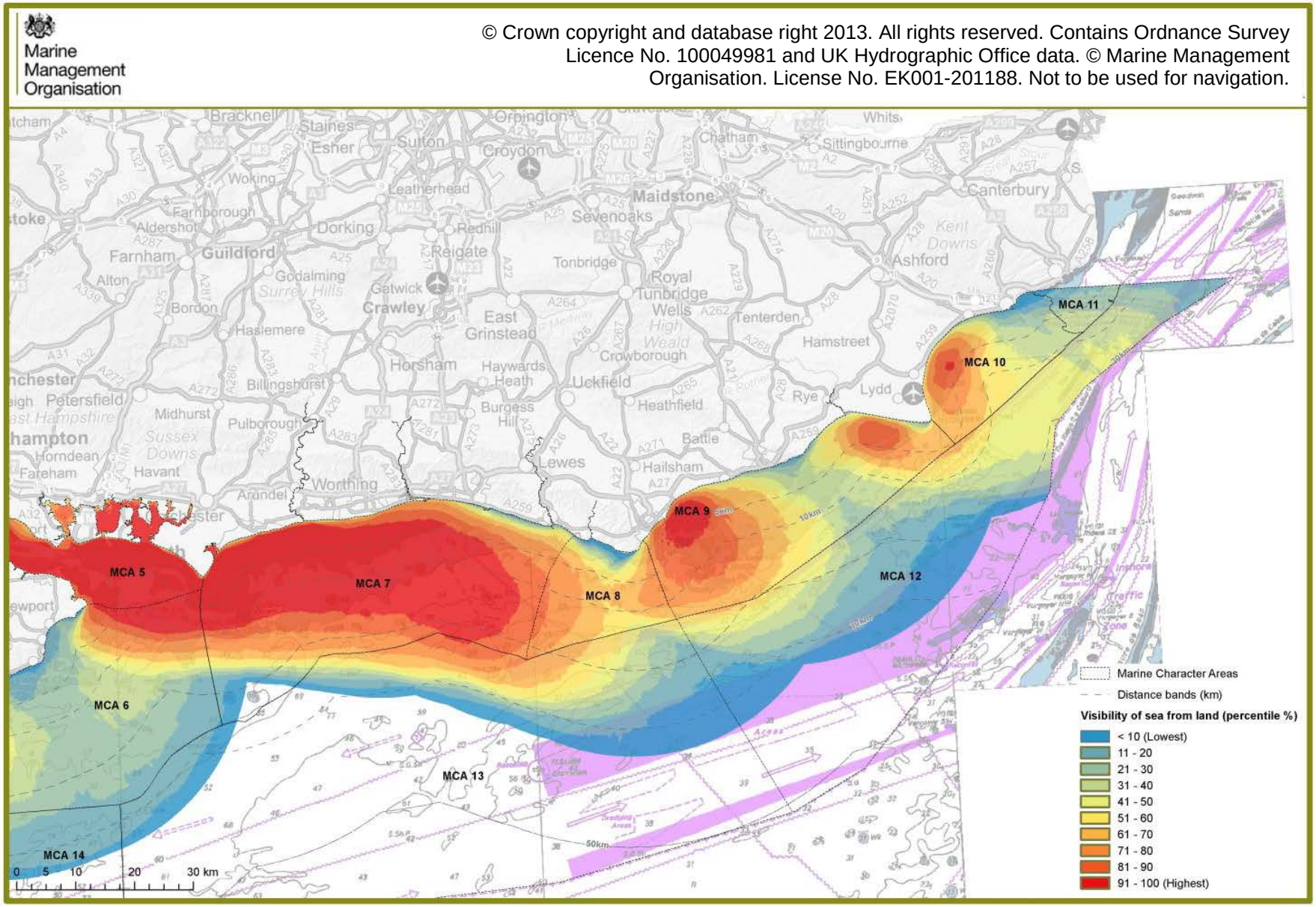


Figure 28: Visibillity of the sea from the land (east).



3.8 Interpretation of the results

3.8.1 Land with sea views

At a strategic scale, the most extensive views of the South Inshore and South Offshore marine plan areas are generally found within 5km of the HWM. A notable exception to this is the South Downs where there are extensive sea views experienced further inland at these higher elevations. It also demonstrates that viewers on the Isle of Portland would enjoy some of the most extensive views of the two marine plan areas. Due to its elevated topography and position, the west of the Isle of Wight also provides viewers with extensive views of the sea.

At a more local level, the MCA descriptions include an interpretation of the VRM maps for each MCA – highlighting where viewers on land may expect to have the most extensive views of each MCA. The analysis at MCA level includes reference to areas on land within nationally protected landscapes and on national trails that have views of the sea within them.

3.8.2 Visibility of the sea from land

At a strategic scale, the VRM has highlighted areas of sea within the South marine plan areas that are especially visible to viewers on land. Particularly noticeable is the extent to which the Solent and adjacent waters (between Selsey Bill and Seaford Head) can be seen from numerous locations on land. This is likely to be a result of the extent to which views of the sea extend inland to elevated areas around the South Downs. There are opportunities to view this area of sea from both directions (from the Isle of Wight as well as Hampshire and West Sussex). The coastline behind the Solent is generally low-lying and there is high visibility of this area of sea by viewers close to the coast as well. Embayments in the west tend to be wider and more curvaceous than the east and the most visible areas of sea tend to be those found further offshore. Visibility of the sea in the west is influenced by the elevation of the immediate coastline. High cliffs behind some of these bays results in the sea close to the shore being less visible from the coastline than the waters in the centre of the bay. The coastline in the east tends to be straighter and embayments are less pronounced in comparison.

3.9 GIS data outputs and the digital resource

The VRM outputs for this study comprise two raster (for the detailed mapping) and two vector (for the overview mapping) GIS layers with multiple attributes. The attributes can be used to symbolise the layer in various ways including:

3.9.1 Land with sea views

- Visual splay for each MCA
  - as a single block colour to illustrate visibility or absence of views of the sea surface
  - as a graded colour scheme showing extent of visibility of the MCA in quintiles
  - as a graded colour scheme showing extent of visibility from lowest to highest

  - as a graded colour scheme showing percentage of MCA visible from each location on land
  - visual splay for all MCAs combined
  - as a single block colour to illustrate visibility or absence of views of the marine plan areas (sea surface)
  - as a graded colour scheme showing extent of visibility of the marine plan areas (sea surface) in quintiles
  - as a graded colour scheme showing extent of visibility of the sea surface from lowest to highest
  - as a graded colour scheme showing percentage of marine plan areas visible from each location on land.

3.9.2 Sea that is visible from land

- Visual splay for each distance band (0-1km, 1-5km, 5-10km, 10-20km)
  - as a single block colour to illustrate the areas of sea surface that are visible from land (up to 20km inland)
  - as a graded colour scheme showing extent of sea surface visibility in percentiles
  - as a graded colour scheme showing extent of sea surface visibility from lowest to highest.

- Visual splay for all distance bands combined (0-20km)
  - as a single block colour to illustrate the areas of sea surface that are visible from land (up to 20km inland)
  - as a graded colour scheme showing extent of sea surface visibility(by viewers 0-20km inland) in percentiles
  - as a graded colour scheme showing extent of sea surface visibility from lowest to highest.

3.10 Application

Development of the approach to VRM coincided with the production of marine plan policy development for the East marine plan areas. This pilot approach has produced, for the first time, a baseline visual resource assessment for marine plan areas using an evidence base collected in a clear and consistent manner. The aim of this study is to enable future policy development for the South marine plan areas where this was unachievable in the East. The VRM work also lends itself to future applications at a strategic level that build on experiences elsewhere in Scotland and Wales, as summarised in Annex 5 of this report.

VRM maps produced for the South will form part of a suite of information used to enable decision makers to get a better understanding of the visual resource that each marine plan area provides. It is not appropriate for these maps to be used to assess the visual impacts of particular developments. It would be expected that any offshore development applications be accompanied by development-specific visibility mapping. The data behind the maps is intended to be used as a GIS resource that can be interrogated and viewed alongside other GIS information layers. The VRM mapping has also informed the descriptions of the Marine Character Areas in terms of the contribution that the sea and views of it make to sense of place.

It is anticipated that this pilot approach for producing VRM for the South marine planning process will be reviewed and developed for subsequent seascape assessments in future marine plan areas.

4. Lessons Learned and Limitations

This section provides a summary of the limitations of the seascape assessment undertaken for the South marine plan areas, both for the character and VRM elements. It also sets out how the study might benefit from further work in the South marine plan areas.

