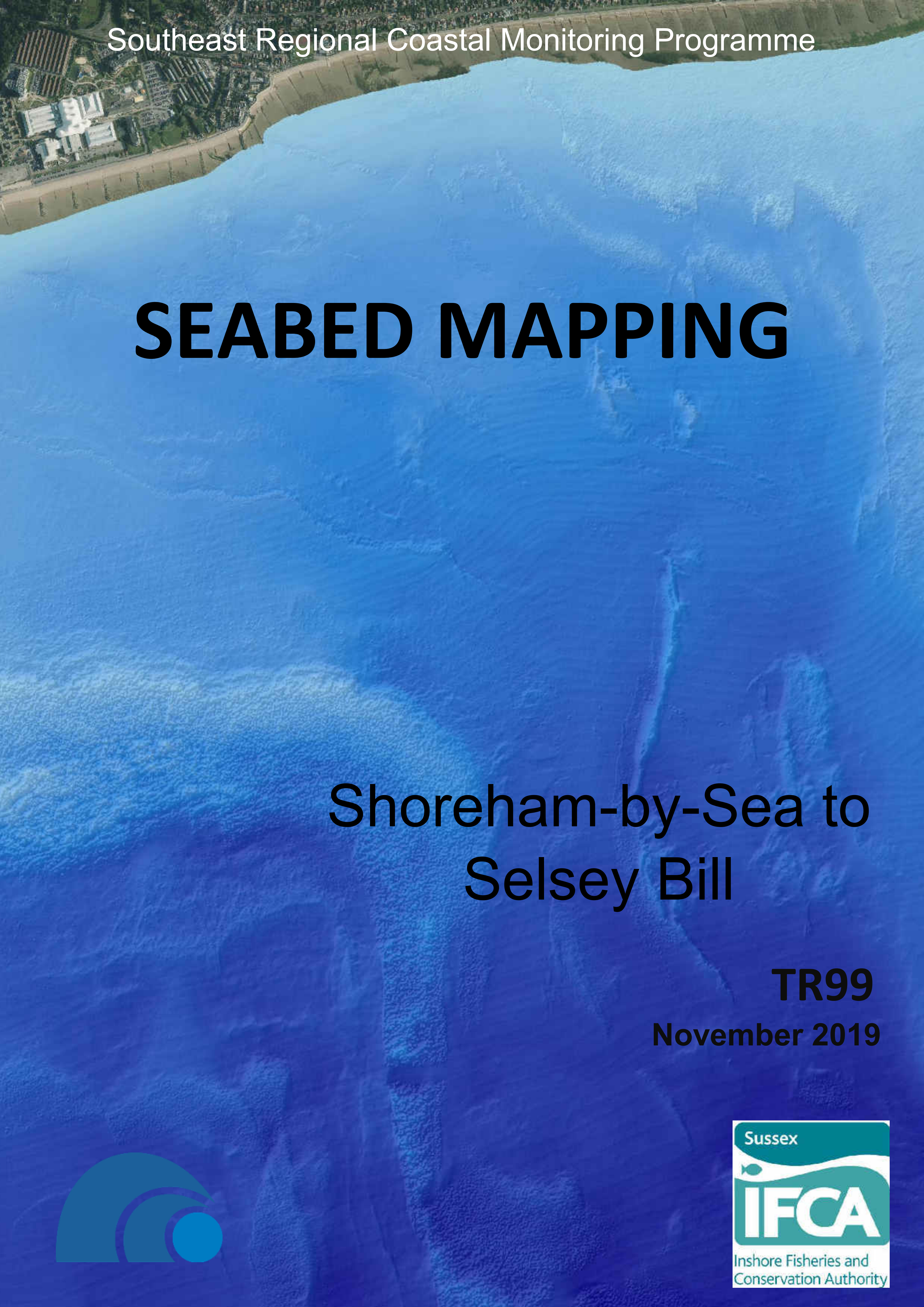

Southeast Regional Coastal Monitoring Programme

SEABED MAPPING

Shoreham-by-Sea to Selsey Bill

TR99

November 2019

Sussex IFCA Inshore Fisheries and Conservation Authority

Cover photo: Bathymetry and hillshade from Bognor Regis

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Document Title: **Seabed Mapping: Shoreham-by-Sea to Selsey Bill**

Reference: **TR99**

Status: **FINAL**

Date: **20/11/2019**

Project Name: **Sussex Inshore Fisheries and Conservation Authority Seabed Mapping Project**

Authors: **J. Evans**

Approved By: **C. Thompson**

Date	Status
09/10/2019	First draft
14/11/2019	Second draft
20/11/2019	Final version

Contents

Introduction

Technological improvements in bathymetric survey equipment and the widespread introduction of multibeam echosounder systems (MBES) within the offshore survey industry have meant that it is now increasingly cost-effective to achieve 100% sea floor coverage. Although the primary purpose is generally to survey the bathymetry of the seabed. Interpretation of acoustic backscatter information and groundtruthing data collected during the survey, in combination with the bathymetry, can be used to produce indicative maps of other important features, such as broad scale marine habitats, substrate type and anthropogenic features.

According to the European Environment Agency[1] there is a growing pressure on the marine environment from human activities and information on marine habitats is essential for assessing the impact these activities have on the marine environment. New management policies need to be informed by relevant data if they are to make appropriate decisions and achieve long-term sustainable use of the marine environment and its resources (Populus *et al.,* 2017). The growing development in seabed mapping and the creation of broad-scale seabed habitat maps based on full-coverage environmental data and physical characteristics can be extremely useful to a variety of marine stakeholders.

Sussex Inshore Fisheries and Conservation Authority (IFCA) commissioned the Channel Coastal Observatory (CCO) to interpret the available bathymetry, backscatter and groundtruthing data for a particular area of interest with the main purpose of creating a set of indicative, broad scale maps. These detailed maps can be used to inform and develop a range of coastal management, marine conservation, and planning policy objectives.

This particular seabed mapping project uses four different datasets collected over the past six years by the Maritime and Coastguard Agency (MCA), as part of their Civil Hydrography Programme (CHP), and in partnership with the CCO to extend the surveys into the coastal zone (nearshore 1 km).
All surveys collected meet IHO Order 1a specification which delivers 100% seafloor coverage, along with backscatter and groundtruthing sediment samples. The surveys were completed between 2013 and 2018.

All data collected through the National Network of Regional Coastal Monitoring Programmes and the Maritime and Coastguard Agency's CHP are collected to meet the CHP Specification, fully validated, supported with metadata, and freely available under the Open Government Licence. Collecting high quality seabed data can still be prohibitively expensive and time consuming for many stakeholders. It is vital that stakeholders take advantage of the increasing wealth of high resolution seabed data being collected and made freely available.

This report describes the methodology and gives a basic interpretation of the bathymetry, backscatter and groundtruthing data through a series of detailed thematic maps, including surficial substrate, equivalent EUNIS Level 3 marine habitats and anthropogenic features.

[1] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/marine-environmental-pressures/marine-environmental-pressures accessed 07/10/2019

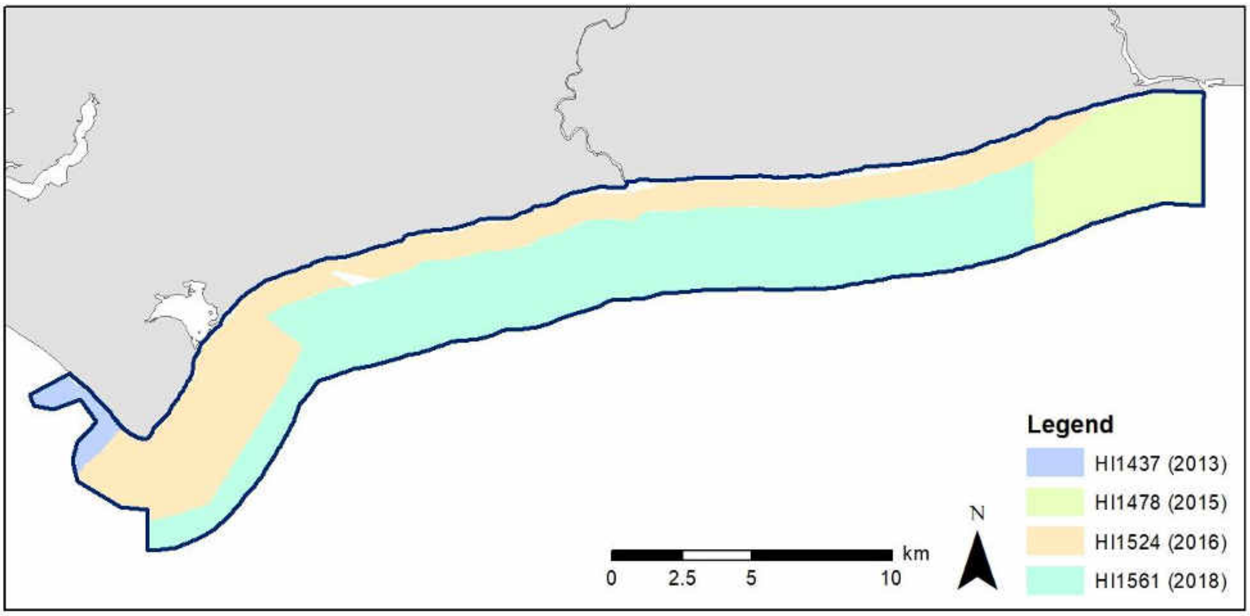


Figure 1: Extent of the seabed mapping coverage. Each of the four different bathymetric surveys used to create the maps have been highlighted

Marine Habitat Classification Scheme

Methods of marine habitat mapping are being continually developed and refined with the latest EU wide EUSeaMap produced by EMODnet (The European Marine Observation and Data network), updated in 2019[2] (Populus *et al.,* 2017). The system is based on the European Nature Information System (EUNIS) habitat classification which is a hierarchical system based on physical characteristics, such as the substrata it occurs on, depth, salinity and the type of wave and tidal energy conditions it is associated with. An extensive report of the classification system can be found online at https://archimer.ifremer.fr/doc/00388/49975/50583.pdf

Classification ranges from basic descriptions (high level classifications) such as littoral rock, to very detailed descriptions (low level classifications). Up to six levels are defined but Levels 4-6 require biological samples and therefore the MBES survey and sediment samples can only be used to map to Level 3; nevertheless, the results of Level 3 and substrate mapping can be used by other agencies who might wish to map to a more detailed level.

This report uses the Marine Habitat Classification for Britain and Ireland[3], which was also updated in 2019[4], and is directly comparable to the EUNIS classification. Habitats are classified up to Level 3 with the addition of a rock and thin sediment classification which is often necessary in coastal regions and will be explained in the following sections.

Level 1 Environment (marine)

A single category is defined within EUNIS to distinguish the marine environment from terrestrial and freshwater habitats.

Level 2 Broad habitats

These are extremely broad divisions of national and international application for which EC Habitats Directive Annex I habitats (*e.g.* reefs, mudflats and sandflats not covered by seawater at low tide) are the approximate equivalent. At EUNIS Level 2, there are eight broad marine habitats classifications (Table 1).

Typical UK boundary depths	Rock	Rock and thin Sediment	Sediment
	Littoral Rock	*Littoral Rock and thin Sediment*	*Littoral Sediment*
MLWS	*Infralittoral Rock*	*Infralittoral Rock and thin Sediment*	*Sublittoral Sediment*
8.5 mCD	*Circalittoral Rock*	*Circalittoral Rock and thin Sediment*	

Table 1: EUNIS Level 2 marine habitat classifications

[2] https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=5&center=-4.4,56.03&layerIds=16,17,33,26,40,43&baseLayerId=-3

[3] https://mhc.jncc.gov.uk/media/1027/04_05_introduction.pdf

[4]

Level 3 Main habitats

These serve to provide very broad divisions of national and international application which reflect major differences in biological character. They are equivalent to the intertidal Sites of Special Scientific Interest (SSSI) selection units (for designation of shores in the UK) (JNCC, 1996) and can be used as national mapping units. At EUNIS Level 3 (Table 2), the broad habitat types from EUNIS Level 2 are sub-divided further based on sediment type, wave exposure and tidal current strength. Sediment below the littoral zone isn't further subdivided as sediment communities do not differ as significantly as rock communities do (Parry *et al.,* 2019).

Rock			Rock and thin sediment			Sediment			
High energy littoral rock	*Moderate energy littoral rock*	*Low energy littoral rock*	*High energy littoral rock and thin sediment*	*Moderate energy littoral rock and thin sediment*	*Low energy littoral rock and thin sediment*	*Littoral mud*	*Littoral sand*	*Littoral mixed sediment*	*Littoral coarse sediment*
High energy infralittoral rock	*Moderate energy infralittoral rock*	*Low energy infralittoral rock*	*High energy infralittoral rock and thin sediment*	*Moderate energy infralittoral rock and thin sediment*	*Low energy infralittoral rock and thin sediment*	*Sublittoral mud and sandy mud*	*Sublittoral sands and muddy sands*	*Sublittoral mixed sediment*	*Sublittoral coarse sediment*
High energy circalittoral rock	*Moderate energy circalittoral rock*	*Low energy circalittoral rock*	*High energy circalittoral rock and thin sediment*	*Moderate energy circalittoral rock and thin sediment*	*Low energy circalittoral rock and thin sediment*				

Table 2: EUNIS Level 3 marine habitat classifications featured in this report; with the addition of Rock and thin sediment.

In the habitat classification, bedrock, stable boulders, cobbles or pebbles and habitats of mixed boulder, cobble, pebble and sediment (mixed substrata) as well as artificial substrata (concrete, wood, metal) are collectively referred to as rock. Boulders and bedrock are always rock regardless of stability. Cobbles are considered rock if stable enough to support robust erect epibiota, while pebbles must be stable enough to support fragile epibiota. If an area of pebbles/cobbles is known to have high energy and mobile substrata, and there are few erect epibiota, it is likely to be sediment habitat.

Highly mobile cobbles and pebbles (shingle), together with gravel and coarse sand are collectively referred to as coarse sediments. Mixed sediment consists of heterogeneous mixtures of gravel, sand and mud and may often have shells and stones also. See Appendix 3 of https://mhc.jncc.gov.uk/media/1041/jncc-report-546-revised-2019.pdf for full descriptions and the folk classification triangle.

'Rock and thin sediment' is not a recognised category in the current classification systems but is recognised as necessary addition by literature (Coggan *et al.,* 2011). Rock and thin sediment collectively refers to areas where rock is only covered by a thin veneer of sediment (<1m) and at times the geology beneath the sediment can be defined or becomes visible. Seismic and acoustic surveys of such as areas often suggest that they should be classified as rock habitats. However, grab samples or video trawls if available, suggest the area should be classified as sediment. These type of habitats can show characteristics of both hard and soft substrate with both epifauna and infauna present. Rock and thin sediment acts as an interim between the pure rock and sediment areas.

The littoral zone lies landward of Mean Low Water Springs (MLWS) with the sublittoral zone seaward of MLWS. For areas of 'Rock' or 'Rock and thin Sediment', the sublittoral zone is split into the infralittoral zone and the circalittoral zone based upon site-specific biological parameters (see Marine Habitat Boundaries section).

Habitat Mapping Methodology

Bathymetry, backscatter and groundtruthing data were used to provide information for the production of maps displaying anthropogenic features (*e.g.* cables and pipelines, wrecks, trawl marks and sea defence structures), substrate type and EUNIS Level 3 seabed habitat maps (Figure 2).

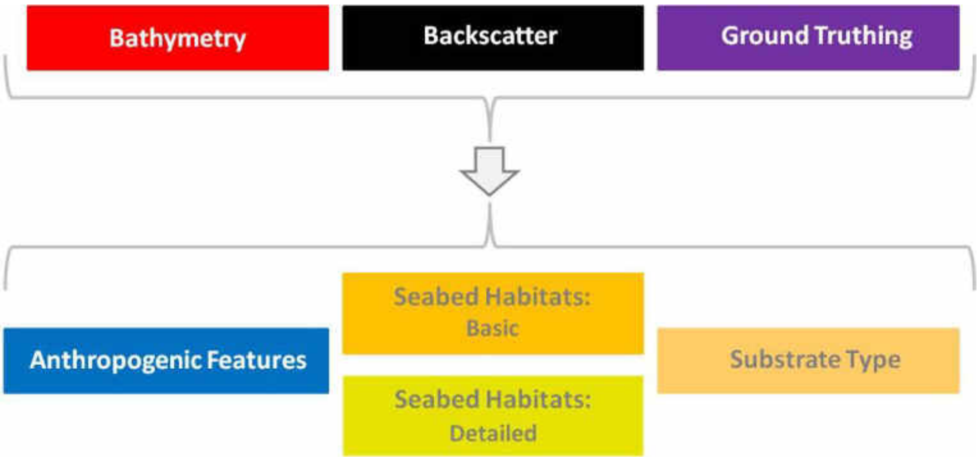


Figure 2: Seabed mapping stages

Bathymetry

All four surveys meet IHO Order 1a standard swath bathymetry specification set out by the MCA. A table can be found in annex 2 with details of each individual survey. The UK Hydrographic Office (UKHO) undertook quality-control of the data and produced a quality-controlled data set in UTM/Chart Datum, at 1m or 2m resolution.

Figure 3a illustrates the high resolution of the bathymetry and superimposed on aerial photography. Figure 3a also demonstrates the required overlap with land-based survey data thus avoiding the well-known 'white ribbon' strip of seabed close to the shore where data is seldom captured. Depths in a number of the figures are colour-coded with orange colours indicating shallow depths and dark blue the deepest areas.

Hillshade

Within ArcGIS v10.6, a hillshade layer was derived. The hillshade layer is a form of artificial sun-illumination which helps to illustrate depth changes and features in the bathymetry dataset. This layer is particularly useful for displaying and enhancing areas of bedforms, seabed of variable texture and areas where there are numerous depth changes across relatively short distances. Figure 3b illustrates how the hillshade layer can enhance the seabed.

Seabed Slope

The seabed slope map distinguishes those areas of the seabed that have a steep gradient or sharp changes in slope from those areas which are relatively flat; this aids the identification of bedrock and geological features, sedimentary bedforms and anthropogenic features (*e.g.* pipelines and channels). The seabed slope is derived within ArcGIS by calculating the slope angle of the seabed using a central cell and comparing its value to those around it. The extract from the slope layer in Figure 3c clearly shows how the slope map can identify areas of rock. The colour scheme used is a classified symbology dividing the slope angles into nine categories. Green indicates relatively flat or low angle topography, with increasing slope represented by gradation from yellow to orange, and red indicating steepest slope angles.

Backscatter

The intensity of the return acoustic signal during the bathymetric survey can be collected simultaneously and is termed ’backscatter’. The backscatter indicates the nature and relative composition of the seabed and is an extremely important variable for mapping the seabed. Backscatter can provide information on the roughness and texture of the seabed substrate, and variability in sediment type. Backscatter will often highlight features invisible to the bathymetry dataset. Backscatter files were delivered by the survey contractor in a post-processed file format as a mosaiced GeoTIFF image.

Many factors can influence backscatter intensity, for example, changes in seabed slope or adjustments to survey vessel equipment configurations. It is not simply the case that a given backscatter intensity represents a defined sediment type. The backscatter data layer does not provide information as to what types of sediment the boundaries are showing – for example gravel to sand or sand to mud. To define this substrate type or marine habitat, combined analysis of bathymetry, backscatter and groundtruthing information is required. Backscatter, therefore, requires expert analysis and must be viewed in combination with bathymetry and groundtruthing information to give confidence in the resulting substrate and marine habitat maps.

The importance of backscatter for substrate classification and habitat mapping can be seen by the changes in the intensity (grey scale) of the backscatter that are not visible in the bathymetry, as exemplified in Figure 3d. Since the backscatter boundaries are observed across numerous survey track lines, it can be concluded that these denote a real change in seabed texture; for example, either constrained pockets of sediment within an area of exposed or outcropping bedrock, or of a different grain-size to the surrounding substrate.

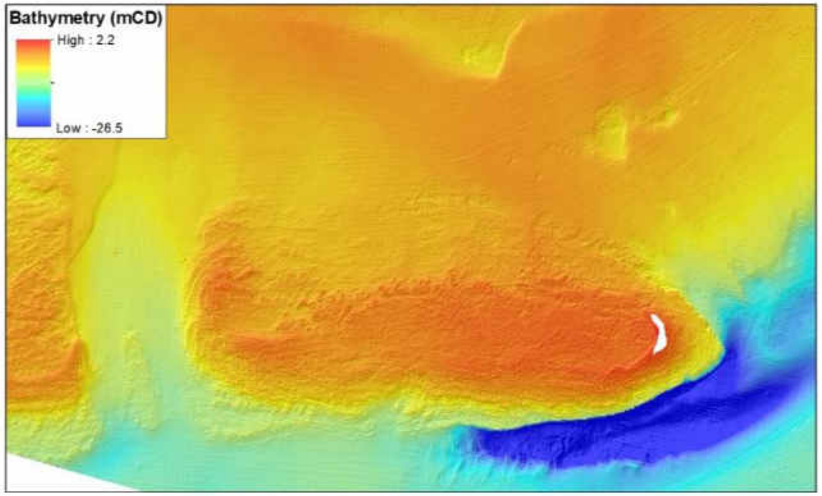


Figure 3a: Bathymetry, Mixon Hole

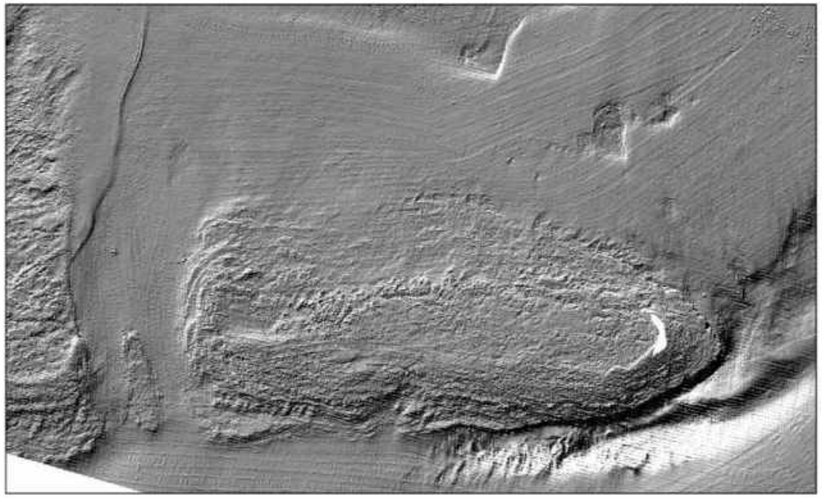


Figure 3b: Hillshade, Mixon Hole

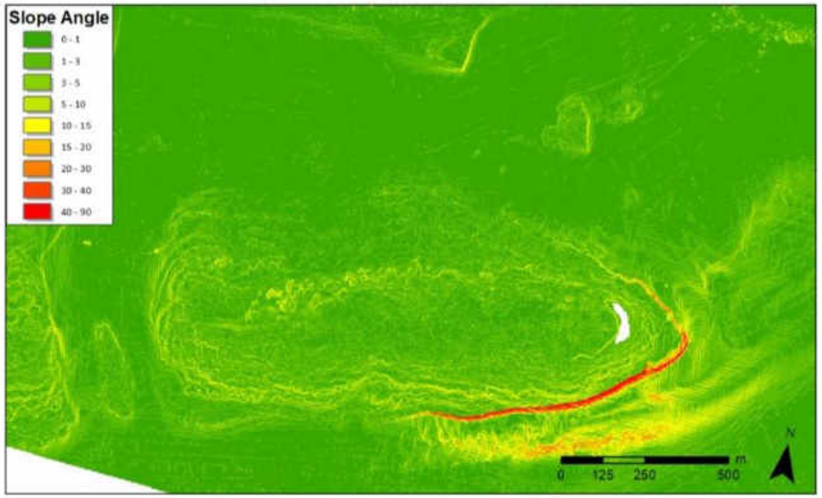


Figure 3c: Slope angle (degrees), Mixon Hole

Figure 3d: Backscatter, Mixon Hole

Figure 3:

Groundtruthing

Groundtruthing data is a key requirement to enable the production of detailed substrate, marine habitat and biotope-type maps. A wide range of information can be useful, such as sediment samples, photographs and videos of seabed and features, topographic beach survey data for inter-tidal areas, nearshore marine geology maps (solid and drift) and visual dive records and observations.

62 sediment samples were taken within the mapping area across the four different hydrographic surveys. Figure 4 shows some examples of the sediment types to be expected in the survey area and the full extent of the sediment points can be found in Appendix 3.

Sandy Mud | Sand | Mixed sediment | Coarse sediment

Figure 4: Sediment variation in the nearshore zone: Sandy Mud, Sand, Mixed sediment and Coarse sediment

Further groundtruthing and substrate information was sourced from JNCC marine recorder, Seasearch, BGS and Sussex IFCA.

Hydrodynamic Data

The seabed habitat classification is split into low, moderate or high energy at EUNIS Level 3. To get an indication of the energy state across the area the broad-scale EUSeaMap[5] was consulted. Energy levels are calculated using a number of factors including wave fetch, orientation of coastline to prevailing wind, wave energy at the surface and seabed (modelled) and tidal stream data. EUSeaMap classifies the majority of the area as high energy apart from the littoral zone and areas sheltered from the prevailing wind by the headland of Selsey Bill. These energy classifications can be further supported by the type and thickness of sediment present.

The Southeast Regional Coastal Monitoring Programme's network of waverider buoys was used to confirm and indicate any local variability in the area. In particular, two Datawell Waverider MKIII buoys located approximately 2.5km offshore of Selsey Bill in Bracklesham Bay and 7.5 km offshore from Rustington. Both wave buoys are located at a water depth of approximately 10 mCD. The wave buoys were used to assess the hydrodynamic conditions of the mapping area. In Bracklesham Bay the average monthly significant wave height, since 2008, ranges from 0.55 – 1.02 m with significant wave height rising up to 3-3.5 m during storm periods. The Rustington wave buoy has average monthly significant wave height, since 2003, ranging from 0.44 – 1.30 m with significant wave height rising up to 3.5-4 m during storm periods.

Tidal currents were estimated from UKHO Admiralty Chart tidal diamonds and indicate weak currents along the coastline apart from at Selsey Bill where moderate strong tidal streams of 2.2 knots can occur during spring tides. These data were collectively assessed against national indicative criteria to determine the typical hydrodynamic energy conditions within the study area.

The entire mapping area has been designated as moderate energy. The habitat modelling projects EUSeaMap and UKSeaMap classify the region as a high energy regime, based on estimated wave and tidal energy at the surface and seabed. However, the coastline within the mapping area would be classified as an exposed coastline which can be both high and moderate energy. Tidal currents are moderately strong and the average wave heights for the area indicate wave energy would regularly interact with the relatively shallow seabed along this stretch of coastline. However, the species recorded in the JNCC marine recorder ranging from 1905 – 2019 indicate the majority of species found in the infralittoral and circalittoral zone (inc. kelp, red seaweeds, sponges and hyroids) would usually occur in a moderate energy environment. The difference between broad scale physical data and local environmental data points indicate that there is most likely an overlap between moderate and high energy regimes in the area. High energy during extremes and moderate energy on average.

Marine Habitat Boundaries

A number of boundaries are needed to comply with the EUNIS habitat classification system. A littoral to sublittoral boundary (Intertidal zone) was created by producing a Mean Low Water Springs (MLWS) contour for local area (0.4 mCD Littlehampton / 0.5 mCD Pagham, Bognor Regis / 0.6 mCD Selsey, Worthing, Shoreham).

A defined boundary between the infralittoral and circalittoral zone is required, which is known as the depth at which only 1% of light will penetrate to the seabed; using a physical parameter to infer a biological boundary. For the infralittoral zone the upper limit is marked by the top of the kelp zone whilst the lower limit is marked by the lower limit of kelp growth or the lower limit of

[5] https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=3&center=-15.000,51.600&layerIds=3&baseLayerId=-3&activeFilters=

dense seaweed growth. The depth at which the circalittoral zone begins is directly dependent on the intensity of light reaching the seabed; in highly turbid conditions, the circalittoral zone may begin just below water level at MLWS.

The infralittoral/circalittoral boundary was derived by EMODnet using satellite derived data combined with groundtruthing points from the JNCC marine recorder to calculate the level of light at the seabed. Using this layer as a guide and combining with local groundtruthing information, the infralittoral/circalittoral depth has been set at 8.5 mCD for the entire area. The majority of the mapping area is shallower than this value. Both boundaries were created by producing a contour in ArcGIS v10.6 using the bathymetry data.

Using all of the above data allowed the seabed to be classified into useful indicative habitat and substrate maps. Some boundaries are definitive, such as the edge of a rock platform or a protruding rocky outcrop. Other boundaries, especially those between sediment types and the infralittoral/circalittoral boundary, cannot always be treated as definitive because the change is gradual and can vary seasonally or daily. The boundary is placed in the best position using the data available but often these boundaries transition imperceptibly into one another. Such boundaries cannot be treated as exact boundaries but as a representation of what is present in the survey area.

Substrate Map

A substrate map was derived by removing the depth boundaries, energy boundaries and the ‘Rock and thin Sediment’ category. Where the seabed was categorised as ‘Rock and thin Sediment’ it was re-classified to reflect the surficial sediment type overlying the rock or in rare cases re-classified as rock. The example shown in Figure 5 indicates areas of bedrock and variations in broad sediment types.

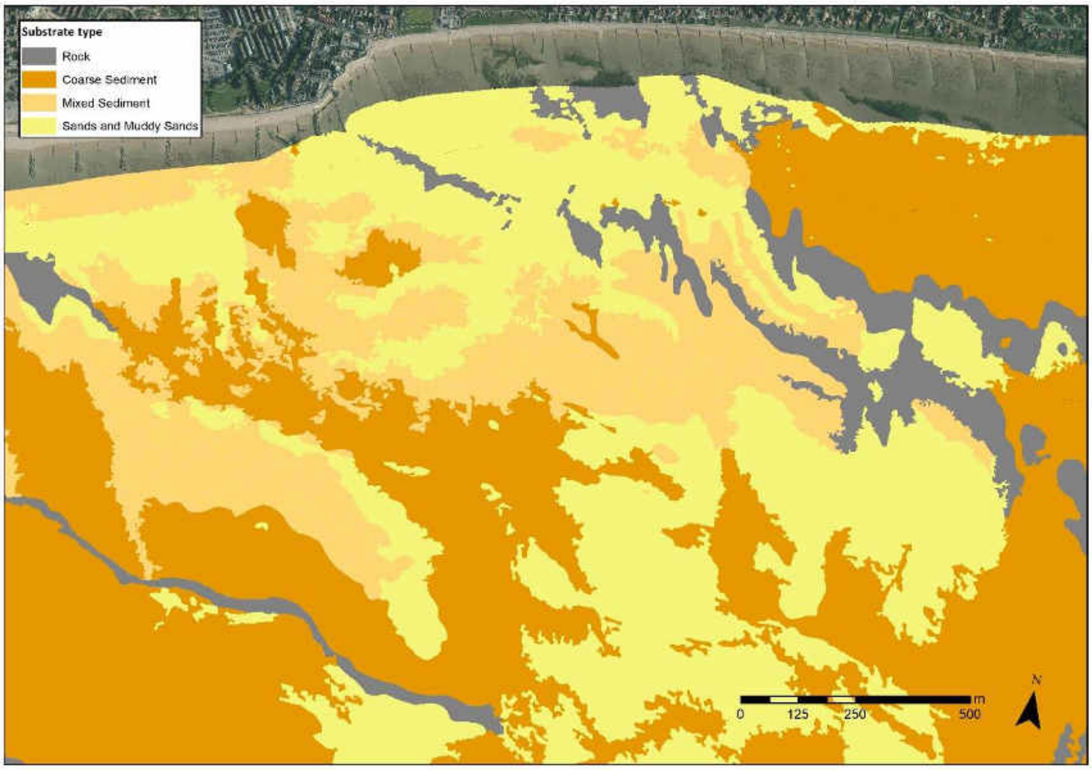


Figure 5: Substrate mapping, Bognor Regis, West Sussex

Anthropogenic Features

Anthropogenic features were identified in the bathymetry, including sea defences, piers, cables and pipelines (Figure 6). Such features are easily discernible using the hillshade layer.

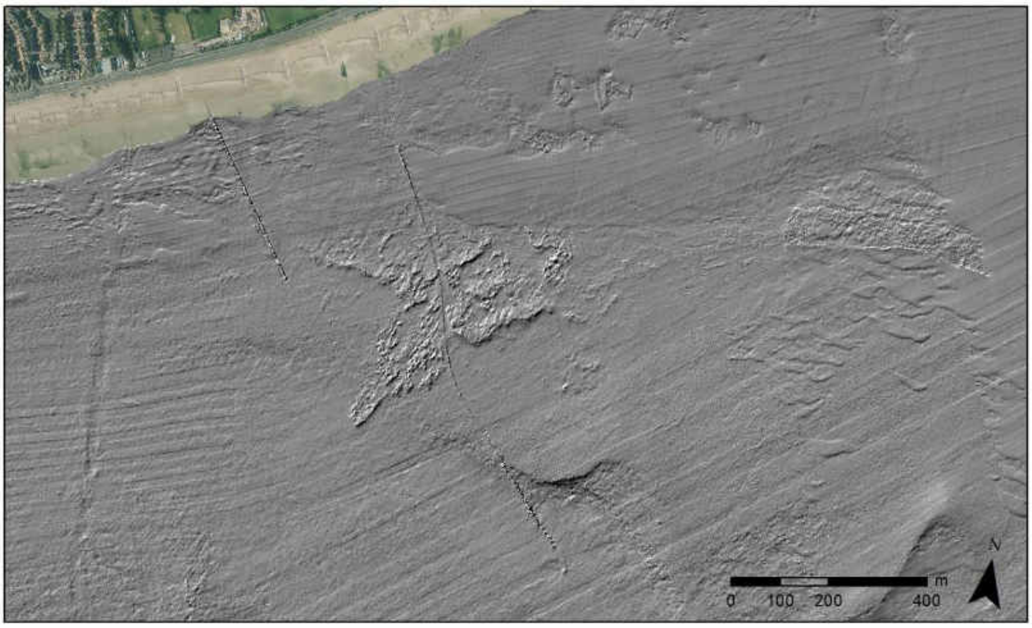


Figure 6: Anthropogenic features, Lancing, West Sussex

Confidence

The MESH confidence assessment tool was used to determine confidence levels in the acquired remote sensing data, groundtruthing data and the interpreted mapping and data products, so that end-users can determine their adequacy for decision-making (see https://webarchive.nationalarchives.gov.uk/20101014084644/http://www.searchmesh.net/Default.aspx?page=1693).

Bathymetric data collected in accordance with and achieving compliance with the MCA Civil Hydrography Programme Specification generally produces a high confidence level due to the 100% seafloor coverage and vertical and horizontal positional accuracies. The Confidence Assessment for this marine habitat mapping report is 81 (Appendix 1), indicating a high level of confidence in the remote sensing data acquisition, groundtruthing available and interpretation of the various datasets to generate the series of maps and datasets.

Seabed Mapping Results

The swath bathymetry data are freely available, under Open Government Licence, from www.coastalmonitoring.org either as text, ascii or SD (Fledermaus) files. The EUNIS Level 3 marine habitat map and substrate type maps are also available for viewing and download as shapefiles. Summary maps of:

- Bathymetry
- Backscatter
- Seabed slope
- Anthropogenic features
- EUNIS Level 3 marine habitat
- Substrate

have been prepared for the following inshore sections of coastline:

- Shoreham-by-Sea
- Worthing
- Elmer to Atherington
- Littlehampton
- Bognor Regis
- Pagham to Selsey
- Selsey Bill

Shoreham-by-Sea

The coastline from Shoreham-by-Sea, westwards, consists of a steep gravel beach extending offshore at a shallow gradient. The backscatter clearly illustrates the varying composition of the littoral seabed with areas of exposed coarse sediment clearly visible and correlating with local aerial photography. The areas of *Littoral sands and muddy sands* and *Littoral mixed sediments* continue into the sublittoral zone and are thick enough to mask the underlying seabed.

The backscatter data highlights two very distinct areas of sediment extending offshore. Finer sediment can be identified through its lower backscatter intensity compared to the surrounding gravel. These areas are classified as *Sublittoral mixed sediment* with small areas of finer *Sublittoral sands and muddy sands.* Further offshore areas of mixed sediment occur along ridges in the seabed. The ridges in the seabed continue eastwards but suddenly lose definition in the backscatter. Figure 7 is a cross-section showing the changes in elevation across the ridges and the location of the cross-section on the maps. The ridges are a feature in the data from Shoreham through to Littlehampton but, apart from change in elevation, cannot be distinguished from the surrounding seabed by sediment type.