4.1.1 Character assessment

The main limitations of the character assessment undertaken for the South, and suggestions for future improvements, are as follows:

- **Time and resources available to undertake coast-based fieldwork**. The fieldwork undertaken in the South was primarily undertaken by boat survey. A more comprehensive understanding of character would be obtained from further survey work from the adjoining coastline. With many parts inaccessible by road, this would require careful time and resource planning.
- **Time and budget contingency for poor weather conditions.** Most survey days benefited from clear and calm conditions, but some observations were affected by poor visibility. Re-visiting the affected areas might be a future consideration.
- **Undertaking all survey work in clear and calm conditions.** Whilst important to health and safety and staff welfare this limits the extent to which the boat survey could heighten understanding of adverse sea and weather conditions and their contribution to marine character.
- **Focus of boat-based surveys on the inshore and coastal waters.** This recognises that influences on character tangible from the sea surface (as perceived from boat survey) are more apparent where land/sea interactions are taking place. Where possible, future assessments would benefit from even wider use of digital and consultation information for the offshore areas to ensure a fully informed and balanced assessment is made across the marine plan areas.
- **Further consultation and peer review.** The MMO might consider further consultation on the MCA description documents at a future date.
- **Evaluation of condition, sensitivity and future management needs.** The MCA desciptions provide detail on the current character of the seascape. These documents could be expanded to cover a review of current condition, forces for change and sensitivity, which in turn would inform the production of tailored management and planning guidelines.
- **Time and budget constraints.** The time and budget available for detailed reporting following consultation and boat survey work was constrained by set deadlines. Linked to the above points, a further review of the MCA descriptions might be beneficial to ensure they are as comprehensive as possible.

4.1.2 Visual Resource Mapping (VRM)

The overarching limitation for the development of the VRM in the South related to time and budgetary constraints. Suggestions for further refinement and additional work to further develop the approach are detailed below.

- **The mapped outputs represent the baseline scenario** i.e. the sea surface rather than any particular offshore development scenario, such as wind turbines. There is potential to build on this work with the addition of development scenarios (note that this will not increase visibility of the sea surface itself).
- **The modelling is based on a bare ground digital representation of the Earth's surface without any surface features.** Therefore visibility (and intervisibility) is likely to be an exaggeration of the actual situation. The addition of surface features such as buildings and vegetation would have the effect of disrupting some views. Adding in this information could be a future consideration to further refine the VRM results for the South.
- **The resolution of the Digital Elevation Model**. A finer resolution than that used in the current mapping could be used to account for small topographical features.
- **Views of the sea from France have not been considered**. Future work might source an equivalent digital elevation model for France.
- **Imposing a theoretical limit on visibility.** The mapping in the South applied a theoretical limit of 35km, based on current guidance relating to the visibility of offshore wind turbine developments. Future work may wish to explore this assumption in more detail.
- **Distance between observer points.** The work in the South placed observer points 500m apart. A finer-grained spacing may be considered to account for topographical features such as ridgelines and peaks.
- **An objective, not subjective assessment.** No provision was made to weight the analysis towards high quality views or locations where large numbers of people live/visit. Building in such qualititaive information is a future consideration.
- **The use of data from one Met Office station.** The validity of using visibility data from just one Met Office station as a proxy for visibility conditions in the South remains to be tested. Obtaining data from further stations may be a consideration.
- **Exclusion of sea to sea views.** After some initial exploration, it was decided that further exploration of sea to sea views was not a priority for this study. Mapping of sea to sea views could be extended in future to include views experienced along ferry routes and shipping lanes.
- **Information in the GIS attributes.** In addition to the VRM information contained in the GIS attribute tables, future work may consider including more information about each cell, e.g. designations, proximity to particular landscape/seascape features.

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Annex 1: Data List

Theme	Data Layers	Source (obtained from)	Basemap / context	Boundaries	Descriptions
Baseline information					
Maps and Charts	Admiralty Charted Raster - various scales	Oceanwise (emapsite)	Y	Y	Y
	Marine Themes charted vector features	Oceanwise (emapsite)	Y	Y	Y
	OS maps – 1:50,000	Ordnance Survey (MMO)	Y	Y	Y
	OS maps – 1:25,000	Ordnance Survey (MMO)	Y	Y	Y
Boundaries/ Extent of Jurisdictions	Mean High Water Mark	OS Open Data (OS)	Y	Y	
	Mean Low Water Mark & LAT	OS Open Data (OS)	Y		
	Renewable Energy Zone	UKHO (MMO)	Y		
	12 nautical mile limit	UKHO (MMO)	Y		
	Unitary Authority boundaries	OS Open Data (OS)	Y		
	Harbour limits	Oceanwise (emapsite)	Y		
	Marine Plan Areas	MMO	Y	Y	
	Ports	Oceanwise (emapsite)	Y	Y	
	Counties/Local Authority boundaries	OS Open Data (OS)	Y		
	UK Continental Shelf Limit (and other limits)	UKHO (MMO)	Y		
Other boundaries	Solent Forum boundary	Solent Forum (digitised)	Y	Y	
	IFCA boundaries	IFCA (MMO)	Y	Y	
	Vessel Transport Services area (Dover Strait)		Y	Y	Y
Character					
Land/ Seascape Character	National Character Areas	Natural England (Magic)		Y	Y
	Marine Natural Areas	Natural England (digitised)		Y	Y
	Terrestrial Natural Areas	Natural England (Magic)		Y	Y
	Seascape Character Assessment (East)	Natural England (MMO)		Y	Y
	Dorset Coastal and Marine Character Areas	Dorset Coast Forum		Y	Y

Theme	Data Layers	Source (obtained from)	Basemap / context	Boundaries	Descriptions
	Historic Seascape Characterisation • Devon to Dorset • Hastings to Purbeck • Thames Estuary and Kent	English Heritage (EH)		Y	Y
	Dover Strait Character Assessment	NOSTRA (LUC)		Y	Y
Natural					
Bathymetry and elevation	OS Landform Panorama	OS Open Data (OS)			
	Bathymetry	DEFRA (MMO)		Y	
Geology and Geomorphology	Bedrock,Sedimentary and Superficial	Oceanwise (emapsite)/BGS		Y	
	Geopark designation (English Riviera)	Devon County Council		Y	
Tides and Climate	Shoreline Management Plans	Environment Agency (MMO)		Y	
	Met Office data	Met Office			
Landcover/ vegetation/ habitats	European Habitat designations	Natural England (Magic)			Y
Biodiversity Designations	Special Areas of Conservation (SAC)	Natural England (Magic)			Y
	National Nature Reserves (NNR)	Natural England (Magic)			Y
	Ramsar sites	Natural England (Magic)		Y	Y
	Site of Special Scientific Interest (SSSI)	Natural England (Magic)			Y
	Marine Conservation Zones	Natural England (Magic)		Y	Y
	Important Bird Areas/RSPB Reserves	RSPB			Y
	OSPAR MPAs	JNCC		Y	Y
	UK BAP Habitats	Natural England (Magic)			Y
	Special Protection Area (SPA)	Natural England (Magic)		Y	Y
	Birds	JNCC ESAS			Y
Cultural/social					
Shipping and navigation	Activity and Licence	Oceanwise (emapsite)			Y
	Transportation and routes	Oceanwise (emapsite)			Y

Theme	Data Layers	Source (obtained from)	Basemap / context	Boundaries	Descriptions
	Shipping	AIS/Anatec (MMO)			Y
	Ferry routes and infrastructure	Oceanwise (emapsite)			Y
	National limits	UKHO (MMO)			Y
Recreation	Sailing	RYA (MMO)			Y
	Small craft mooring	Oceanwise (emapsite)			Y
	Tourism sites	OS/internet research			Y
	Bathing waters/beaches	EA, Blue Flag (MMO)			Y
	National Trails	Natural England (Magic)			Y
Industry, Energy and Infrastructure	Infrastructure	Oceanwise (emapsite)			Y
	Tidal Energy Resource	UK Renwables Atlas			Y
	Renewable Energy	The Crown Estate/4coffshore/REPD			Y
	Oil and Gas, aggregates	UK Deal, Crown Estate (MMO)			Y
	Wave Power Resource	UK Renewables Atlas			Y
Military activity	MOD areas	Oceanwise (emapsite)		Y	Y
Fishing	Fishing activity	CEFAS/IFCA Southern & Sussex (MMO)			Y
Landscape Designations	National Parks	Natural England (Magic)		Y	Y
	AONB	Natural England (Magic)		Y	Y
Heritage	UKHO wrecks and obstructions database	Oceanwise (emapsite)			Y
	Protected Wreck Sites/Other wrecks	English Heritage (EH/MMO)			Y
	Heritage Coast	Natural England (Magic)		Y	Y
	Historic Parks and Gardens	English Heritage (EH)			Y
	Listed Buildings	English Heritage (EH)			Y
	Protected Wreck Sites/Other wrecks	English Heritage (EH/MMO)			Y
	Historic casualties	English Heritage (MMO)			Y
	Scheduled Monuments	English Heritage (EH)			Y