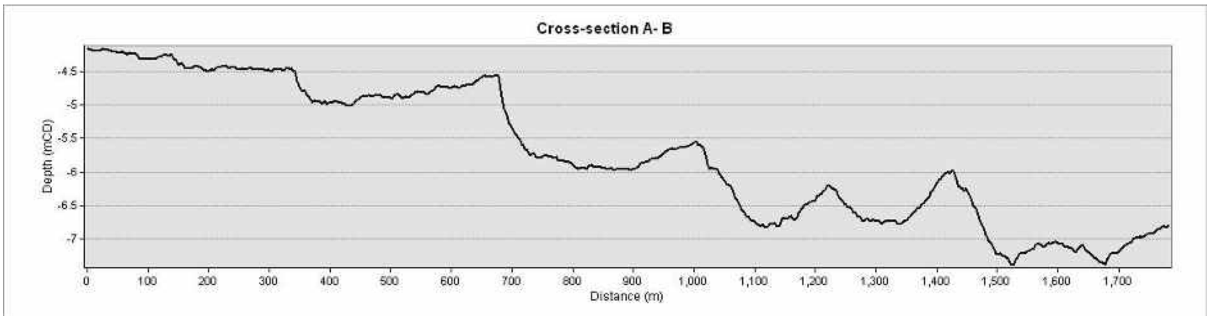


Figure 7: Cross-section highlighting localised bathymetric feature

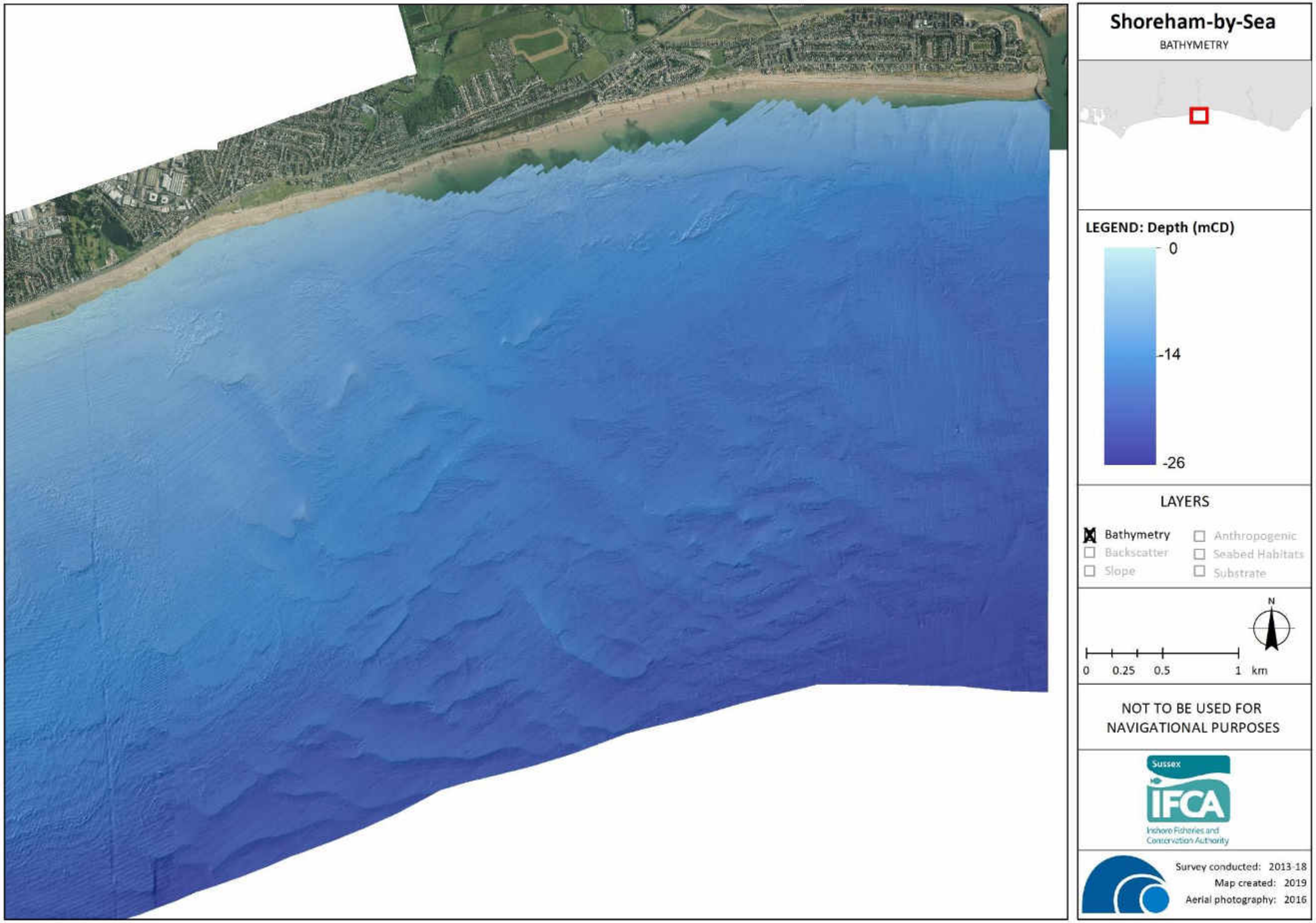
The majority of the remaining seabed has been classified as *Moderate energy rock and thin sediment* with the overlying sediment classified as coarse sediment. According to groundtruthing the underlying seabed consists mainly of exposed bedrock, chalk boulders, pebbles and cobbles interspersed with mobile coarse sediment and sparse levels of algae indicating it's within the infralittoral zone.

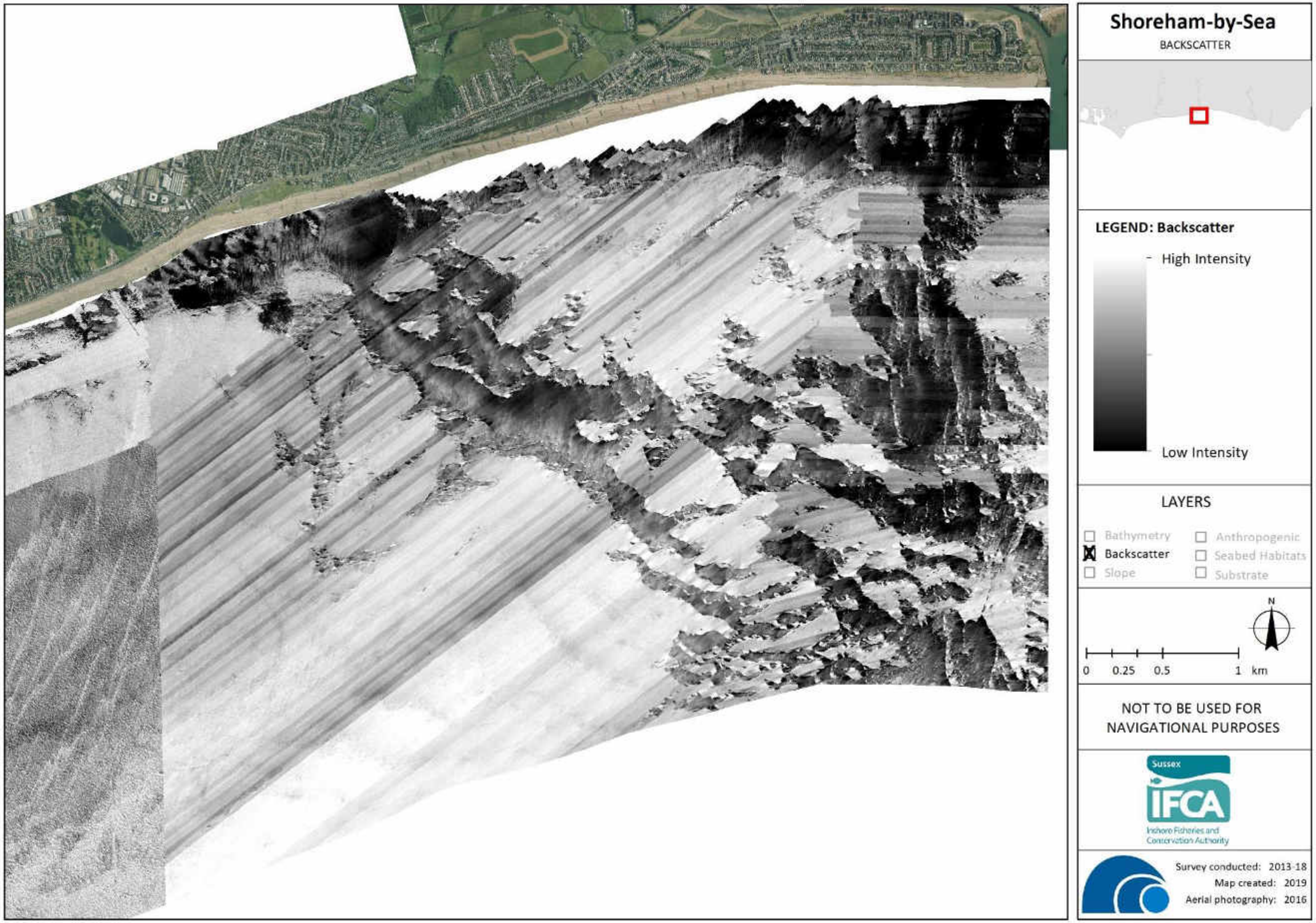
There are several small outcrops of *Moderate energy infralittoral rock* found in close proximity to the littoral zone which are clearly outlined in the hillshade and can be confirmed as chalk bedrock by groundtruthing data. No obvious bedrock or rocky outcrops are found further offshore along this section of coastline. The combination of bedrock covered in a mixture of large boulders, pebbles and cobbles interspersed with coarse sediment means this area fits the rock and thin sediment category.

No bedforms are observed or scour marks surrounding the five wrecks.

Anthropogenic features in the area include an armoured cable and pipeline extending from the beach offshore.

Two historical kelp observations from diver records (1995 & 2012) occur in this section of coast. The point from 2012 was recorded close to the nearshore infralittoral rock.


Shoreham-by-Sea
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Shoreham-by-Sea
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
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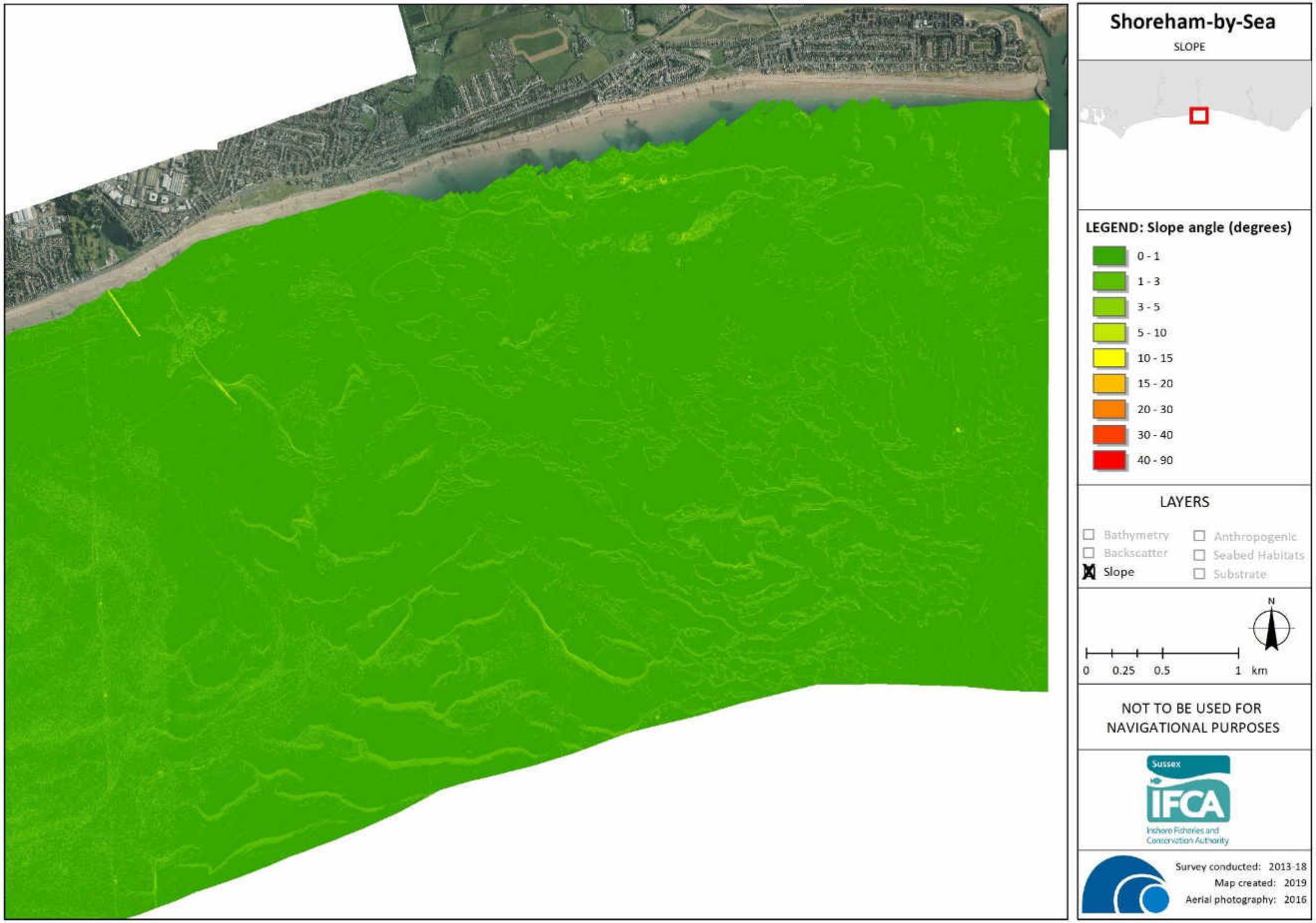
Shoreham-by-Sea
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
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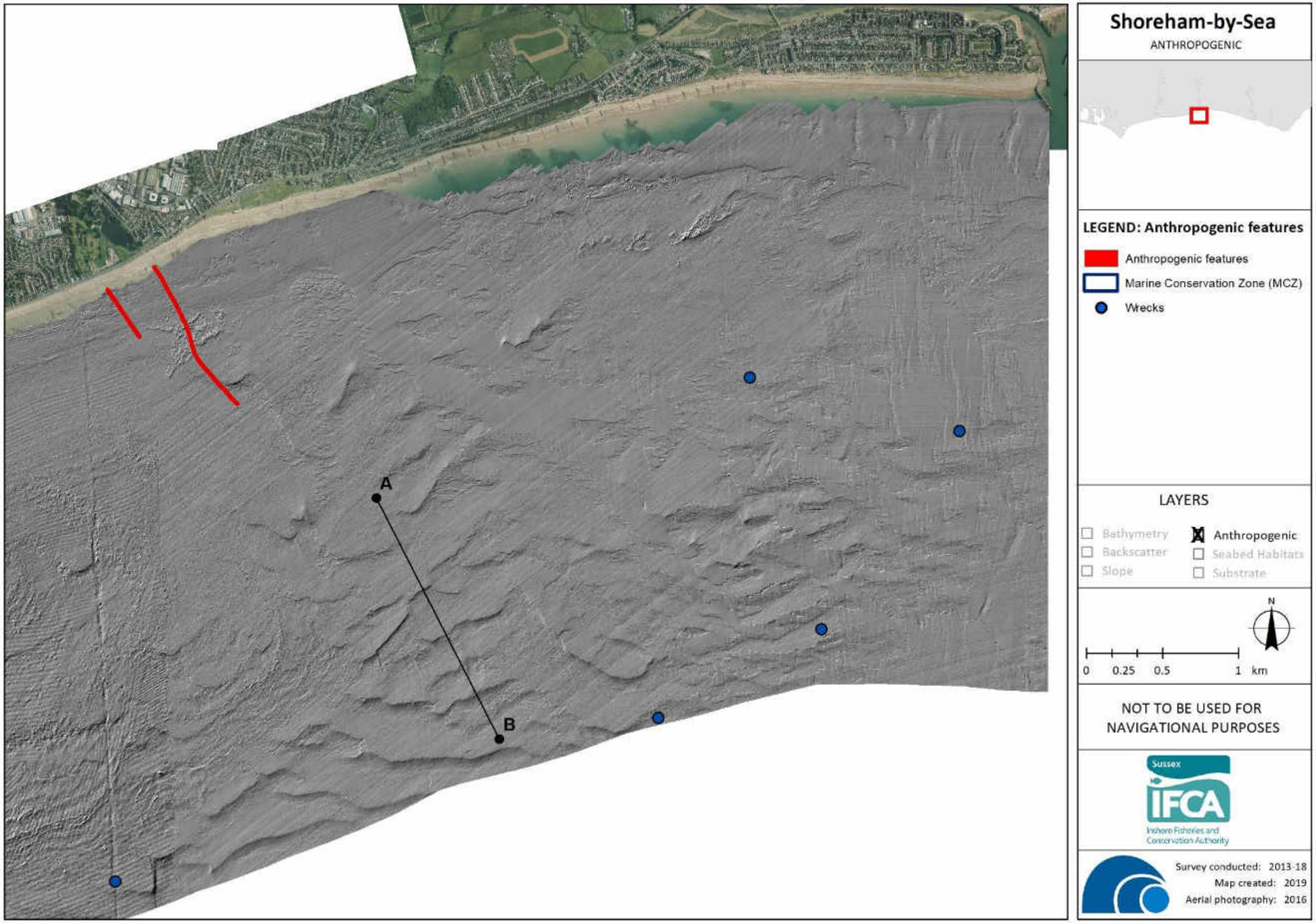
A
B
Shoreham-by-Sea
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
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0 0.25 0.5 1 km
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Survey conducted: 2013-18
Map created: 2019
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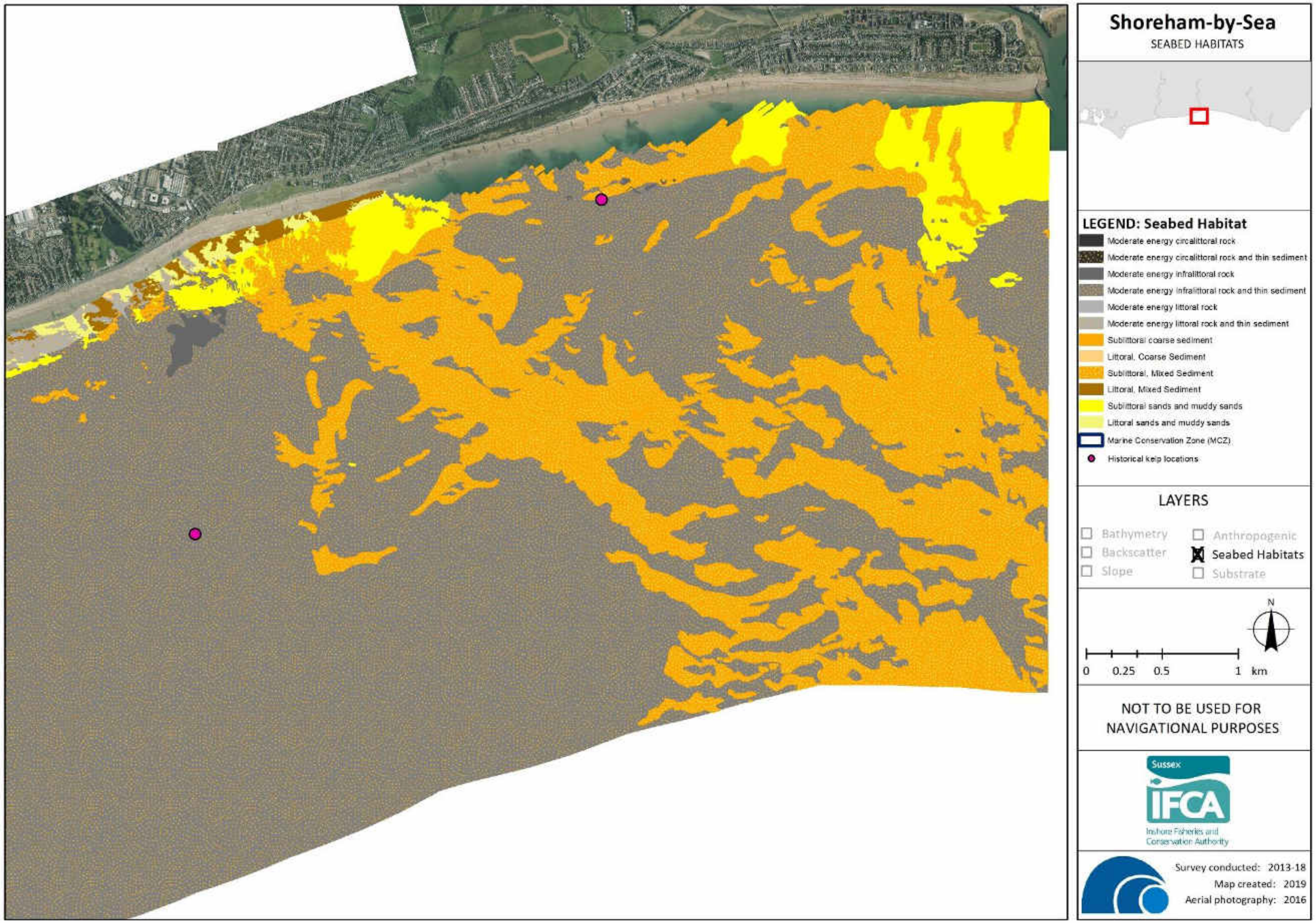
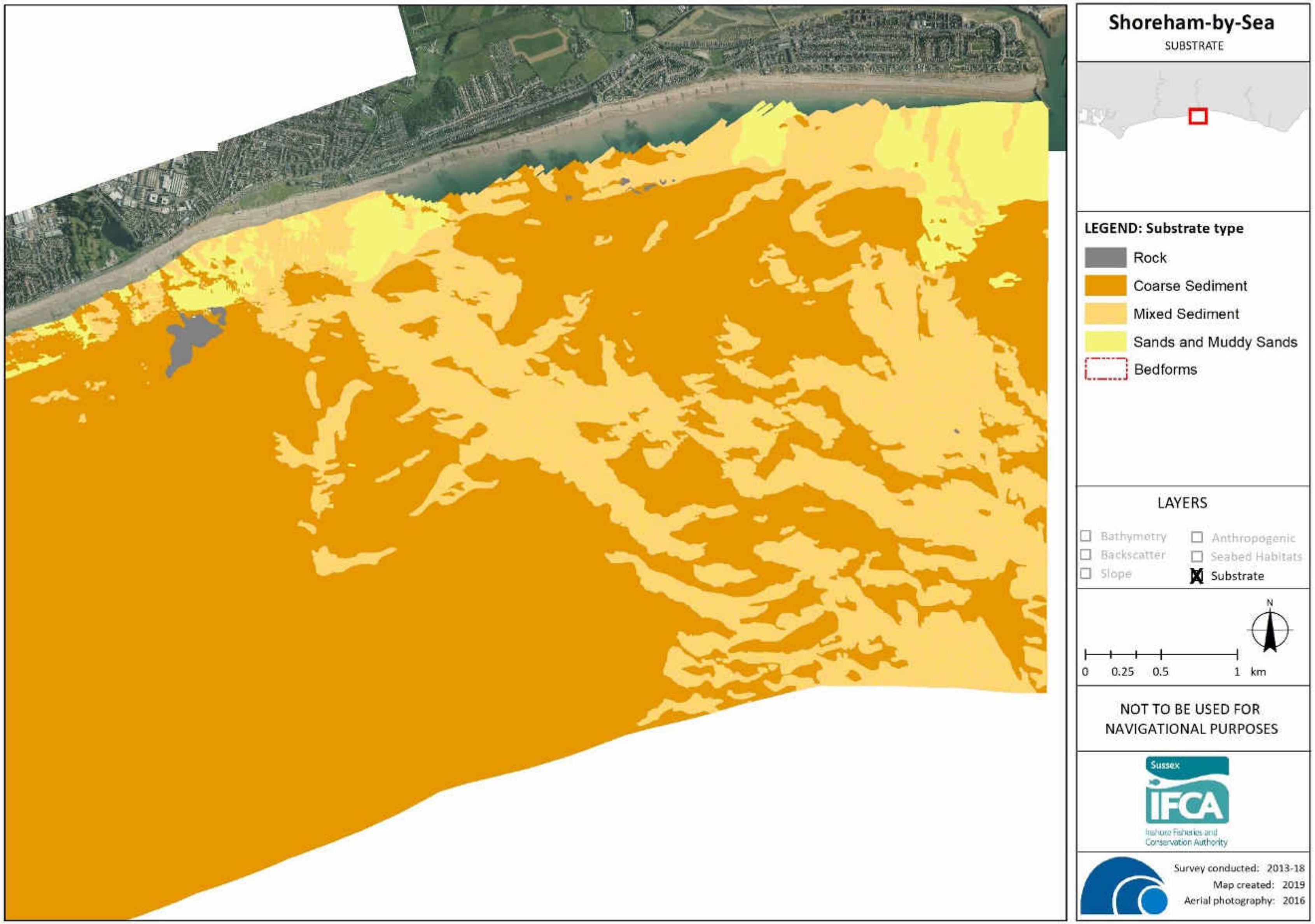

Shoreham-by-Sea
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Shoreham-by-Sea
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Worthing

The coastline along the Worthing frontage has an initial steep gravel beach which flattens and extends gradually offshore. The intertidal seabed consists of a cobbles, pebbles and coarse sediment and is typical of this coastline[6]. Patches of *Littoral sand and muddy sands* and *Littoral mixed sediment* are clearly highlighted in the backscatter and correlate with the aerial photography for the area.

The nearshore seabed is flat and gradually declines further offshore where its descent becomes more gradual and ridges appear on the steeper slope. These ridges are described in the Shoreham-by-Sea section and continue along the offshore extent of this area (Figure 7).

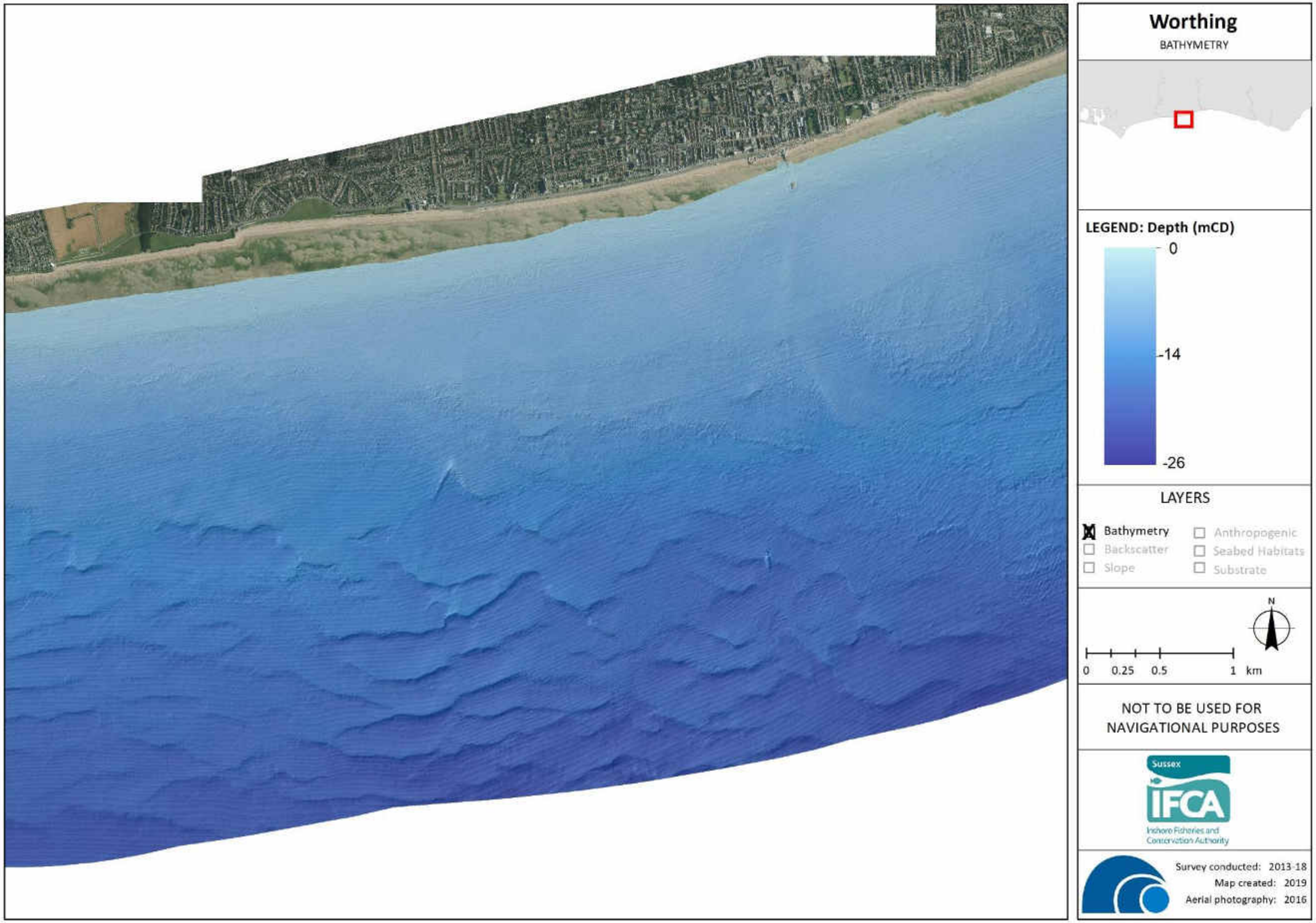
The majority of the seabed offshore appears very homogenous in the backscatter, with all groundtruthing indicating the seabed consists of patchy bedrock with chalk boulders, cobbles, pebbles and coarse sediment. If pebbles and cobbles do not appear mobile and support epifauna, then they can be considered rock. Throughout this section there is evidence from diver recordings of kelp and various seaweeds along with epifauna including sponges, anemones and crustaceans. The seabed could be classed as rock using the epifauna as a guide or as sediment using the grab samples of gravel and gravelly sands. Therefore the majority of the seabed has been classified as *Moderate energy rock and thin sediment*. No bare bedrock or rocky outcrops are present in this section.

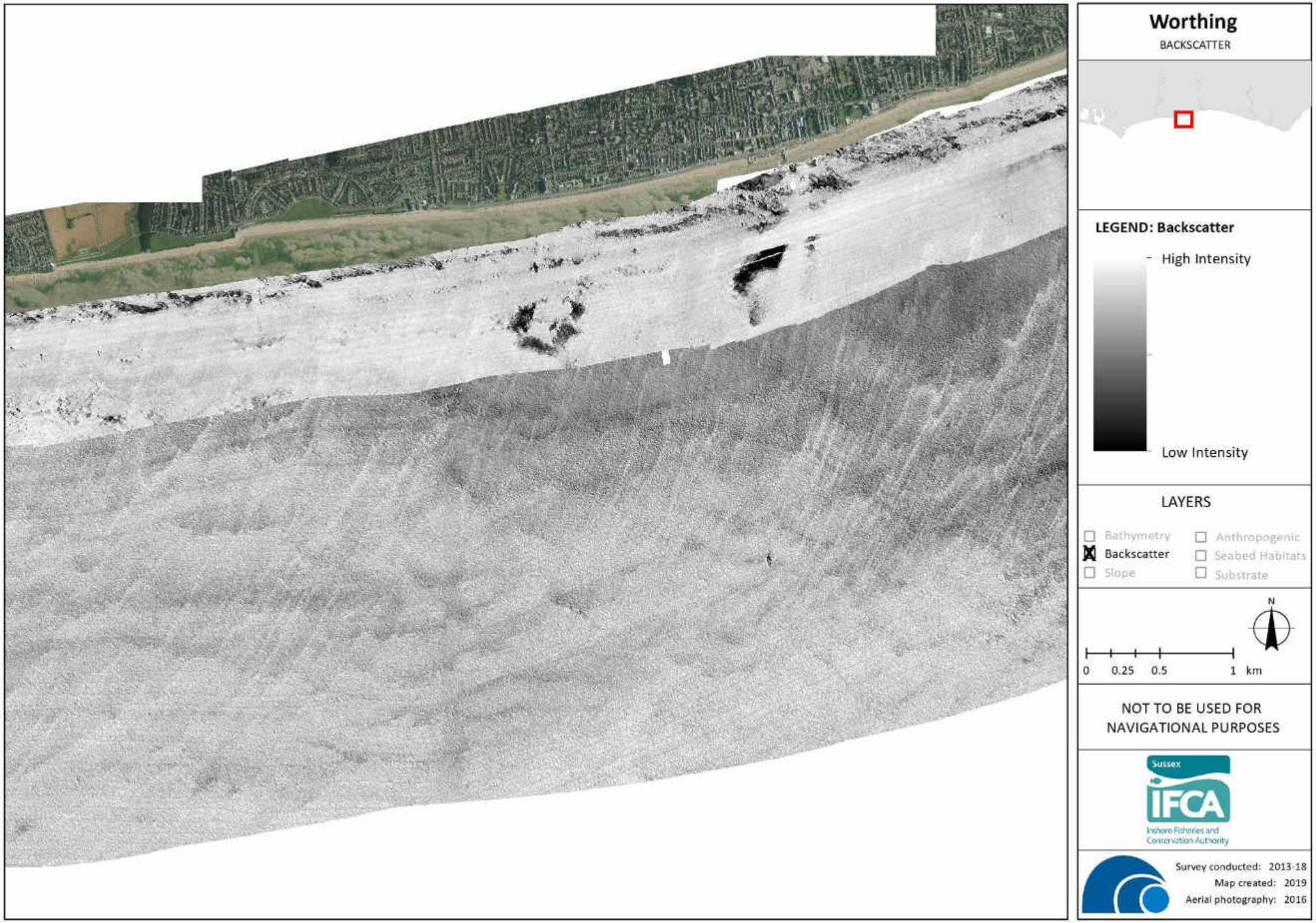
The lack of fine sediments and historical assemblages of previously mentioned marine fauna indicate this is an exposed infralittoral shoreline.

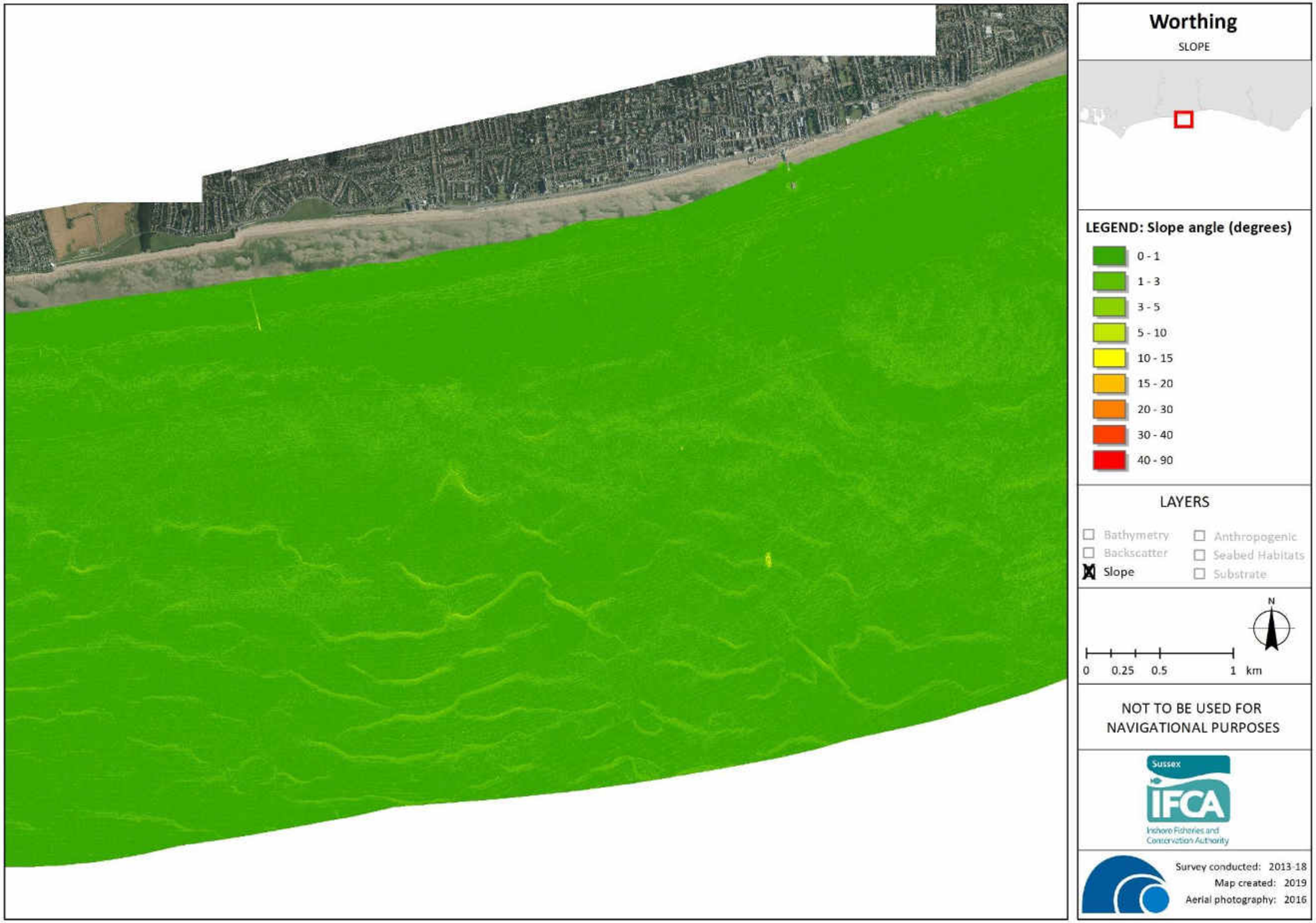
Four historic diver records of kelp are located in this section. Spread across the *Moderate energy rock and thin sediment* and primarily collected in 1994 with one from 2012.