Theme	Data Layers	Source (obtained from)	Basemap / context	Boundaries	Descriptions
Perceptual / aesthetic					
Light pollution	Night skies	CPRE			Y
Intrusion	Intrusion mapping	CPRE			Y
Tranquillity	Tranquil Areas	CPRE			Y

Annex 2: Boat Survey Assessment Form

General information

MCA Number & Name		
Date / time of survey	*Date:*	*Time:*
Conditions	*Weather:*	*Sea:*
Surveyor name(s)		

Physical and natural influences

Topography and geology *(land form, geological observations, nature of intertidal zone)*	
Scale and aspect	
Natural influences *(hydrological features, natural processes,)*	
Seas and tidal conditions *(prevailing weather conditions, tides etc)*	

Aesthetic and perceptual qualities

Aesthetic / perceptual qualities	
Degree of local distinctiveness	
Major land/sea marks and key views *(note any relationships with other MCAs)*	

Sea/coastal activities

	Marine	*Coastal*
Commercial/economic activities		
Recreational activities		
Cultural associations		
Any other observations		

Annex 3: Summary of Workshop Comments

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
Lyme Bay West	Protected Landscapes, 26 June 2013	- Intervisibility across the whole of Lyme Bay (into MCA 2) - Harbouring coast, more sheltered than MCA 2 - Tor Bay: very embayed, sheltered and enclosed - Bury Head and Sharpham Point form a junction between the developed bay to the north, and rugged, high cliffs with long views out to sea (high exposure) to the south - Wreck diving and recreational fishing	- **'Tor Bay and** Lyme Bay (West)' as Tor Bay is a very distinctive part of the MCA - Look at south-western boundary as it intersects the land
	Dorset Coast Forum, 1 July 2013	<u>Group 1</u> - Characterised by ports, shipping and fishing - Anchorage for ships - More 'humanised' – buildings, resorts and ports - More fishing - Water quality is different here <u>Group 2</u> - Distinctive fishing – whole of Lyme Bay is heavily scalloped - Main ports are Brixham, Exmouth, West bay, Lyme Regis and Weymouth with smaller ports at Beer and Sidmouth - West Lyme Bay has a more commercial and industrial character (compared to east which is recreation and tourism) - Heavily potted and fished across the whole bay - MCA 1 forms a place of refuge in heavy sea conditions – major tankers often anchor up off Torbay - Aquaculture developments are expected in the western part of Lyme Bay e.g mussel farms - World War II connections at Slapton Sands – D Day practice	- Can't have 2 Lyme Bays! - Not happy with 'Tor Bay' (east and west is better)
	Devon Maritime Forum, 3 July 2013	- Estuaries: very different character to much of the coastline. Should be brought out in descriptions. - Exe Estuary is a product of both human and natural factors (sediment constraints e.g. from railway)	- Lyme Bay could just be one area - Geological faultline at Seaton Chine, western end of Seaton

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Exe Estuary: international bird habitat - Light conditions from Exmouth estuary and coast are favoured by artists - Railway line (linking resorts) with key views across bay and red cliffs - Can see ships on horizon - Coastal defences from Dawlish are very prominent, different flood defence policy due to protecting the railway. - Other areas to the east will be left (existing defences). - Tor Bay is a Geopark which extends offshore. - Brixham trawlers - Remains of early man/artefacts (Tor Bay) - When human occupation – land covered the channel (before it was submerged) - Growth of C19th tourism resorts, coinciding with the railways - Dartmouth and Brixham are key centres - Shellfish, crabbing, potting, mussels (Exe) - Early fishing connected with Newfoundland - Quad bike fishing - Area critical in establishing historic links overseas - Recreation: • Estuaries; marinas, yachts, people able to go out to sea. • Harbouring areas; more fishing activity (commercial) than MCA2. - Big focus of activity in this part of Lyme Bay (as opposed to Dorset side) - World War II training exercises were carried out in the area with radar stations along east of MCA1 into MCA2. - Character of beaches change with those west/south of Exmouth being sandier and more sheltered - Devon: • Big change into developed coastline • More gentle climate • Calm, sheltered bay	Promenade (could more appropriately form boundary with MCA 2) - Can the Jurassic Coast World Heritage Site be used as the boundary? - Consider inshore boundary – further out? - Check curving line (geology)

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		• Historic tourism centres; transport links - South West Coast Path - High cliffs (apart from around main settlements) - Varied coastline	
Lyme Bay East	Protected Landscapes, 26 June 2013	- Wreck diving and recreational fishing - More exposed, wrecking area - Practice for Normandy landings on Chesil Beach - Golden Cap: highest point along the whole of the south coast - Diverse and dynamic coastline – very active, landslips – including the largest in Britain - Fossilised landslides also visible along the shoreline – toes extending into the sea - Coastal navigation marks for Lyme Bay: Hardy's Monument, Osmington White Horse, Clavell Tower	- Lyme Bay **East**
	Dorset Coast Forum, 1 July 2013	<u>Group 1</u> - Wild area - World Heritage Site - Protected areas - Different human perception (compared to MCA 1) - More coastal processes – land slips - Better water quality than in Lyme Bay West - Strong tidal pull - Marine litter - Beach angling (e.g Chesil) - Very exposed - More tranquil and less recreational activity <u>Group 2</u> - Chesil Beach is a distinctive and iconic feature – a text book example of longshore drift - Tourism, leisure and recreation character (fewer large fishing vessels) - Netting and pot fisheries with large vessels in the west part of the bay	- Good to have boundary where it is between 2 and 3 due to the sea conditions

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Outside the 12 mile limit = Belgian, French, Spanish beam trawlers across the Bay - Sea conditions are generally rougher in the east (unless there is an easterly wind) - Smaller diving sites (U boats and submarines) but not as commercial as MCA 4 - Moonfleet set here - Abbotsbury Fleet = test site for the bouncing bomb (Barnes Wallace) - Smugglers Trail at Golden Cap	
	Devon Maritime Forum, 3 July 2013	- Literary associations	
Portland Bill and Lulworth Banks	Protected Landscapes, 26 June 2013	- Iconic coastline: Durdle Door, Lulworth Cove - Inspiration for artists, including Turner (coastal landscapes and seascapes) - Historic quarrying directly off the sea cliffs into waiting ships – Portland stone used for St Paul's cathedral; Purbeck stone also used on other famous London buildings - Portland Harbour: deep waters used by the Navy - Military exclusion zone off Lulworth – live firing continues - World War I and II features around Swanage - Double high tides	- Check boundary between MCAs 3 and 5 *(now 6)* – less North-South line, have a look at the Dorset LDA report boundaries
	Dorset Coast Forum, 1 July 2013	<u>Group 1</u> - Stunning sweeping coastline views to and from sea - Commercial ports – Weymouth port and harbour - Informal recreation and formal (sailing) recreational use - Coastal defence/MOD - MOD history - Active coastal processes - Inshore fishing fleet - Charter boats/angling - Good bathing waters	- Lulworth Banks – this is too local (don't mention in name) – although opposite comment also made in other group (see below) - Portland Bill to Durlston better - Confusion over names – why are some headland to headland and others something else?

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Strong tidal resource – (as per the Tidal Atlas) and dynamic tidal flow - Important coastal archaeology - Rocky reefs (SAC) – high biodiversity value - Features heavily in literature and art - Dominance of land – historic buildings <u>Group 2</u> - Tourism based – Swanage, Lulworth (but note that Portland Bill is very different = major port) - Extensive military activity - Much less intensely fished – few fishing boats at Lulworth, Swanage and Poole – mainly potting and netting - Important Bass fishing at Portland Race (rod and line) - Recreational charter boats are a characteristic (angling) especially high density of fishing over the Shambles – Sole, Bream, Bass - Scuba diving activity across the whole MCA e.g Kimmeridge – geological feature and wreck sites - A number of large commercial dive companies based at Swanage and Castletown, Portland - Large wreck sites, including off Portland - Important for art and literature – inspirational coast – Powys circle - Augustus John, Elizabeth Monks, Sylvia Townsend Warner based at Chalden Herring (Bloomsbury offshoot) - Important sea bird colonies at Durlston and Portland – which tie the two ends of the MCA together - Important bird migration route via Portland - Migratory fish (Salmon) up Avon, Itchen, Frome, Piddle and Fleet - Kimmeridge marine nature reserve (check location) - Moonfleet set in MCAs 2 and 3	- Should Poole Bay be separate or bought into part of MCA 5 *(now 6)* – the bay connection with the open sea is very strong? But also acknowledged boundary due to chalk ledge and tidal races which clearly delineate a line between Needles and Durlston - If based on tidal regimes MCA should be larger - Portland Bill tidal stream is local not strategic - MCA3 should go to Durlston Head
	Devon Maritime Forum, 2 July 2013	- Portland Deep and Military Danger/exercise zones	- Should be renamed ‘Portland, Weymouth Bay and Purbeck’