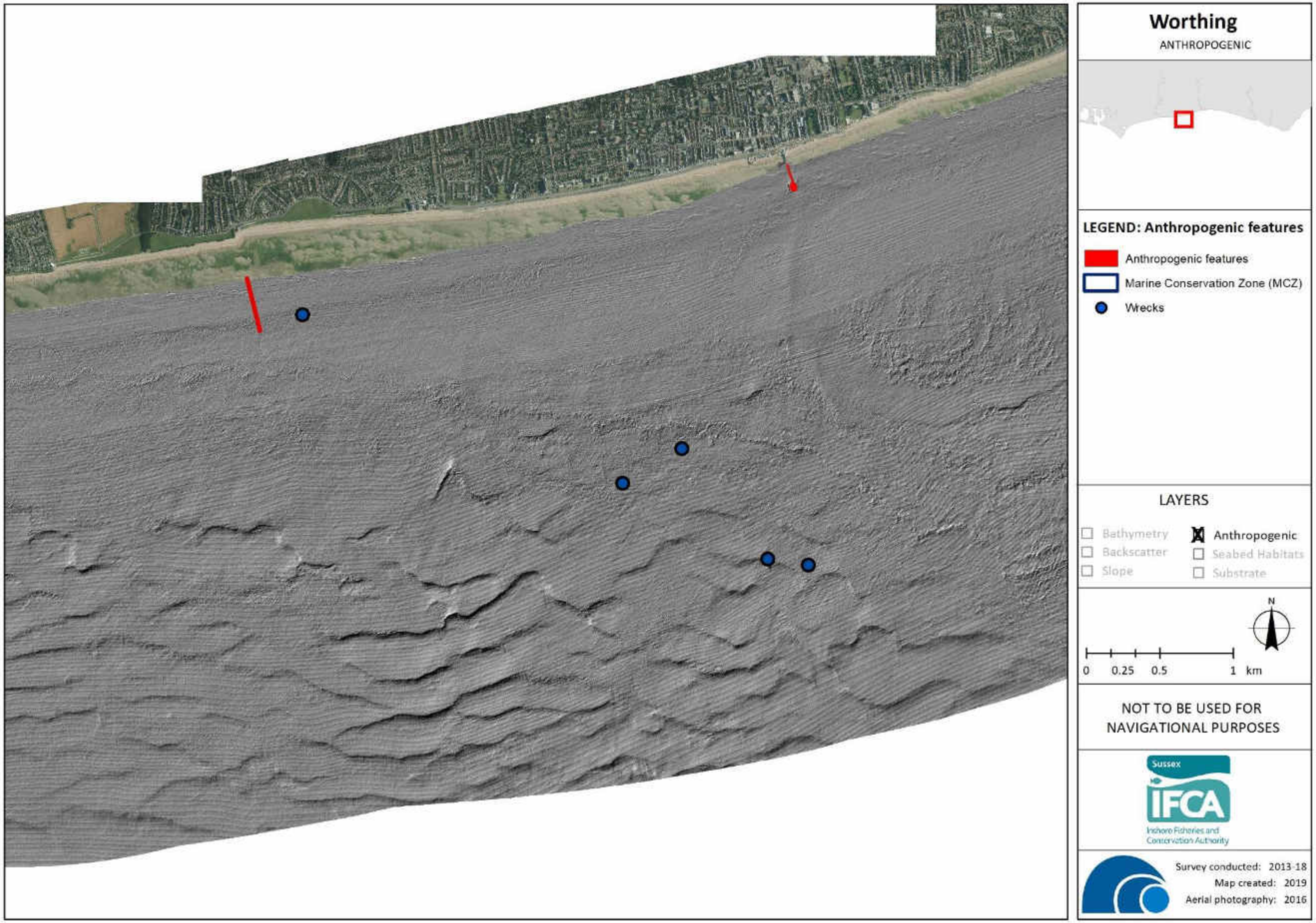
No bedforms are present. Five wrecks were found with no evidence of scouring.

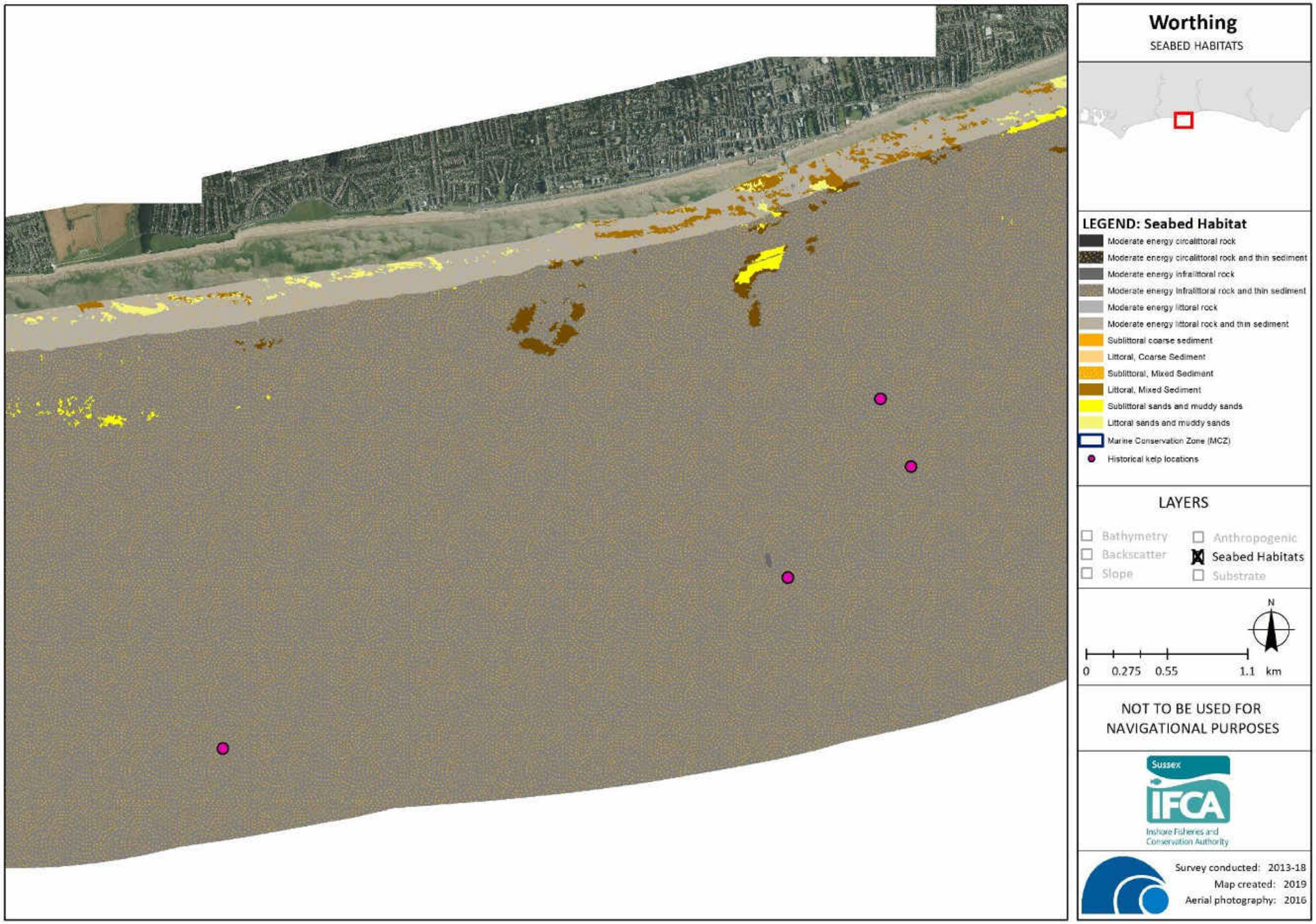
[6] https://goo.gl/maps/mvrQqqXWo72js3ALA

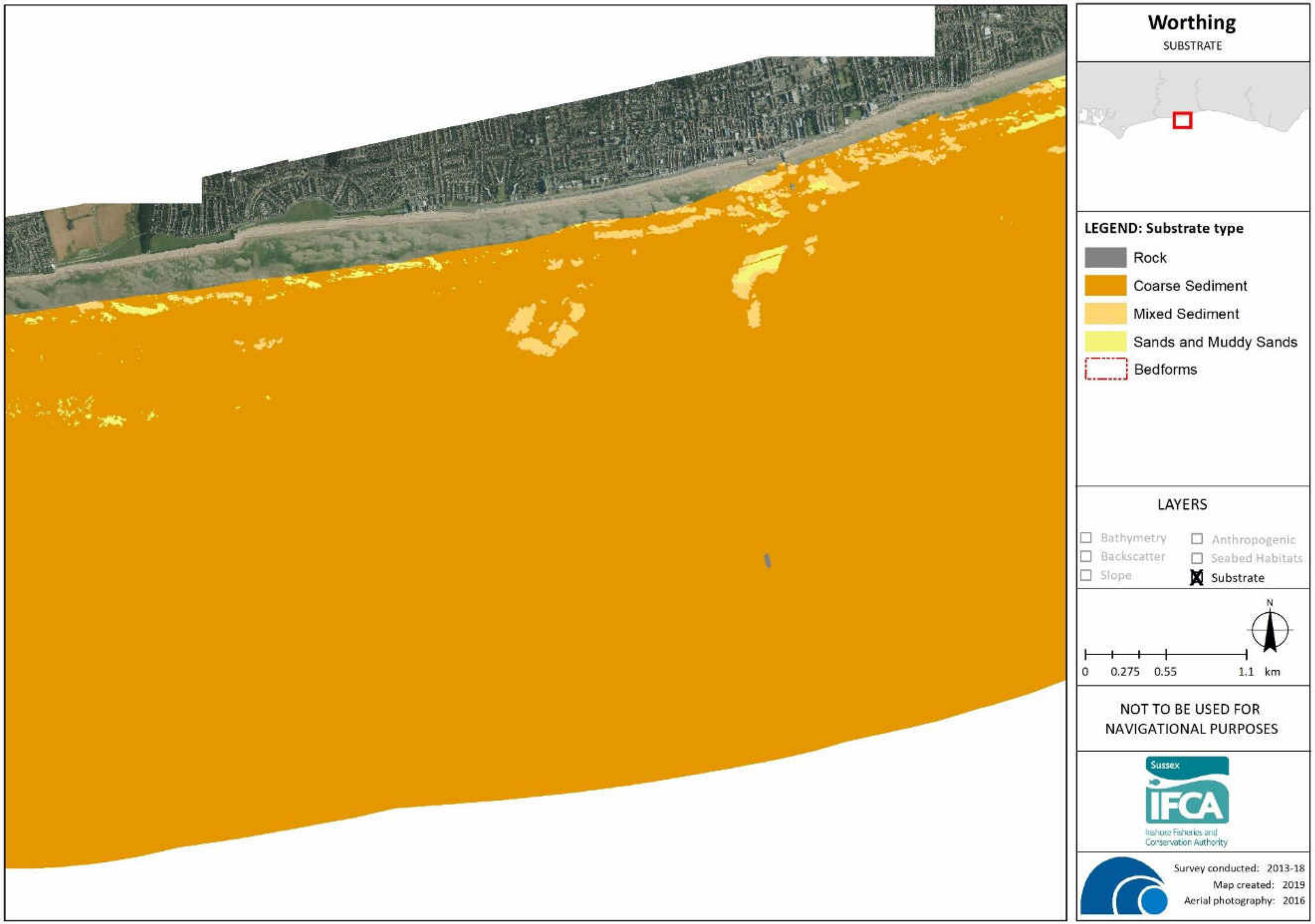

Worthing
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Worthing
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Worthing
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Worthing
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR
NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Worthing
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Worthing
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Littlehampton

Continuation of steep gravel beach backed by concrete promenade. The littoral zone is flat and extends out almost 300 m in places and is classified as *Moderate energy littoral rock and thin sediment.* Areas of fine sediment extend seawards from the beach and clearly defined in the backscatter and aerial photography. Two sinuous coarse sediment sandbars are located in the littoral zone in the centre of the map and are approximately 0.75 m higher than the surrounding seabed. They are clearly visible on the slope and anthropogenic maps.

The entrance to Littlehampton harbour, formed by the River Arun, enters the sea to the west of Littlehampton. Either side of the river the entrance is protected by a timber seawall on the west side and a concrete breakwater on the eastern side[7]. These anthropogenic structures have promoted the deposition of sediment either side of the entrance. A small delta of coarse sediment is evident with large areas of fine sediment found to the east of the entrance covering the underlying bedrock. Likely deposition of silt from the tidal River Arun.

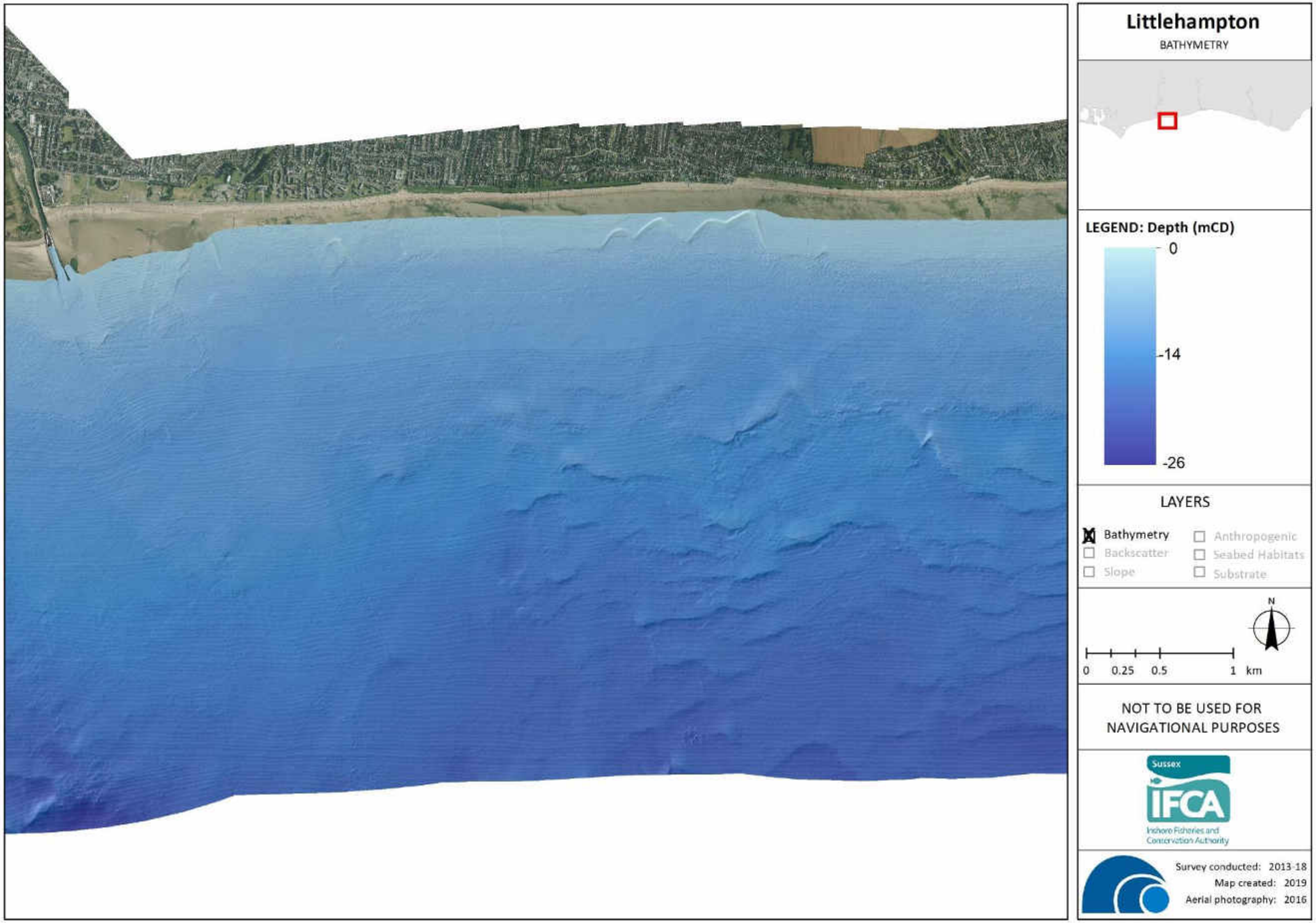
The majority of the seabed along this section is classified as *Moderate energy infralittoral rock and thin sediment*. Patches of *Sublittoral mixed sediment* and *Sublittoral sands and muddy sands* are located thoughout the infralittoral rock and thin sediment in the nearshore area. Many of these patches are less than 10 m in diameter and clearly defined on the backscatter.

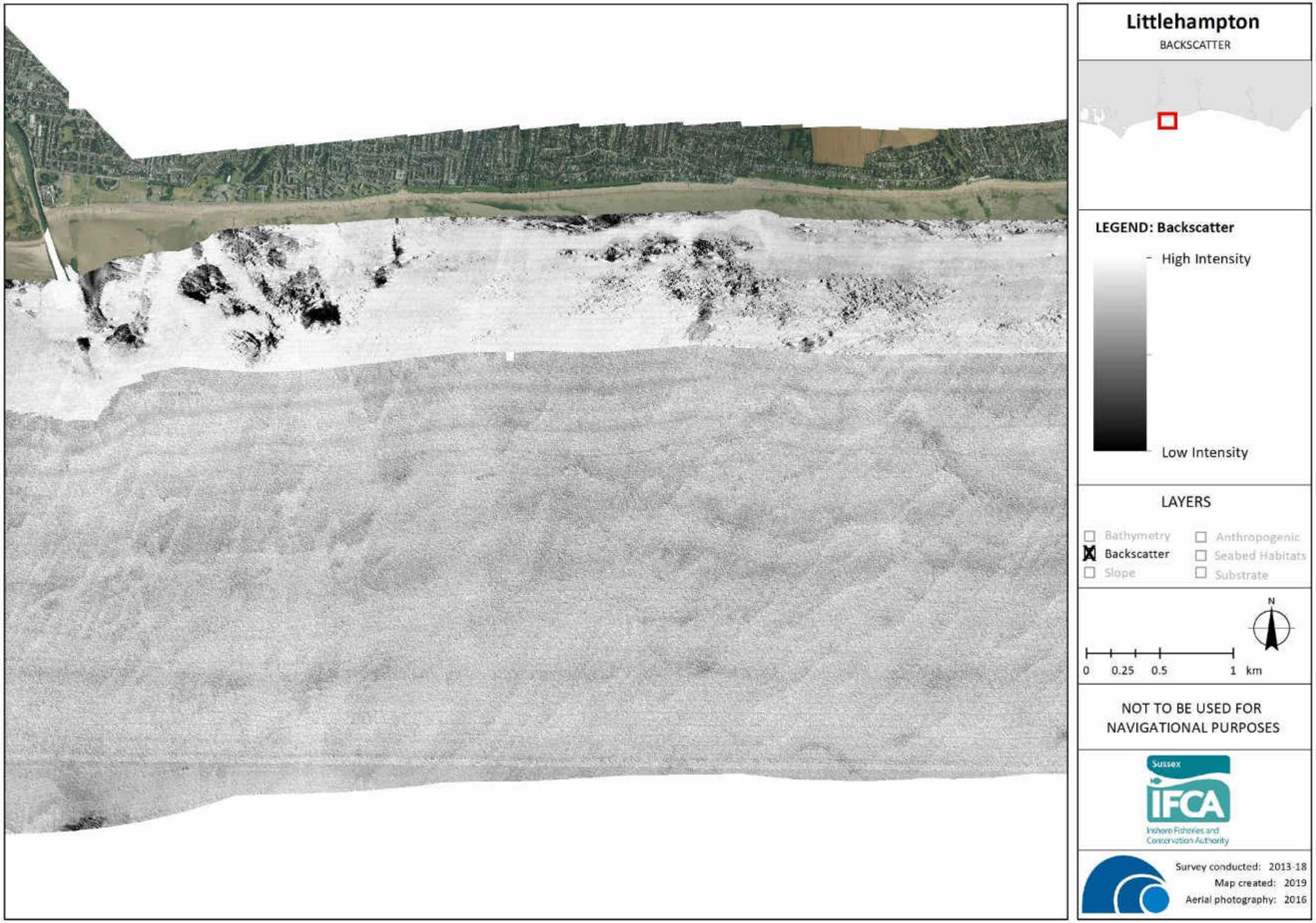
The *Moderate energy infralittoral rock and thin sediment* seabed continues to consist of boulders, pebbles and cobbles along with the continuation of the ridges from previous sections (Figure 7). Groundtruthing points from divers confirm this and sediment grabs from the bathymetry survey classify the seabed offshore as gravel and inshore a variety of gravel, gravelly sand and mixed sediments.

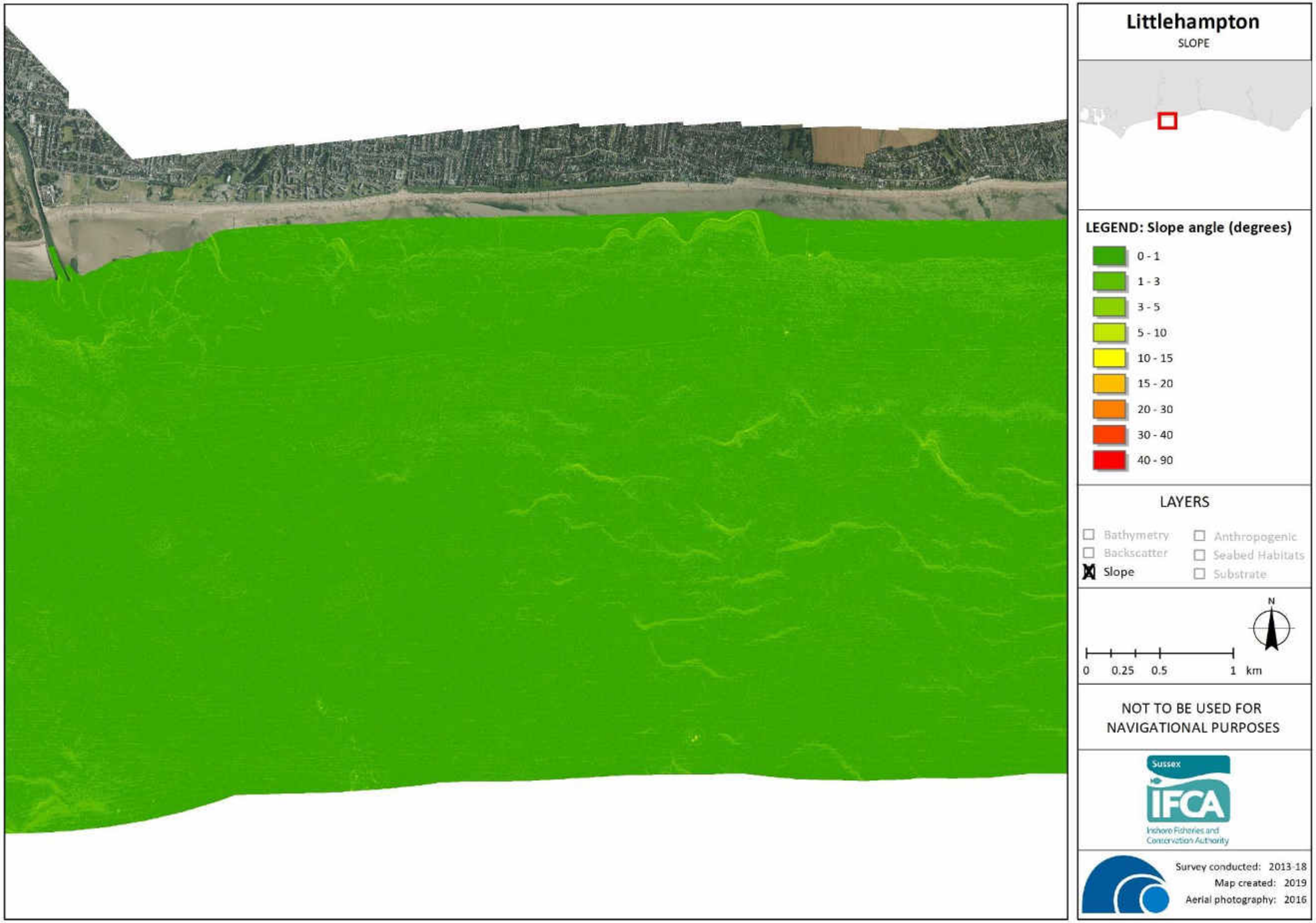
Two historic diver groundtruthing points, from the same survey, record the presence on kelp in this section. Both are located in close proximity to each other and were collected in 1994.

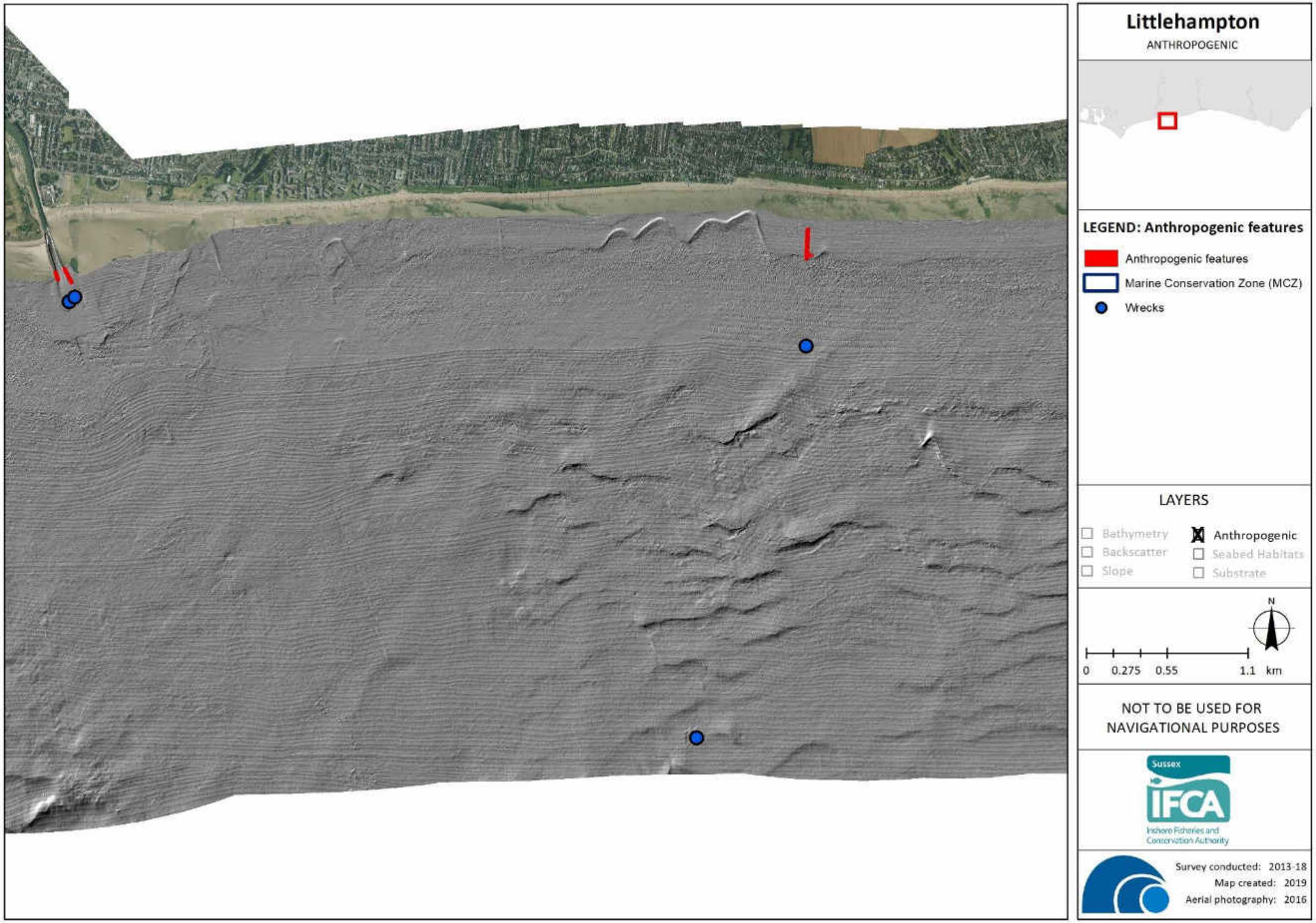
No bedforms are present. Four wrecks are located in this section with no evidence of scouring.

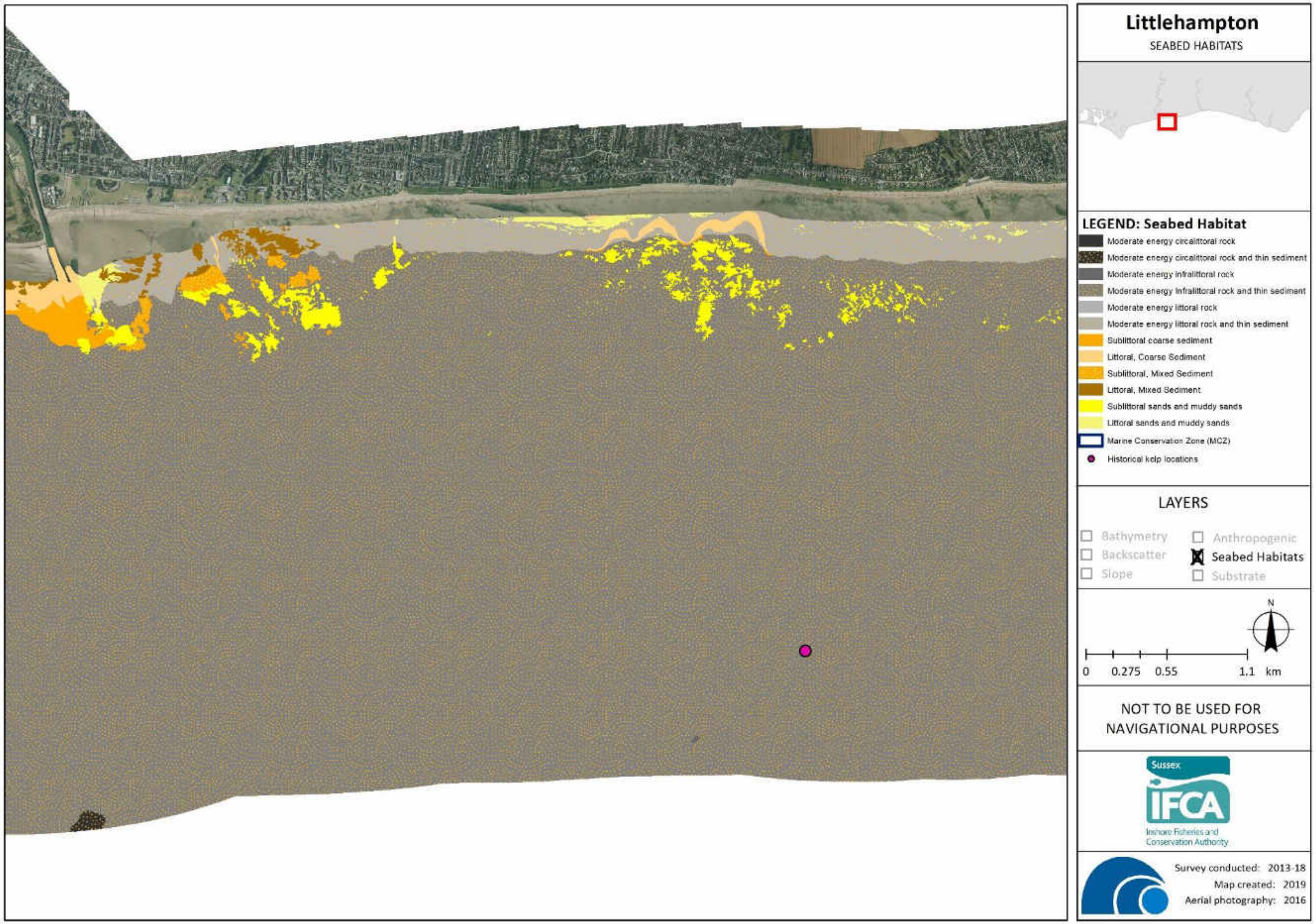
[7] https://goo.gl/maps/HBdyqXa6XW6qs1Ba7

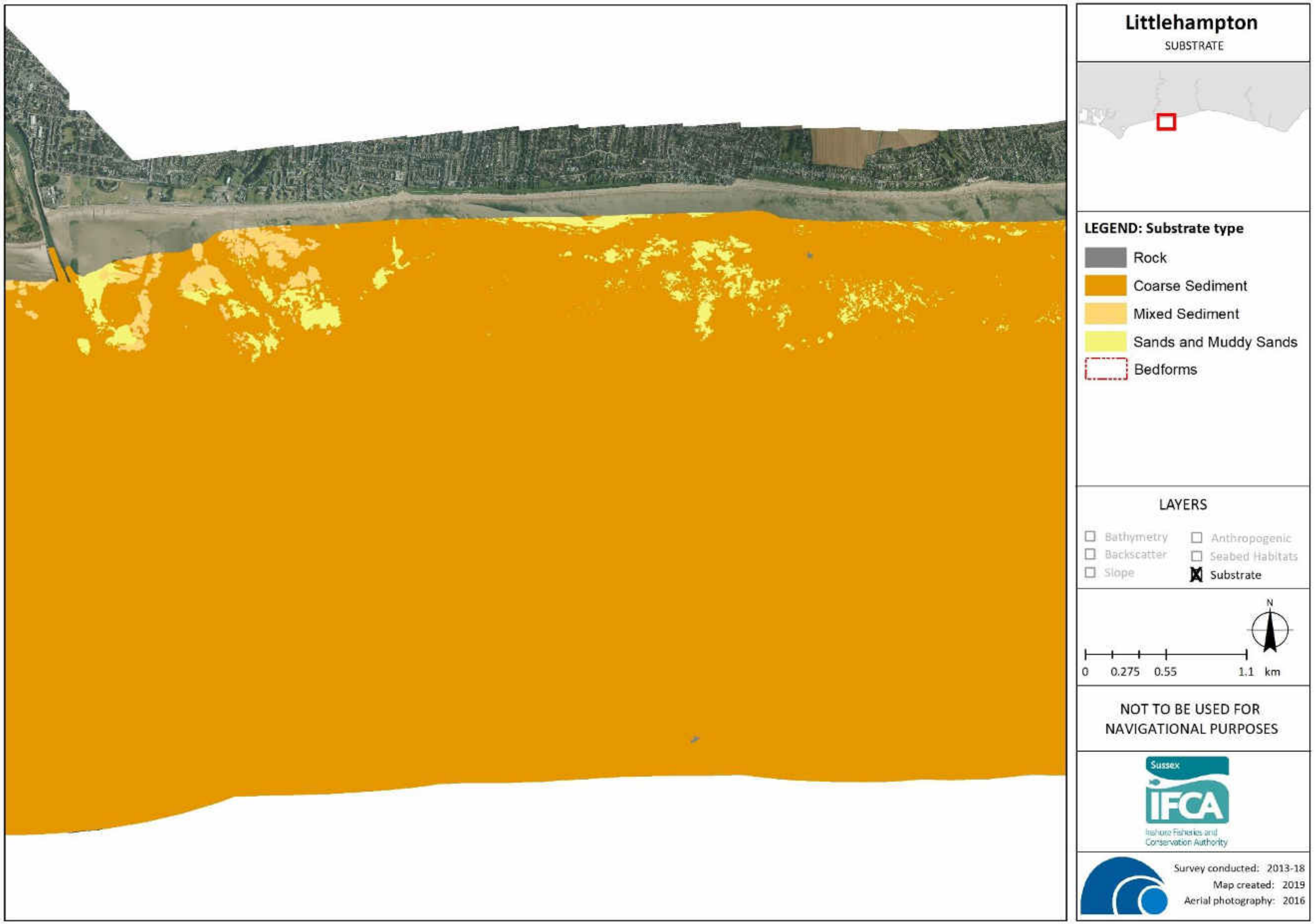

Littlehampton
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Littlehampton to Elmer

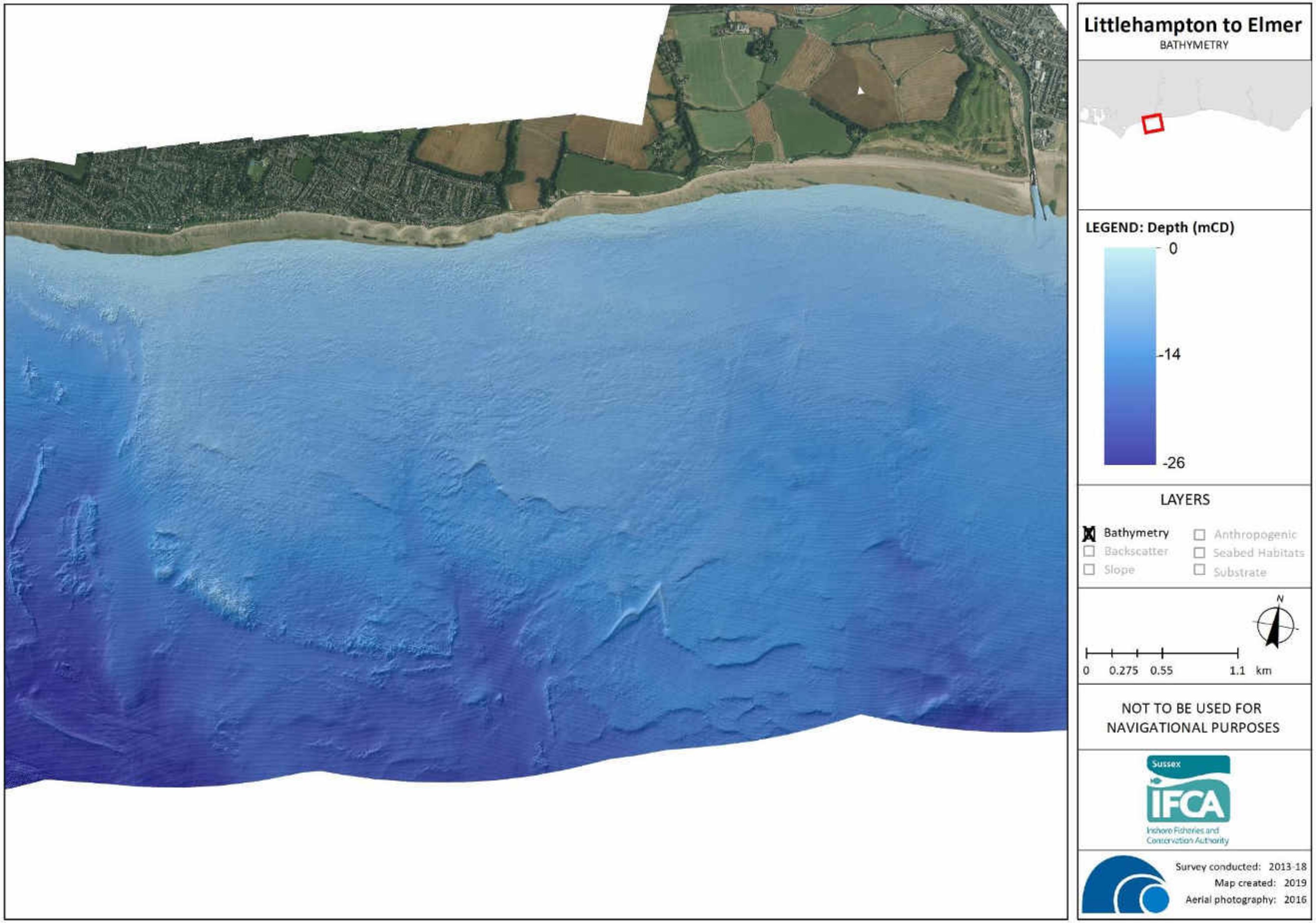
This section of coastline runs between Littlehampton and Bognor Regis and maintains an exposed gravel beach. The beach is consistent with this stretch of coastline and has a steep gradient before tapering off into a gentle foreshore extending offshore. A variety of sediment types are found in the littoral zone and extend out slightly into the infralittoral zone. The littoral zone is significantly wider around the entrance to the Littlehampton Harbour. The edge of the sandy beach can be seen in the seabed habitat map as *Littoral mixed sediment* extending offshore in places.