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
Poole Harbour and the Solent *(note these are now split into 2 MCAs)*	Protected Landscapes, 26 June 2013	- Unique tidal system - Henry VIII fortifications, e.g. Hurst Castle - Undeveloped New Forest coastline – saltmarshes and mudflats – strong naturalistic character and home to overwintering birds - High ecological and landscape importance of the coastline - New Forest coastline: unique in its sheltered character; views out to sea 'constrained' by the Isle of Wight, but intervisibility between the two a key feature of the seascape - Beaulieu River – only privately owned estuary in the country - Distinctive treed coastline east of Lymington - Chichester Harbour AONB suffers from small size. All special qualities relate to coastal edge/ relationship to the sea. All is enclosed estuarine seascape, important intertidal habitats, shoreline oak woodland. Strong cultural influence of historic harbour - Oyster fisheries at Chichester Harbour - Importance of this area as a recreational resource - West Wittering 1.5 million visitors annually (most visited SE destination?). Important sailing harbour and sandy beach - Flat landscape around Chichester Harbour – high sensitivity and huge impact of any development with height element - Business and congestion of leisure craft/shipping – part of character or impact on tranquillity - Note Southampton water is dredged to maintain deep water channel - Conflict between Studland anchorages and seagrass habitats - At Selsey Bill – note shoreline change, coastal erosion, and a major managed realignment project.	- Consider boundary change– better to go to Selsey Bill and retain harbour and associated seascape. View out of harbour is key to character. This area has a consistent character including mudstone, fishing, marine wrecks (important for diving) - Include 'and harbours' in the name
	Solent Forum, 27 June 2013	- Tides - Intervisibility between the Isle of Wight and Solent coastline key to character - Poole Harbour and Christchurch Bay has open views along the coast, to the Isle of Wight and out to sea - Views of the sea in the Solent are east-west, not just to the south.	- The Solent is very varied and would justify further division based on levels of coastal development and marine traffic, and levels of tranquillity. Would justify an

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- What about views at night / influence of lit navigation markers? Important aspects of character (e.g. views to The Needles lighthouse and lit buoys). - Backdrop of the South Downs to Chichester Harbour and the eastern Solent	East/West split - The seaward boundary in the west should follow limits of views, not bathymetry - The seaward boundary in the west should be more easily justified – e.g. following the chalk ridge linking IoW and Durlston Head (including Swanage) - The eastern boundary should extend to Selsey Bill (see boundary of the Solent Forum's remit)
	Dorset Coast Forum, 1 July 2013	<u>Group 1</u> - MCA 4 is characterised by heavy recreational use plus some commercial shipping - Fishing port - Ports and ferry services - Conurbations - High recreational use – formal and informal - Tourist industry important - Shallow warm waters - Important in literature and art - European marine site - Water quality challenges – nitrates – link to landscape - Oil terminal dominant - Importance of fishing in Poole Bay - Future – Navitus <u>Group 2</u> - MCZs – Poole Rocks and Stennis ledge accepted in first round - In the Solent and Poole harbour nitrate discharge into the sea is a	- Happy with name - Does boundary between Needles and Durlston make sense in real life?

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		key issue but not in other MCAs - Importance of connection of Poole Bay with open sea and long views out from harbour (unlike the Solent) - Hengistbury is a major landmark on coast = golden point between the white Needles and Old Harry – very important marker in views to the coast form the sea - Weymouth and Poole = both important as ferry routes and gateways (departure and arrival points for people) – this coastline is important in views from ferries - Busy recreational yachting areas characterise both Poole harbour and Solent - Dorset AONB highlight the variation and complexity of the coast, undeveloped coast, sea views in and out, wrecks - Important cultural aspects – artist groups based at Swanage - Quarrying of cliffs at St Aldens Head and Durlston Ledge/Dancing ledge - Important to get RSPB migratory routes – key migratory route via Poole harbour - Marconi – first signal across the atlantic from poole - Smuggling connections at Durlston and Portland - Migratory fish (Salmon) up Avon, Itchen, Frome, Piddle and Fleet - Important Bass nursery in Poole harbour - Poole – D day departure point - Weymouth and Portland = military harbours (1800 and 1850's)	
Isle of Wight (South) and Offshore Waters (*Name changed to 'South Wight')*	Protected Landscapes, 26 June 2013	- South-west coast is very exposed – compared to eastern 'chines' - Undeveloped coastline (north) fringing the Solent - Rare treeline all the way down to the water's edge - Historic features visible as navigation markers, even within the settlements – e.g. Ryde church tower, pier, Yarmouth Pier - Development is discrete and separated by sections of undeveloped, wooded coastline - East of the island is settled (contrast to the west) – influence of the	- Suggest 'South Wight'

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		19th century railway route - St Catherine's Race: strong currents off the headland - St Catherine's Deep: rumoured to be a military 'dump' for ammunition (none discovered though)	
	Marine Matters, Sussex, 5 July 2013	- In MCA 4 and 5 make sure description picks up factors such as the Hounds – reef structures nearer the shore	- East Bracklesham Bay – this should be included as part of MCA 4 – use 10 m contour as the boundary line
	Solent Forum, 27 June 2013	- Eastern side of the island includes 'seaside resorts' and the most development	- Agree 'South Wight'
	Dorset Coast Forum, 1 July 2013	- Area of transit 'no parking zone' - Offshore MCZ - 'Interlocational' area in terms of views	- Happy with name
Selsey Bill to Seaford Head	Sussex Marine Matters, 5 July 2013	- Be aware that other bits of the South Downs National Park come to the coast here as at Rottingdean and these gaps are very important for visual connections to and from the sea. - Note that the Heritage Coast also extends into this area (don't place all emphasis for South Downs in MCA 7). Also note the views to seascape over Brighton and developed coastal edge to the sea from South Downs inland are also important - Note presence of chalk reef west of Brighton Marina - Major developments in SE along coastal plain here – urban sprawl. Valleys, gaps, rivers to sea = important communications routes historically and today - Piers, jetties and groynes = immediate seascape - The strategic gaps between conurbations are very significant to people and in views from and to the sea - Popular seaside resorts e.g Brighton - Shingle beaches – seaside heritage and vernacular – piers, etc. - Note crustacean fishery at Selsey Bill - Static gear fisheries - Selsey Bill and gasometer – distinctive features from sea to land	- A logic to these boundaries - Look at Admiralty chart for boundary between 5 *(now 6)* & 6 *(now 7)* – dogleg the boundary to take account of reefs and tide as at Portland? - Locally known as the Bay of Sussex

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Piers at Worthing and Brighton - Newhaven – working/industrial harbour - White 'stark' cliffs at Seven Sisters – very different to chalk at Dover - Esturaries and ports	
South Downs Maritime	Protected Landscapes, 26 June 2013	- See South Downs website for special qualities and strong relationship to the sea (also see South Downs inspector's report plus South Downs Landscape Character Assessment) - Importance of visual and physical links between the Downs and coast - Cuckmere Haven is the only undeveloped estuary in the SE - Strategic gaps in development such as at Newhaven are vital in maintaining relationship/connection between Downs and sea. Important to bring these out MCA baseline key characteristics and description - Chalk ledges – European designated. Beachy Head west – wave cut platform (MCZ) - Importance of dark skies along undeveloped Heritage Coast (in this MCA and others) - A changing landscape at Cuckmere Haven – future EA will withdraw sea defences – area of managed retreat - Key issues in relation to Rampion offshore wind farm and relationship with National Park special qualities and historic character - Landfall and terrestrial cabling relating to offshore windfarm proposals in National Park and substation at Bolney - Importance of estuaries of Arun, Adur and Ouse – (hydrological impacts of any developments here) - Pressures for development in Worthing, Littlehampton, Arundel (development squeeze along the south coast) - Pressures for marine aggregates - Port development at Newhaven – visual impact landward and seaward. This is an important strategic gap in the MCA (views from sea to land) – need to bring out in MCA baseline description	- Boundaries make sense

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
	Sussex Marine Matters, 5 July 2013	- Iconic coastline of Seven Sisters, cliffs and important stretch of undeveloped coast - Internally recognised - Strong cultural links – Armada, wrecks - Significant headland at Beachy Head plus deep water - Need to look at South Downs special qualities and National Park designation report – no coastal boundary – includes seascape here - Fixed gear fishing and potting	
Eastbourne, Pevensey and Rye Bays	Protected Landscapes, 26 June 2013	- Note High Weald AONB – distinctive landscape – Fairlight, cliffs, Hastings and Pett Level. Strong character and distinct biodiversity/geology. Relationship between protected landscape and seascape important here (although generally High Water AONB more inward looking). - AONB has done relatively little work on seascape. All of AONB coastline is SSSI and of geological interest - Biological interest at Fairlight Glen – typical ghyll landscape – bryophytes/ferns - Strong cultural links to sea. Weald and ports at Rye and Winchelsea. Weald is a source of timber for shipbuilding. - The part of undeveloped coastline which is the AONB is extremely important perceptually – tranquillity/break in development along this part of the south coast	- Look at name – add Hastings - important maritime town – fishing and defence/invasion, and strong cultural links to sea, also note Fairlight in name.
	Sussex Marine Matters, 5 July 2013	- Fixed gear fishing in Eastbourne Bay - Rye and Hastings both have fishing fleets – inshore trawling fleets (see IFCA website) - Important culturally – e.g fishing community and heritage of Hastings. The historic centre of Hastings is focussed on fishing – important beach fishery - Fairlight cliffs are important feature especially from sea - Camber sands – one of few sandy beaches in SE and presence of sand dunes here - Dungeness power station is key feature	

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Rye – key port (now inland) - Hastings – lots of cultural/educational activities associated with seascape including the wreck museum FLAG = fisheries local action group	

	NOSTRA (Kent), 19 July 2013	- Importance of Fairlight as a headland, notably in views from the sea
		- Fairlight as key divider within the area (2 bays one developed to west and one undeveloped to east)
		- Old cliff line behind the coast is a key feature and offers good views out to sea
		- Recreational fishing at Dungeness
		- Importance of smuggling
		- Land reclamation
		- Napoleonic defences – Martello towers
		- Life boat stations – have own heritage (buildings and boats and should be plotted)
		- Small fishing fleets at Rye, Hastings, Dungeness
		- Fishing launching from beach at Hastings and Dungeness – important coastal heritage
		- Recreational beach fishing at Dungeness
		- Sand dunes at Camber
		- Sound mirrors on Romney Marsh
		- 6th continent
		- World War II links
		- Sand into shingle into cliffs as you head west
		- Military area
		- Cinque port
		- Amsterdam wreck at Hastings
		- Hastings = net sheds and low tech inshore fishing fleet (beach)
		- Hastings cultural quarter (folk music associated with the sea)
		- Smuggling
		- Rye – tourist destination
			- Should this be 2 MCAs or are these too small for this strategic study?
			  - Pevensey Bay and Hastings
			  - Rye Bay
			  - Useful to have a Kent focus point in the title e.g Dungeness
			  - Names should use landscape prominent features to describe

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Camber Sands – sand dunes and vast sandy beach one of few in SE) – sand surfing, wind surfing and kite surfing	
Hythe and East Wear Bays	NOSTRA (Kent), 19 July 2013	- Wave cut chalk cliffs – "white cliffs" - Active dynamic coastal habitats - Shingle bank – Dungeness – largest shingle ridge in Europe - Romney – medicinal leeches and bees - Note that this character area includes 2 fisheries areas – South North Sea and English Channel - Note fisheries split in this area – cod recovery in North sea = less quota, but higher quota for the species in the south. - Small fishing fleets at Folkestone - Recreational fishing at Hythe - Folkestone – potting, whelks, scallops, lobster - Traditional low tech fishing communities - Importance of smuggling - Defences at Royal Military Canal at Hythe - Romney Marshes churches - Saxon Shore (Lyminge) – Roman - Martello towers are a key feature - Castle Hill prehistoric site - Historic defences and historic military features e.g sound mirrors at Greatstone - Wrecks everywhere! - Cultural associations include Turner, HG Wells, Jocelyn Brook (writer) - Romney Marsh has long attracted artists - Derek Jarman cottage and surrounding shack developments at Dungeness and artistic community - Folkestone has a cultural quarter and a strong creative hub - Ingoldsby legends - Dungeness = deserted landscape; remote wilderness character	- Names make sense - Must maintain Dover Strait classification (chalk) as the next character area up (i.e. in adjacent Marine Plan Area) - Name – Dungeness to Folkestone and Hythe - Note that the South Marine Plan boundary follows a line of latitude (character is not defined by this line)

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Dover – tidal energy opportunities - Historic lost harbours associated with the Cinque ports - Greensand cliffs - Heritage Coast - Multitude of designations - Nuclear power station - Cheney wind farm very prominent in views from the sea - Flood defences - Harbour at Folkestone with Influence on land and sea use - Proximity to shortest channel crossing - MOD area - undeveloped coastline and 'danger' area at sea – lack of recreational/fishing activity - Views of France (sometimes very clear – can pick out individual buildings in Calais + nightime visibility of offshore wind farm at Caps - Channel Tunnel - Romney, Hythe and Dymchurch railway - Note that Dungeness characterises both MCA 8 and 9 (Dungeness lighthouses (old and new)) - Unplanned ribbons of development along coast plus Dungeness 'wild west' landscape - Marine pollution – orange sulphurous haze hangs on horizon – particulate emissions from shipping – (smog/haze) – key detractor in this area – thick brown air - Water sports – wind surfers and kite surfers characterise the coast between Littlestone and Greatstone	
Dover Strait Inshore Waters	NOSTRA (Kent), 19 July 2013	- Cataclysmic event – mega flood - Periodic transformation between sea and land over last 2 million years - Break of land bridge 4,000 years ago - Varne Bank is a gravel extraction site - Shallow banks - Fishing (check Balanced Seas reports)	

MCA	Workshop	Key characteristics/special qualities	Boundaries/names
		- Shipping – shipping motorway - National border - Immigration/migration exchange point over many many years - Cross channel swimming - Smog - Views of France - Views of cliffs from the sea	

Annex 4: Organisations Consulted

Consulted Organisations		
ABPmer	Gosport Harbour	Portland Harbour Authority Limited
Adur Council	Hamble Harbour	Portsmouth Council
AONB Dorset	Hampshire County Council	Portsmouth Harbour Master
Arun Council	Hastings Council	Purbeck Council
Ashfords Solicitors	Havant Borough Council	Purbeck District Council
Borough of Poole	High Weald AONB	Purbeck Heritage Committee
Bournemouth Council	Horsham Council	Rother Council
Brighton and Hove Council	Independent experts	Royal Yachting Association
Campaign to Protect Rural England	Isle of Wight AONB	RSPB
CEFAS	Isle of Wight Council	SeaTorbay
Chichester District Council	Isle of Wight Estuaries Partnership	Shepway District Council
Chichester Harbour AONB	Jurassic Coast Trust	Sidmouth Town Council
Chichester Harbour Conservancy	Kent and Essex IFCA	Solent Forum
Christchurch Council	Kent AONB	Solent Protection Society
Cornwall Council	Kent Coastal Network	South Coast Fishermen's Council
Cowes Harbour	Kent County Council	South Devon AONB
Campaign to Protect Rural England	Kent Wildlife Trust	South Devon AONB Estuaries Partnership
Dartmouth Harbour Authority	Langstone Harbour	South Downs National Park Authority
East Devon AONB	Lewes Council	Southampton City Council
Devon & Severn IFCA	Littlehampton Harbour	Southampton Harbour
Devon County Council	Local Nature Partnerships (LNP) – Bournemouth, Dorset & Poole	Southern IFCA
Devon Wildlife Trust	Local Nature Partnerships (LNP) - Devon	Sussex IFCA
Devon Maritime Forum	Local Nature Partnerships (LNP) - Hants and Wight	Sussex Wildlife Trust
Dorset AONB	Local Nature Partnerships (LNP) - Kent	SW Protected Landscapes
Dorset Coast Forum	Lulworth Estate	Swale Borough Council

Consulted Organisations		
Dorset Countryside	Lymington Harbour	Teignbridge District Council
Dorset County Council	Marine Conservation Society	Test Valley Council
Dorset Wildlife Trust	Marine South East	The Rivers Trust
Dover District Council	Maritime and Coastguard Agency	The White Cliffs Countryside Partnership
E.ON	MOD	Torbay Council
East Devon AONB	National Trust	UK Chamber of Shipping
East Devon Council	Natural England	Visit Kent
East Sussex Council	Natural Environment Research Council (NERC)	Wealden Council
Eastbourne Council	Nautical Archaeological Society	Wessex Archaeology
Eastern Solent Coastal Partnership	New Forest District Council	Wessex Water
Eastleigh Borough Council	New Forest National Park Authority	West Dorset District Council
English Heritage	Newhaven Port	West Sussex County Council
Environment Agency	Newport Harbour	Weymouth & Portland Borough Council
Euro Tunnel	Plymouth University	Weymouth Harbour
Exe Estuary Partnership	Poole Council	Winchester Council
Exeter Council	Poole Harbour Commissioners	Worthing Council
Fareham Council	Port of Dover	WWF
Gosport Council	Port Solent Marina	Yarmouth Harbour

Annex 5: Review of Other Approaches to Inform the Development of the Visual Resource Mapping

Wales

Guide to Best Practice in Seascape Assessment (Hill *et al.*, 2001)

Much of the seascape assessment work that has been undertaken in Wales refers to the *Guide to Best Practice in Seascape Assessment* written in 2001 as part of a Maritime Ireland/Wales INTERREG project[8]. This guidance document was intended to assist policy formulation, decision making and project inception along the coast and the seas of Wales.