The majority of this section is classified as *Moderate energy infralittoral rock and thin sediment* and consists of a flat area of seabed mainly consisting of gravel, large pebbles and cobbles with mobile sediment. The majority of sediment points, that are not clearly collected on an area of fine sediment in the backscatter, indicate the sediment is gravel or gravelly sand with large pebbles found. Diver points from Marine Recorder data also correlate this description of the seabed with records of kelp and seaweed growth indicating the infralittoral zone extends across the majority of this section.

At the western extent of this section, the bathymetry descends steeply and the composition of the seabed begins to change. Areas of *Moderate energy infralittoral rock* appear in a band along the edge of this descent with *Sublittoral coarse sediment* forming the slope. Sublittoral sands and muddy sands can be found in the basin formed, both in the infralittoral and circalittoral zone. This basin separates two distinct areas of seabed which will be discussed in the following Bognor Regus section.

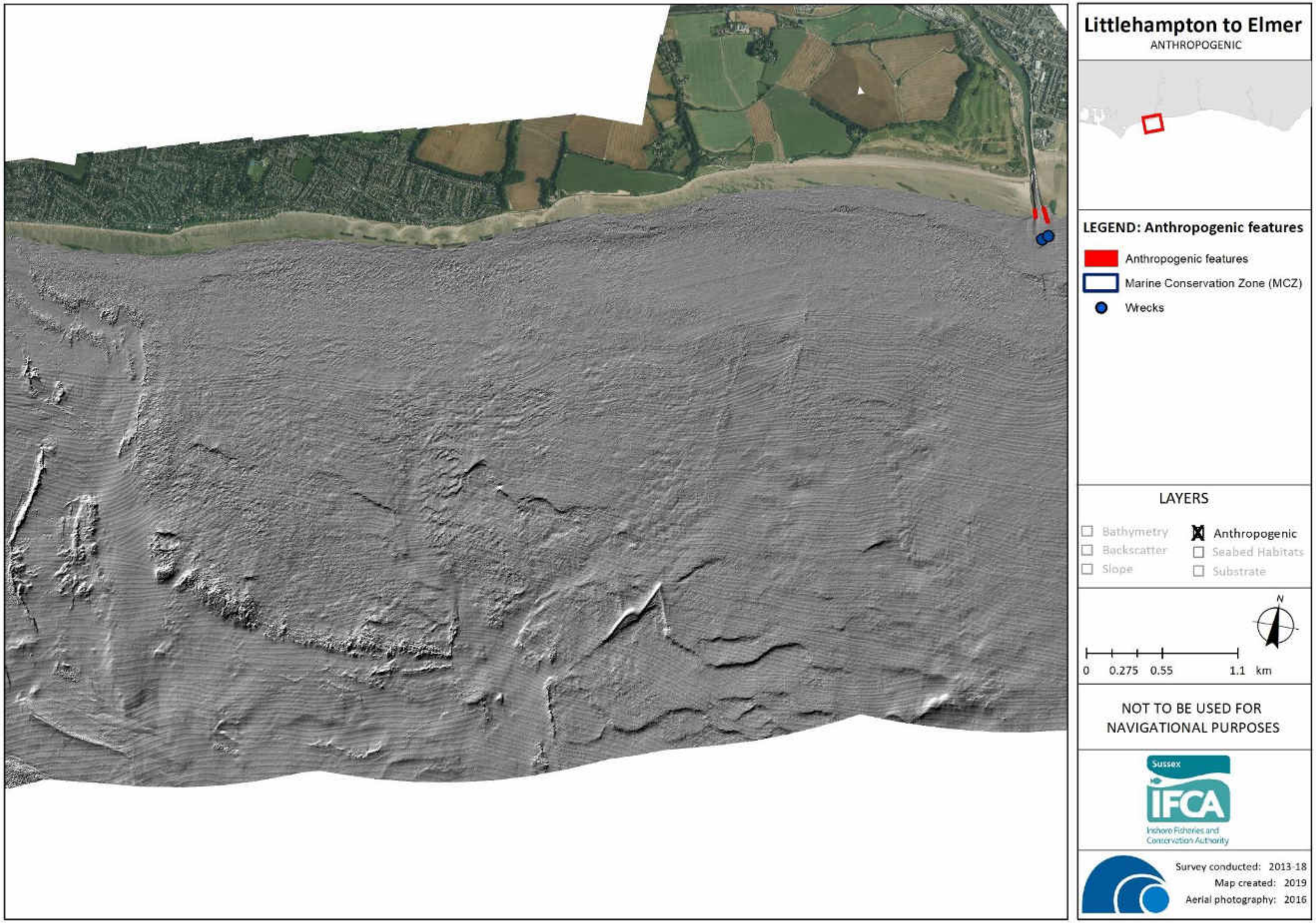
15 historical groundtruthing points from the marine recorder provide evidence of kelp growth in the area. The shallow depth and plenty of anchoring points in the infralittoral rock and thin sediment section is a potentially good environment for kelp growth.

Two wrecks are located in this area, both near the entrance to Littlehampton Harbour. No bedforms are evident in the area.

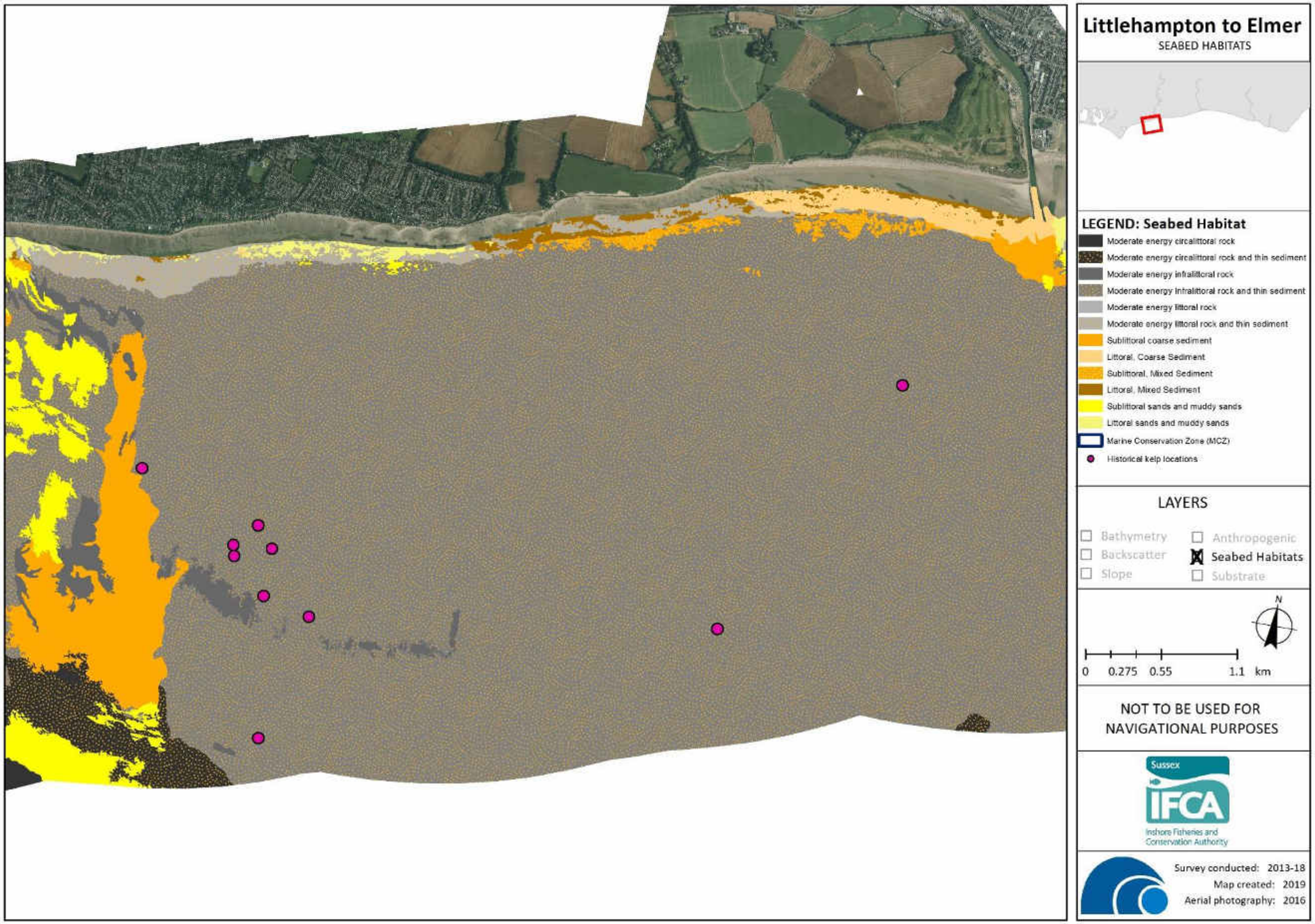

Littlehampton to Elmer
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

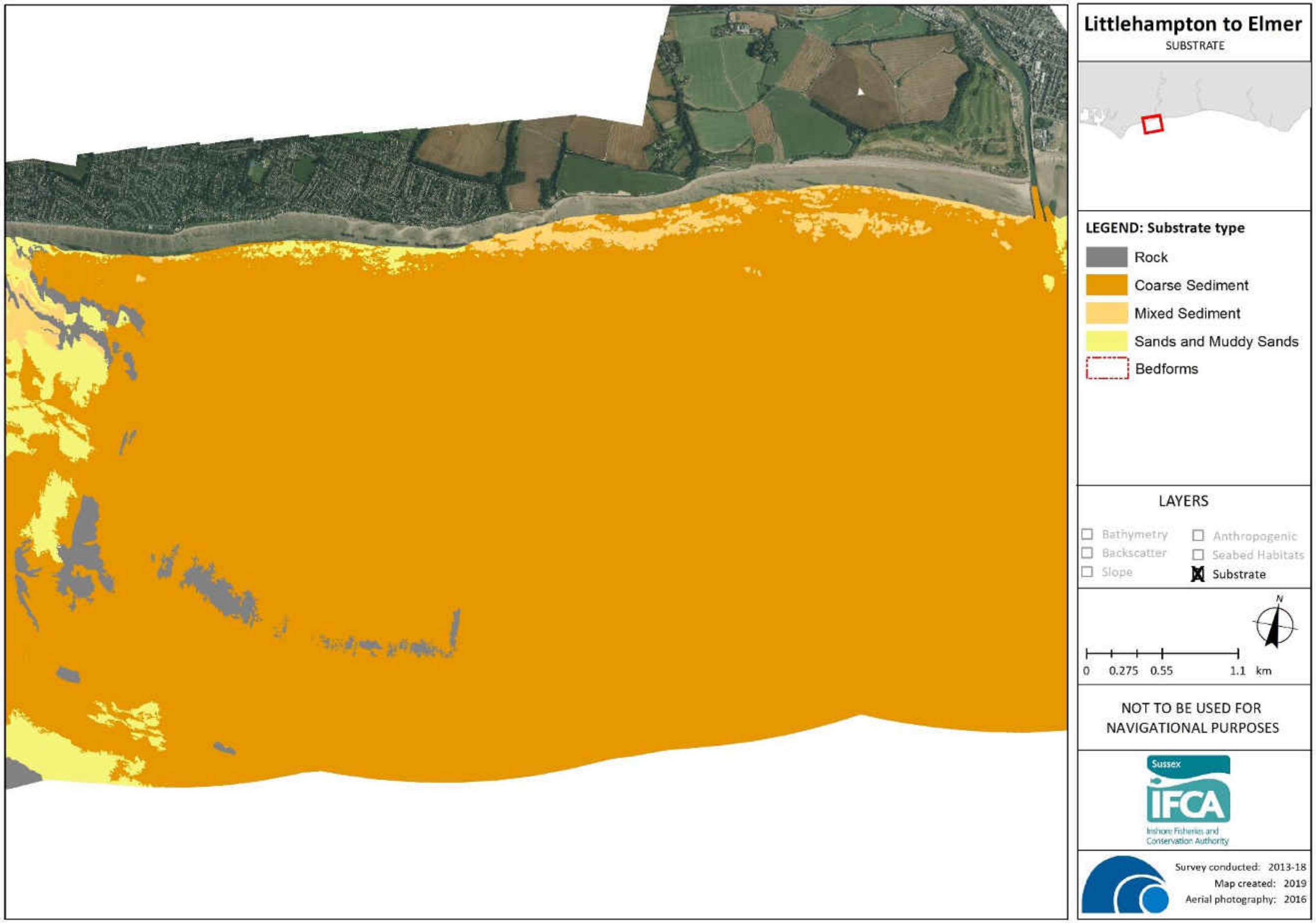

Littlehampton to Elmer
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton to Elmer
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016



Littlehampton to Elmer
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton to Elmer
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral. Coarse Sediment
Sublittoral. Mixed Sediment
Littoral. Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Littlehampton to Elmer
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.275 0.55 1.1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Bognor Regis

The nearshore area is composed of either *Littoral sands and muddy sands*, *Littoral mixed sediment* or *Littoral coarse sediment*. These sediment types are clearly distinguished in the backscatter and extend into the sublittoral zone obscuring the underlying bedrock. The different types of sediment can be directly compared to the aerial photography which is a useful cross-reference (Figure 8) as well as the visible transition from sediment to rock and thin sediment. Further offshore, where the impression of the bedrock can be seen through the sediment, the classification becomes rock and thin sediment with areas classified as sediment only if a substantial area of underlying rock is masked by the sediment.

Figure 8: An example of aerial photography and survey data at Bognor Regis

This section of coastline is significantly more diverse compared to previous sections to the east. Numerous reefs, boulder fields and outcrops of different geological types are present and extend continuously from the littoral zone through to the circalittoral zone providing an opportunity for a wide range of marine habitats.

The main bathymetric feature of this section are the two central ridges of *Moderate energy infralittoral rock* which begin in the littoral zone where only the exposed tips of the underlying outcrop are visible. The exposed tips can clearly be seen in the top right corner of the Figure 8 with areas of sediment trapped in-between and clear marcophyte growth occurring. As the sediment becomes a thin veneer further offshore the bedrock becomes clearly visible and highlighted on the slope map. The groundtruthing points also indicate a historical presence of kelp between the two ridges of infralittoral rock. The seabed further offshore extends into the circalittoral zone where cushion sponges and hydroids have been located in the past, according to groundtruthing, both indicators of a moderate energy environment on circalittoral rock.

Groundtruthing points in close proximity to the infralittoral rock ridges confirm the presence of soft bedrock. This indicates that the two ridges of exposed infralittoral rock are formed from the band of sandstone that separates the chalk and clay bedrock (according to BGS offshore bedrock map[8] seen in annex 4). The rock does not have a sharp outline in the hillshade and returns a lower

[8] http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html#

backscatter intensity than would generally be expected for bare rock. This can indicate either a soft bedrock is present, such as clay or sandstone, or significant levels of biological growth.

The ridges of bedrock separate two different seabeds. A valley is formed either side of the sandstone ridges which rise up to form the two different seabeds either side. The narrow band of sandstone separates chalk bedrock to the east and clay groups to the west. The chalk bedrock extends east towards Shoreham-by-Sea which forms the homogenous *Moderate energy rock and thin sediment* covered in chalk boulders, cobbles and pebbles mentioned in previous sections. Well defined, narrow bands and outcrops of infralittoral and circalittoral rock are found to the east of the sandstone ridges. The defined outline and groundtruthing indicating that these are potential outcrops of chalk bedrock.

To the west of the sandstone ridges of infralittoral rock the underlying clay bedrock rises steeply by approximately three metres to a relatively flat plateau of *Sublittoral coarse sediment* which extends southwest towards Selsey Bill. Areas of *Sublittoral sands and muddy sands* and *Sublittoral mixed sediment* are found on the slope.

The relatively flat plateau has two distinct depressions in the *Sublittoral coarse sediment*, locations can clearly be identified in the slope and bathymetry maps. Fine sediments can be identified in the depression through the backscatter along with the intial impressions of the undelying bedrock was has been labelled rock and thin sediment. Cross-section C-D (Figure 9) illustrates the depth change for one of the depressions and its location is marked on the anthropogenic map.