This report looked in depth at visibility issues relating to judging scale and distance when looking out to sea and also acknowledged the influence of climatic conditions on visibility. The report discussed how the elevation of the viewer (i.e. a person) influences viewing distances offshore.

Figure 1, taken from the above guidance, is used to illustrate the step by step process of defining seascape units at different spatial scales. In this case, the seascape units would be used as the basic unit for characterisation.
The suggested method sets out the following steps:

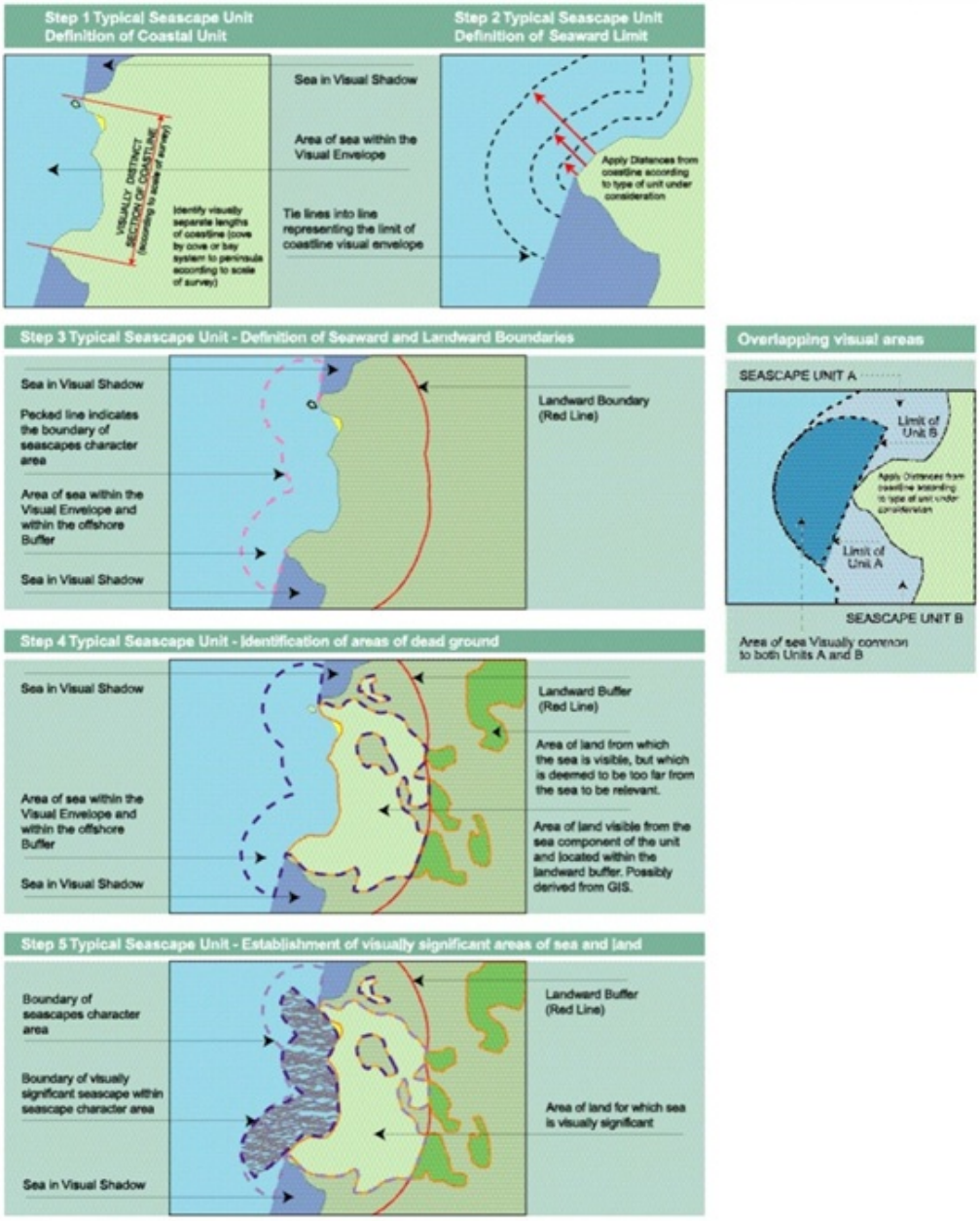
- Define the lengths of coastline for each unit (varying according to scale, but typically headland to headland)
- Establish a seaward limit of seascape units (suggested as 24km for a national scale) by projecting lines in the sea at set distances
- Establish visibility splays at each end of the seascape unit (using GIS)
- Establish the landward boundary – using viewsheds in GIS with a cut-off point (in this case 10 kilometres was viewed as appropriate)
- Identify areas of dead ground
- Establish the visually significant areas of sea and land
- Confirm areas on site through field study.

The stages that followed describe how to move from this initial mapping stage into a field-based visual analysis of the areas and then on to describing the characteristics of each seascape character unit.

For national units, it was acknowledged that the length of coastline that might be covered by one unit may be in excess of 100km, so they could not be based on visual criteria as either limit of such a unit may not be visible from many locations within it.

[8] Hill *et al.* (2001), *Guide to best practice in seascape assessment.* Prepared by the Countryside Council for Wales, University College, Dublin and Brady Shipman Martin as part of a Maritime Ireland/Wales INTERREG project.

Figure 1: Steps in defining seascape units in Wales (Hill *et al.*, 2001).



Information of relevance to the VRM approach:

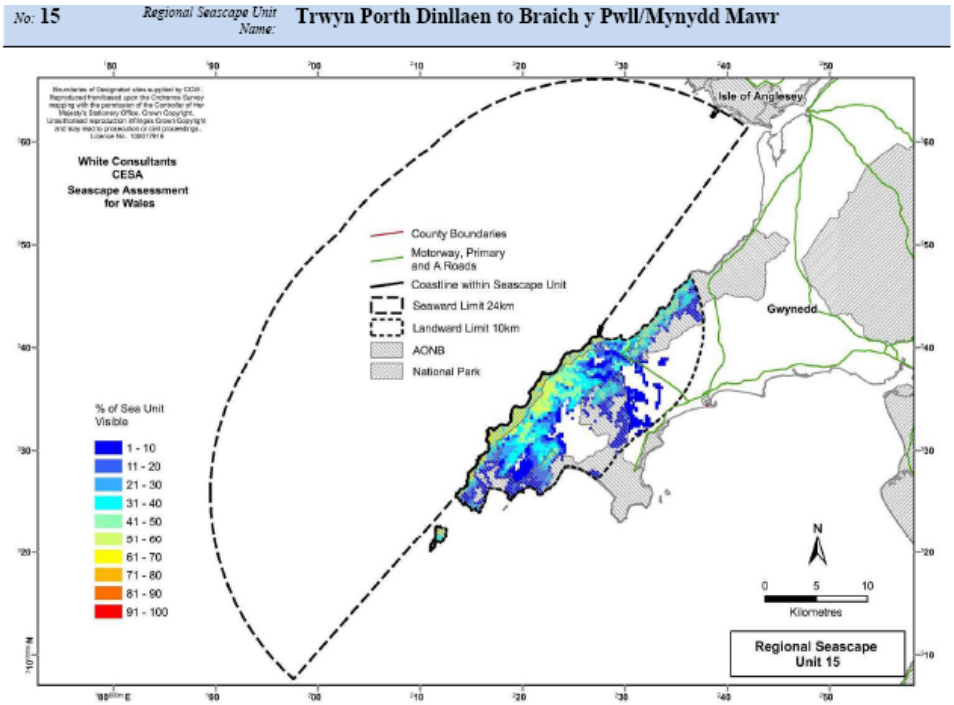
- GIS viewshed mapping is an established method for exploring intervisibility between land and sea.
- Although the seascape units were defined by visibility criteria only, they went on to form the basic units for more detailed characterisation.
- The seascape units extended to a standard distance offshore and onshore. Whilst 10km is appropriate in this instance, this distance needs to be tested for other locations.

Welsh seascapes and their sensitivity to offshore developments (CCW & White Consultants, 2009)

In 2009, the Countryside Council for Wales (CCW) and White Consultants undertook a study to assess the Welsh seascapes and their sensitivity to offshore developments[9]. This built on earlier work undertaken by White Consultants in 2008 and the 2001 work described above. This assessment sought to establish 'what characteristics and qualities make each part of the Welsh coastline distinctive and give its sense of place'. The study provided an assessment of the entire Welsh coast at a broad-brush scale. Whilst the study focused on the visual or scenic aspect of the coastline, it referred to the geological, land use, historic and cultural aspects as well.

One of the main outputs of the study was a regional-scale classification of 50 seascape units. These each take in a length of coastline running between two major headlands; all sea surface visible from the coastline out to 24 kilometres in any direction; and area of land with views of the sea within the seascape unit. 24 km is coincident with the National 12 nautical mile offshore limit. An example is included in Figure 2 below.

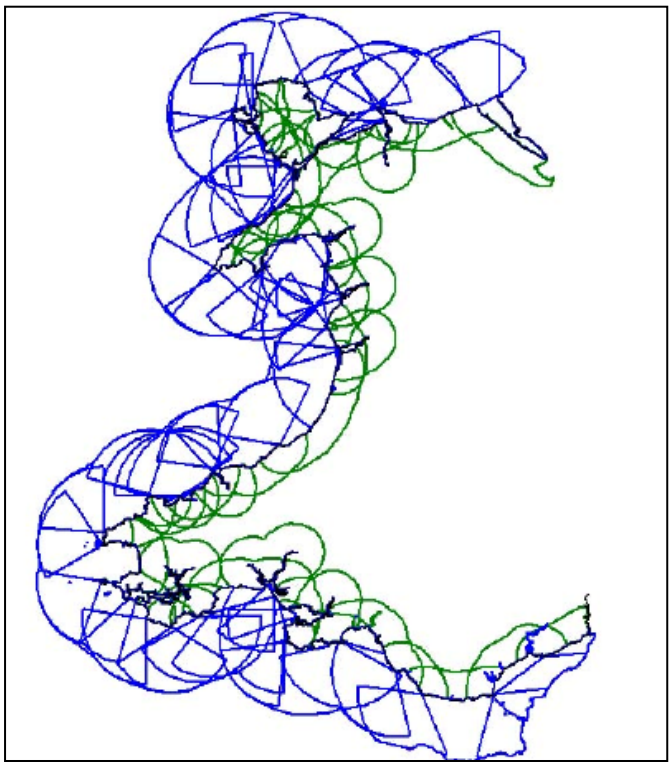
Figure 2: Example of a Regional Seascape Unit in Wales.



All 50 Regional Seascape Units together result in a complicated web of overlapping units as shown in Figure 3.

[9] Briggs, J. and White, S. (2009). Welsh seascapes and their sensitivity to offshore developments: Method Report. Countryside Council for Wales.

Figure 3: All Regional Seascape Units in Wales.



A national overview report was produced as part of the suite of outputs, and within this report, national scale intervisibility maps were produced. Two maps from this report are included at Figures 4 and 5.

Figure 4 shows 'Land with sea views' – illustrating that most land to sea visibility occurs within 10 kilometres of the coastline. The calculation only included land to sea views out to sea as far as 24 kilometres and assumed a bare ground surface. A bare ground surface represents the topography of the earth's surface without including any surface features such as vegetation, buildings, etc. Micro topography, e.g. of sand dunes, is ignored.

Figure 5 shows the relative visibility of the sea surface from land. This map shows how much land can be seen from the sea surface, taking relative values for Wales as a whole. It takes into account topography and the earth's curvature. It covers the areas of sea between 0 and 24km from the coastline (Mean High Water). Those areas showing highest visibility tend to be where surrounding landform rises (known as the 'amphitheatre effect'). Areas with the lowest visibility tend to be near the coastline, on peninsulas, where they are shielded from wider view by local landform. The data used only related to visibility from land in Wales, so if England was added,

Liverpool Bay and the Severn might by depicted as having higher levels of visibility. Both of the mapped outputs below are being used by Natural Resources Wales to roll out a national SCA, building on work undertaken by LUC in 2012 to pilot a character assessment approach in North West Anglesey. This is both in terms of informing the boundaries of character assessment units (similar to the Marine Character Areas defined for this study), and the accompanying character descriptions.

Figure 4: Land with sea views in Wales.

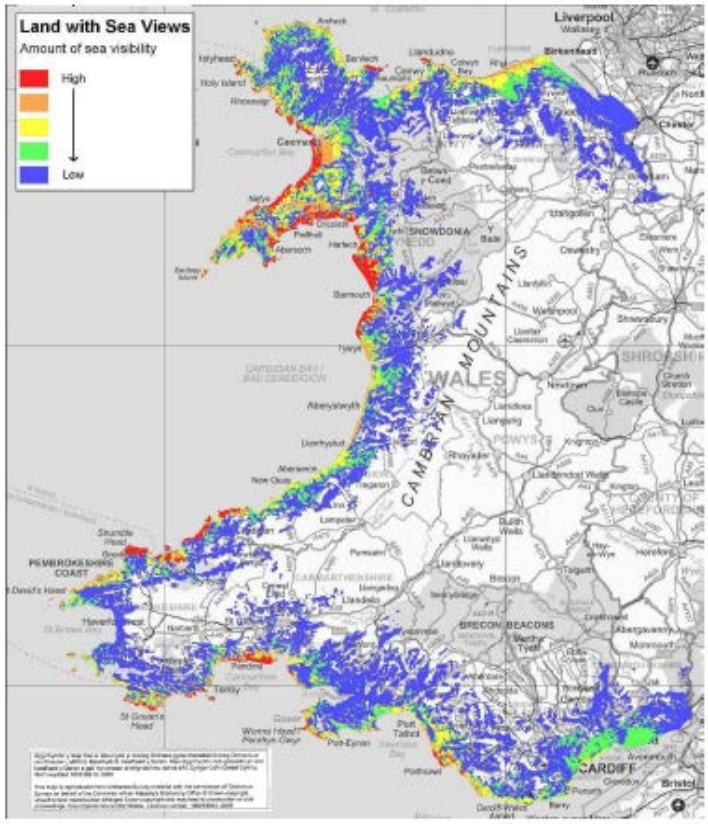
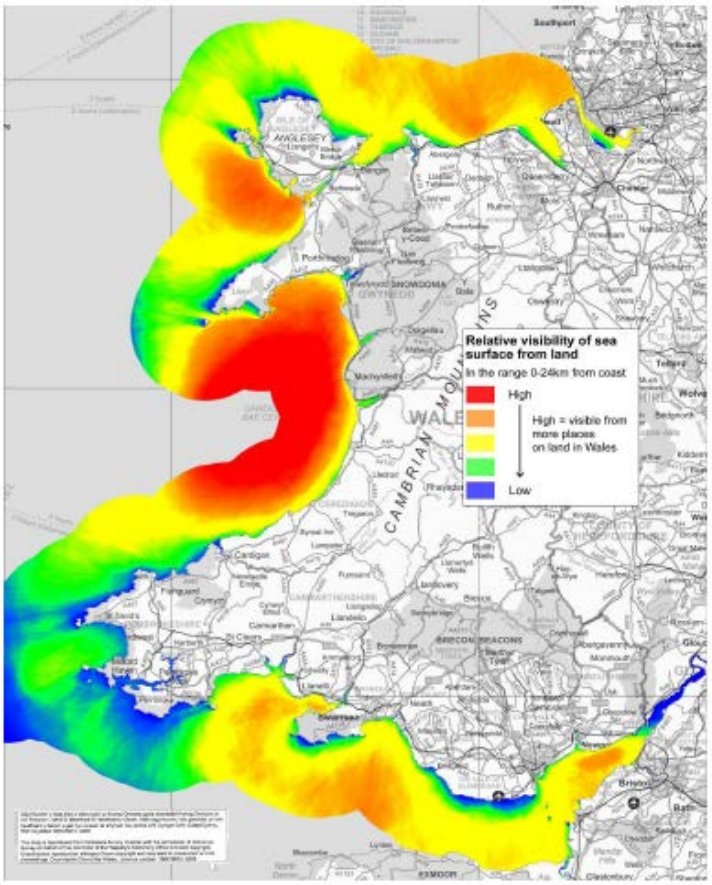


Figure 5: Relative visibility of the sea surface in Wales.



Information of relevance to the VRM approach:

- Overview maps showing land with sea views and sea surface visibility are a useful tool to understand the visual relationship between land and sea
- In the Welsh context, the most extensive views of the sea are within 10km of the coastline
- Overview maps require careful interpretation as not all areas that are expected to show very high intervisibility show as the darkest reds. This is because the visibility scale is relative to the whole of Wales and although an area can have high intervisibility, it will not be the darkest shade of red if there are other areas with higher intervisibility.

Welsh Seascapes and their Sensitivity to Tidal Stream Development (LUC, 2011 for CCW)

This study, undertaken by LUC in 2011 on behalf of CCW, was commissioned to provide the landscape and visual evidence for a GIS tool being developed to inform advice on the potential environmental impacts of tidal stream development around the Welsh coast. The study focussed on four areas – Anglesey, Llŷn, Pembrokeshire and the Severn Estuary.

The regional seascape units defined for Wales (as described above) were considered to be too strategic to use as the spatial framework for this particular assessment. It was therefore necessary to create smaller sub-units that could be used as the basis for the assessment. A linear characterisation of the coastline was undertaken extended out to 5km offshore. The sub-units had an associated landward extent of up to 15km. Further offshore, units were less 'defined' and were based on distance only.

As one of the elements of the study relating to views and visual amenity, GIS was used to generate Theoretical Zones of Visibility of theoretical tidal turbine devices placed in each sub-unit. This method was used to test the maximum potential visibility of tidal stream development.

For each sub-unit defined, the character of the land within the ZTV was described and where possible quantified. This allowed an evaluation of the potential impacts for each sub-unit under this development scenario.

Information of relevance to the VRM approach:

- Although attempts were made to use the Regional Seascape Units as the spatial units for this study, they were found to be too strategic
- The study showed that it would be useful to have spatial units that were based on areas of similar character rather than units that had shared intervisibility only.

Pilot Seascape Character Assessment for Wales (LUC, 2012)

In 2012, CCW published a pilot SCA for Wales undertaken by LUC. The pilot was to explore the emerging technique of SCA, using a study area in North West Anglesey to pilot the approach. Similar to the 'character' strand of this current South marine plan area assessment, this study focused on using the SCA Wheel (Natural England,

Countryside Council for Wales, Scottish Natural Heritage, 2011) to define, assess and describe the character of defined areas.

The previous map showing land with sea views (Figure 4) was used to help inform the landward boundaries of the character areas used for this study – identifying those areas with moderate to high sea views and using that information, along with other sources (particularly LANDMAP – Wales's national landscape characterisation tool).

Attempts were made to 'nest' any new character areas/types within the existing regional seascape units (RSUs), but this proved difficult and inappropriate as these units' boundaries were derived primarily based on intervisibility rather than a more integrated approach of defining areas which share broadly similar combinations of geology, bathymetry, ecology, human influences and perceptual and aesthetic attributes (combining to produce 'character'). This, and the level of overlapping areas, meant that these units were not able to be 'nested' within the hierarchy being developed. However, for the newly defined SCA, reference was made to the relevant RSUs within the descriptions. The RSU unit descriptions (rather than the units themselves) provided a wealth of useful information for the new MCA descriptions.

Information of relevance to the VRM approach:

- It is difficult and inappropriate to nest visibility-derived seascape units and character areas/types within the same hierarchy.
- Intervisibility mapping is a useful tool to explore the extent to which the sea influences the character of the hinterland.

Scotland

An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms (Scot *et al*., 2005)

In 2005, Scottish Natural Heritage (SNH) similarly undertook 'An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms'[10]. As in Wales, this strategic-scale study identified seascape units (33) for the country, assessing their sensitivity to a single development scenario (i.e. in this case, offshore windfarm developments). A visibility assessment was carried out using GIS to produce a comparative scale of visibility for the seascape units. This study drew heavily on the Welsh Guide to best practice in seascape assessment work. In this study, 'visibility assessment' was defined as 'the objective process to determine the potential visibility of a seascape or of windfarm development within a seascape within set parameters'.

The study adopted the Welsh methodology (as described above) with a few modifications to make it more appropriate for the more complex Scottish coastline. For example, rather than purely using visual criteria to define the seascape units, seascape character, visibility mapping, coastal geometry and orientation amongst other factors were taken into account. These resulted in seascape units that

[10] Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06).

extended 10km inland (as guided by the Welsh guidance), and 35km offshore as potential visual ranges were considered higher in Scotland than in England or Wales.

An additional seaward boundary of 8km was included in the assessment so that it could be compared to the 35km assessment. 8km was also the distance from shore that was used for the development scenario in this study.

With the focus of the study being on sensitivity and capacity in relation to offshore windfarms, the visibility assessment looked at distances of visual significance for turbines specifically. In order to do this, ZTVs were modelled to assess the relative visibility and values (e.g. ratio of seascape covered by national scenic area).

Assessments of land to sea intervisibility were carried out during different stages of the project using viewshed modelling in GIS to generate ZTVs, as follows:

- At an early stage, mapping of land to sea and sea to land visibility within 35km landward and seaward boundaries was carried out using GIS.
- Resultant patterns of visibility were used alongside seascape character types and sedimentation cells to define the 33 seascape units.
- Visibility analysis was carried out to determine comparative visibility indices (based on the offshore windfarm scenario) for each seascape unit.

Visibility of the sea and land from ferry routes was calculated as well as visibility of landscape designations from land and sea. For visibility calculations, a coarser resolution was used than the Wales maps in order to reduce the computation time and allow the whole of Scotland to be assessed in one calculation. A sample turbine height of 150 metres was used.

A visibility index was then generated to give a comparative visibility rating for each seascape unit. This was an objective measure using only the ZTV mapping results (based only on landform and a single development scenario). Ratings run from high to low, taking no account of how many people are likely to view the seascape or in what context. Figure 6 shows the visibility of the sea from land at 150m turbine height.

Figure 7 shows variations in visibility of land from a 150 metre turbine height above sea level[11] and within 25 kilometres of the coastline with the seascape units. Following on from this point, value judgements were applied by evaluating the percentage of land covered by a valued landscape within the 10 kilometre landward limit. Scores were applied to the different types of landscapes to apply a weighting. This was then used to establish a sensitivity rating for each unit.

As an additional element of this work, preliminary research was done to look at the meteorological effects on visibility in Scotland. General conclusions were drawn from a multitude of studies and the results were used to inform the limits of visual significance.

[11] Only locations with a depth of 50m or less were included. This was considered to be the limit of potentially developable areas at the time of the study.

Information of relevance to the VRM approach:

- In some cases there may be a need to extend the visibility mapping beyond the 24 kilometres set out in the Best Practice Guidance (2001).
- Whilst meteorological effects on visibility should not be ignored, the effects can be extremely complex and variable and are difficult to incorporate into the GIS visibility mapping.
- Assessing a development scenario can be used to assess sensitivity of the seascape units, but this is different to the requirement of the VRM – which is to assess the baseline situation.

Figure 6: Visibility of sea from land at 150 metre turbine height (SNH, 2005).

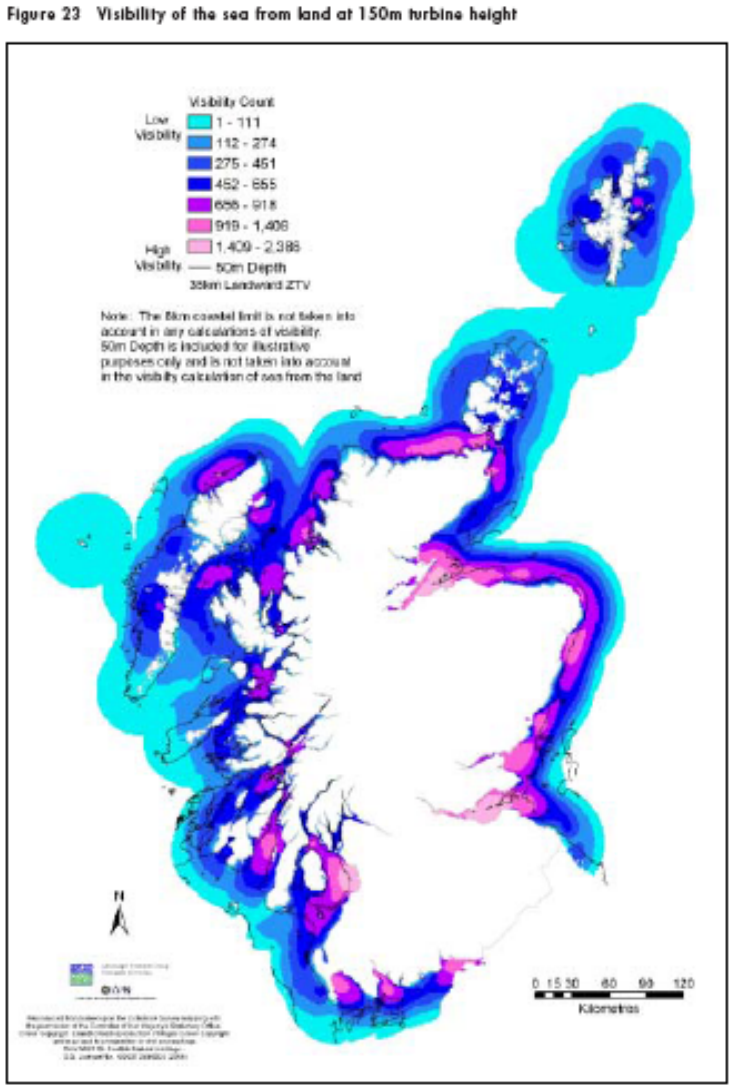


Figure 7: Visibility of land from a 150 metre turbine height above sea level.