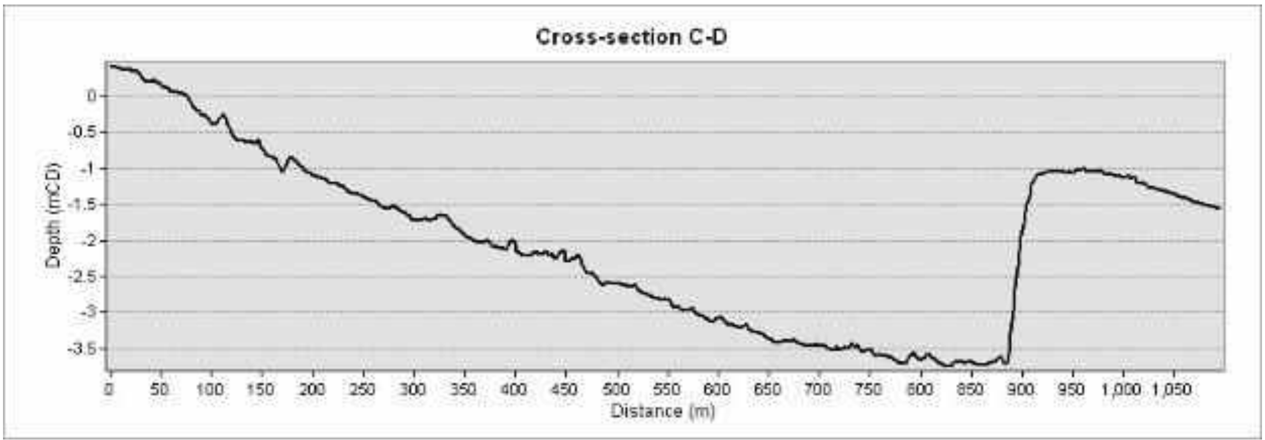
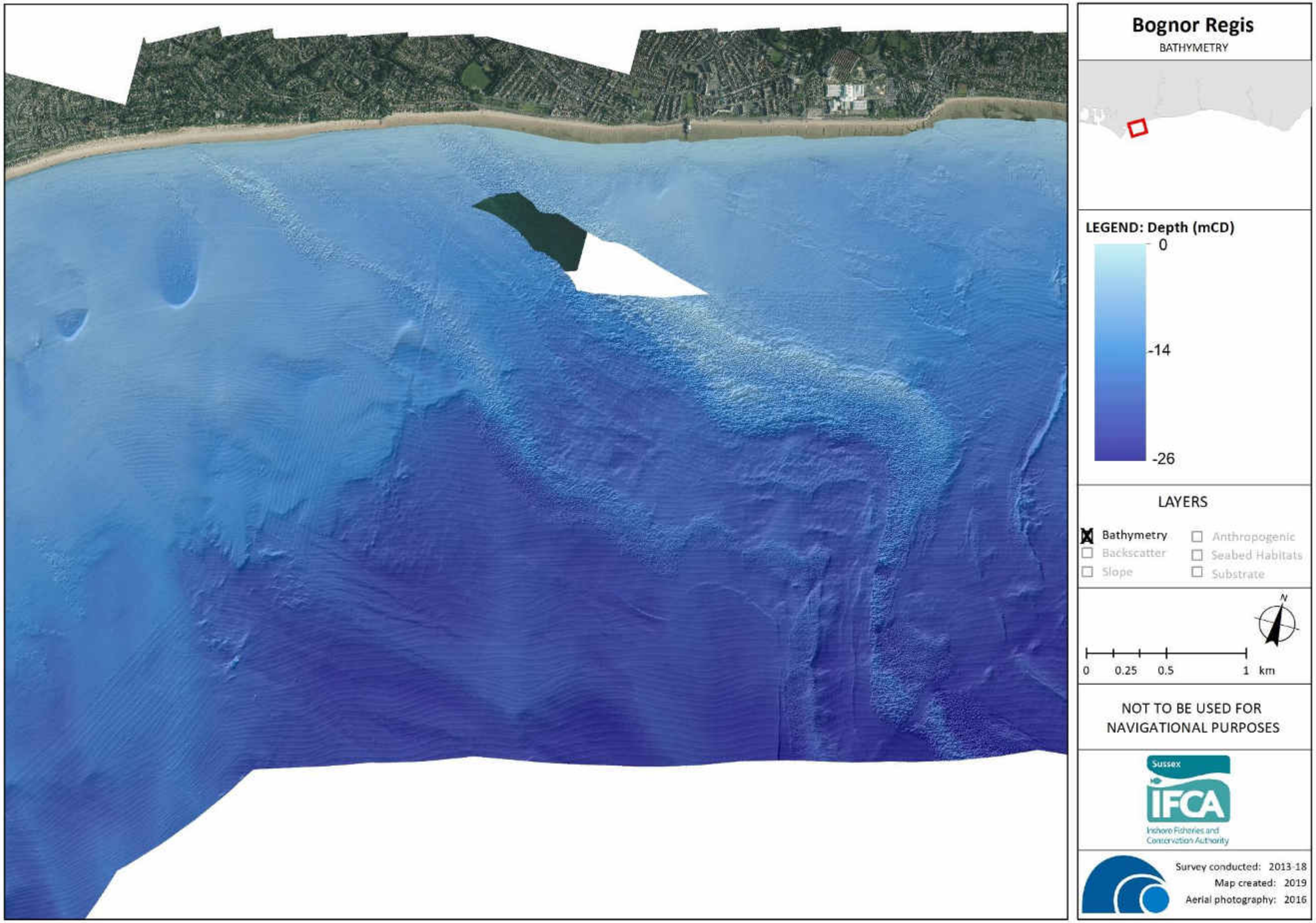
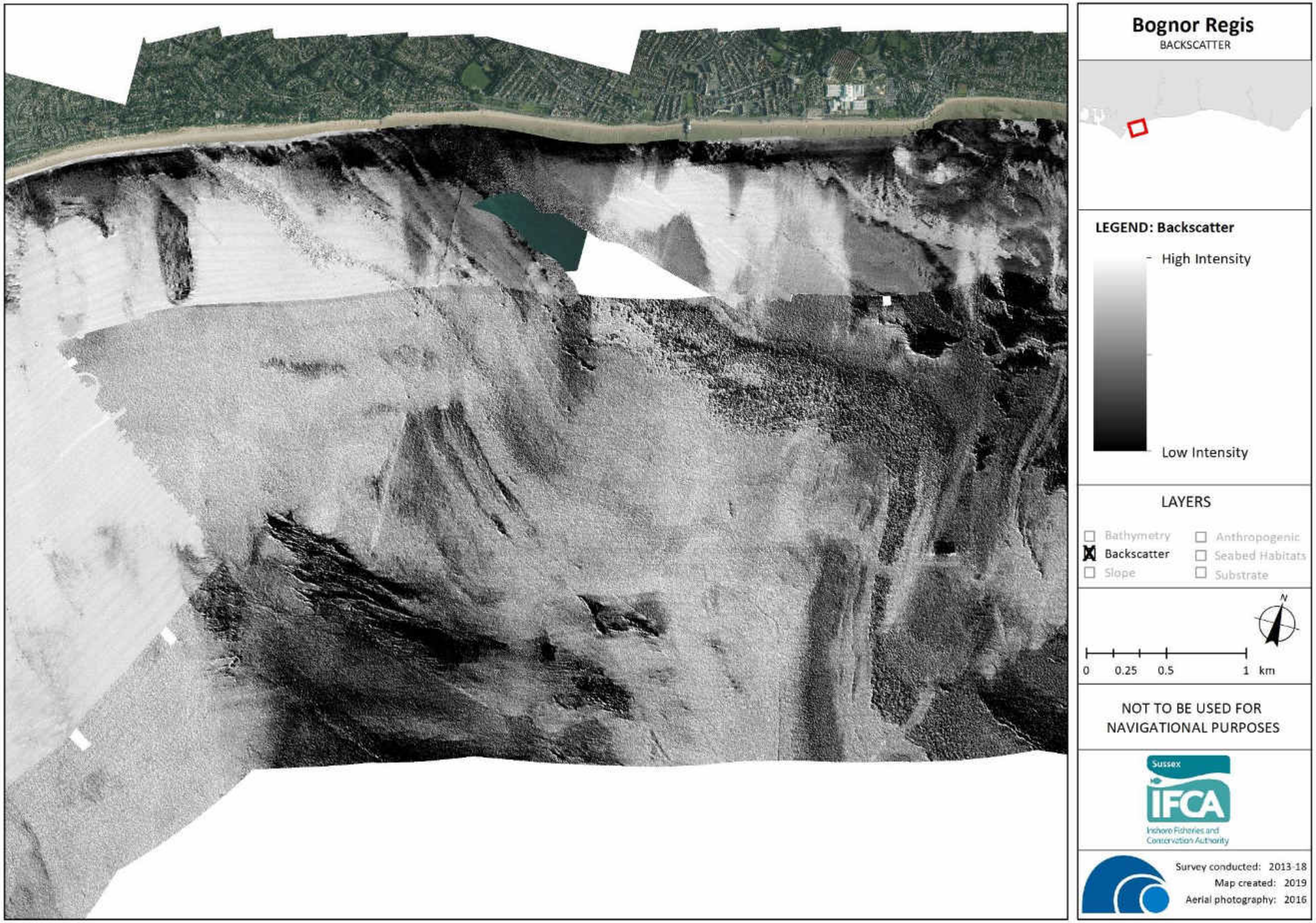


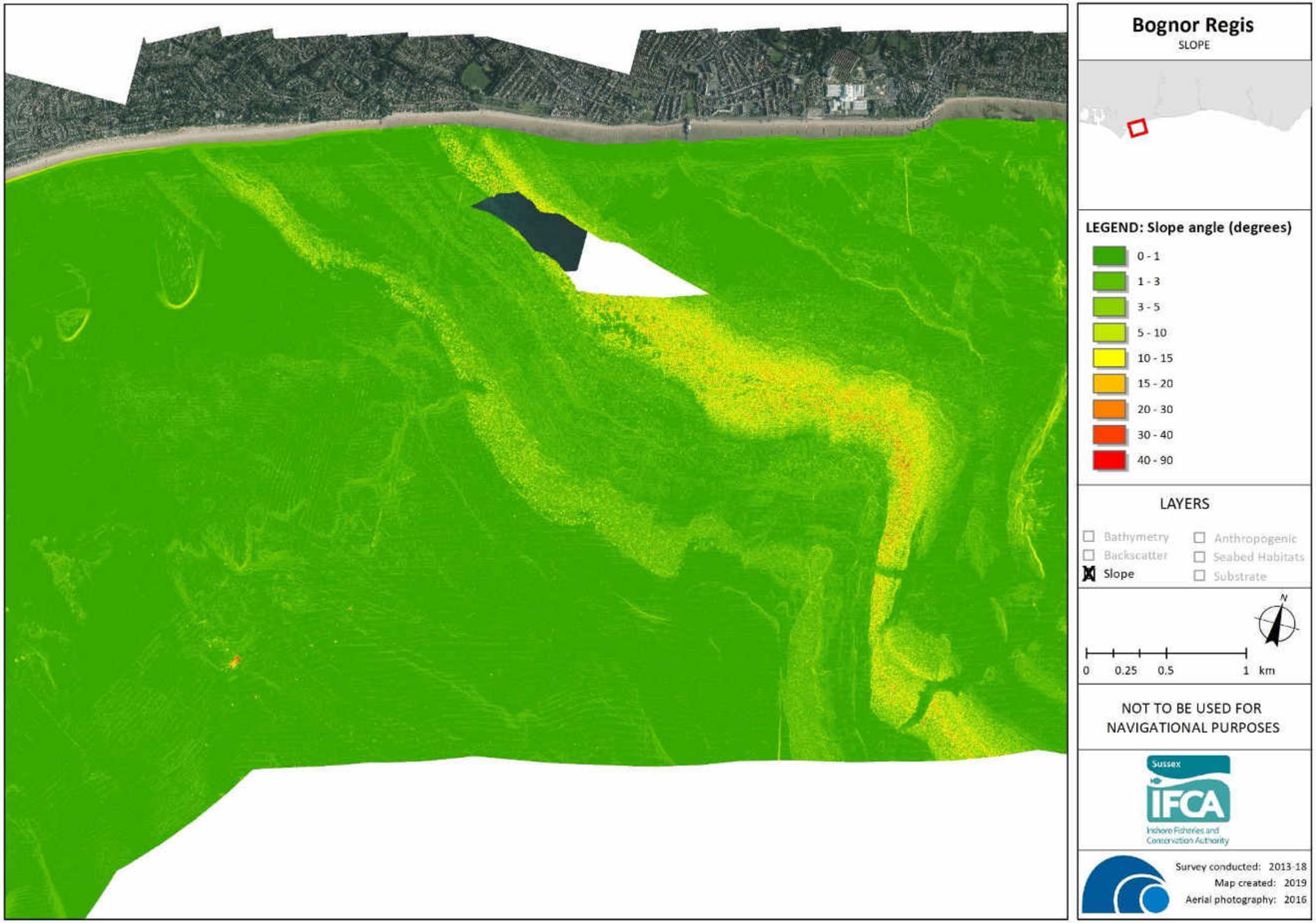
Figure 9: Cross-section illustrating change in depth across a depression in the seabed

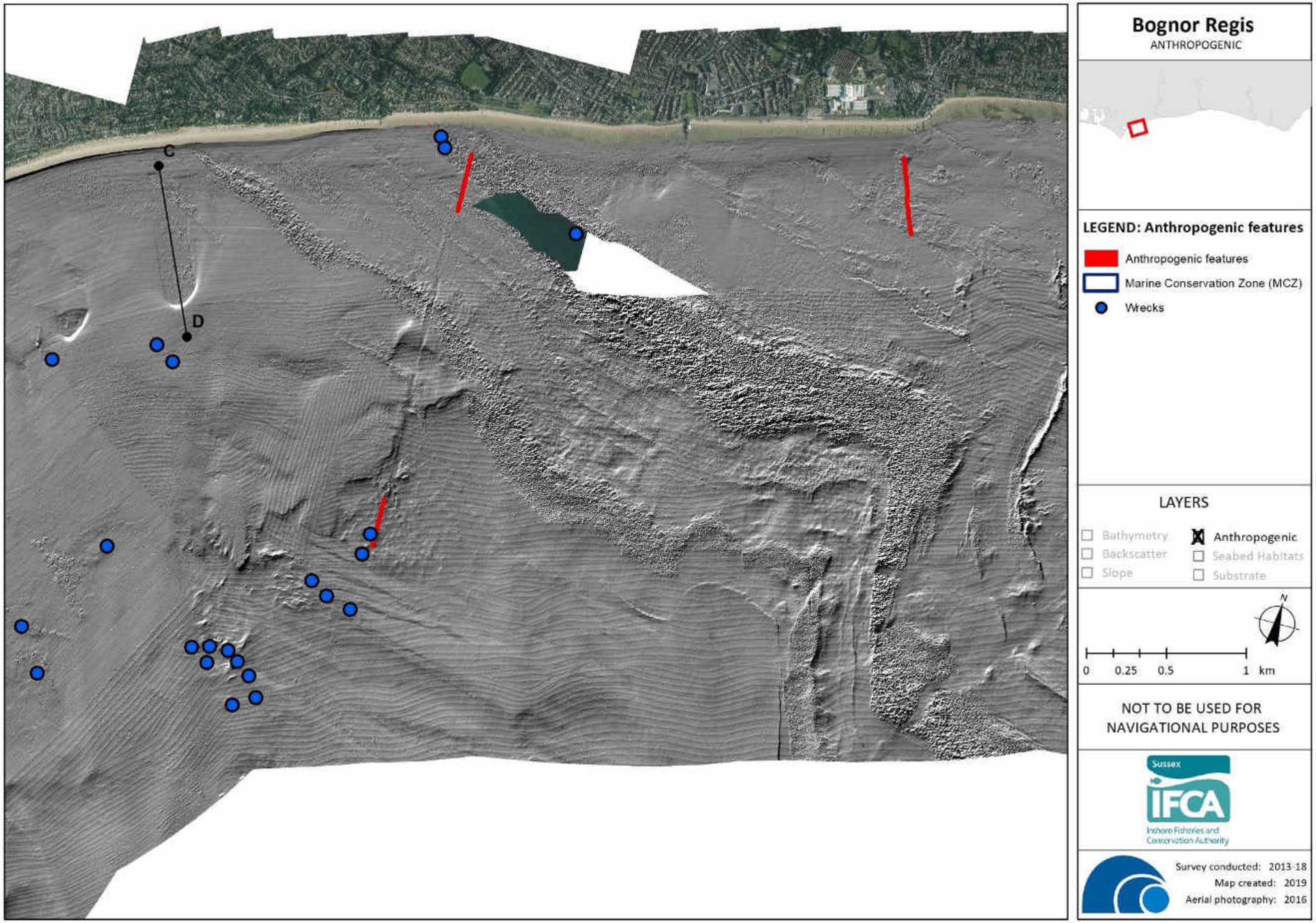
11 wrecks are present in this section including a WW2 wreck found in an area of mixed sediment offshore. No bedforms or scouring can be seen surrounding the wreck.

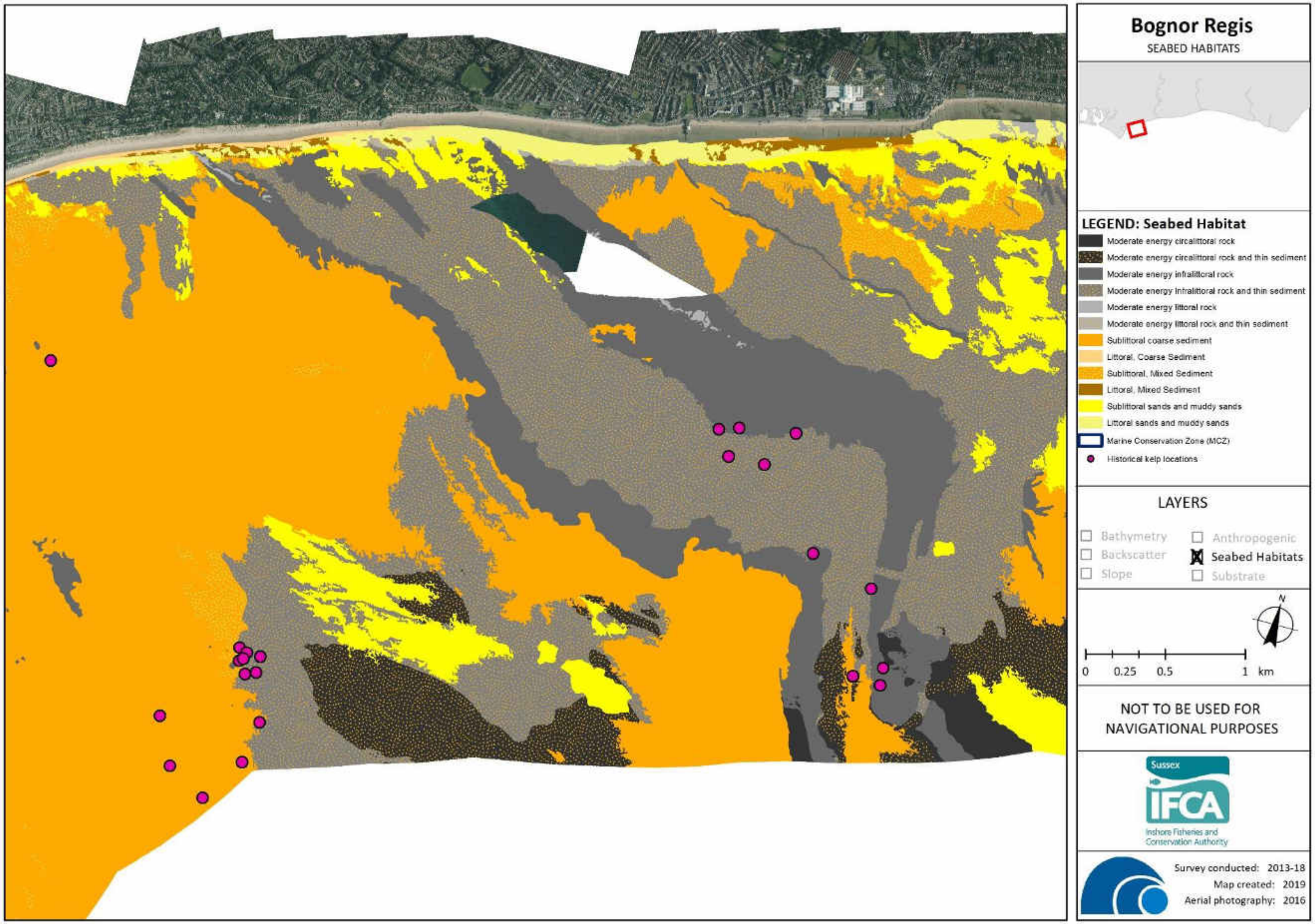
There is a section of data missing in this section which is part of the sandstone ridge located in the centre of the map. This is due to the rocky area being too shallow and difficult to survey successfully.

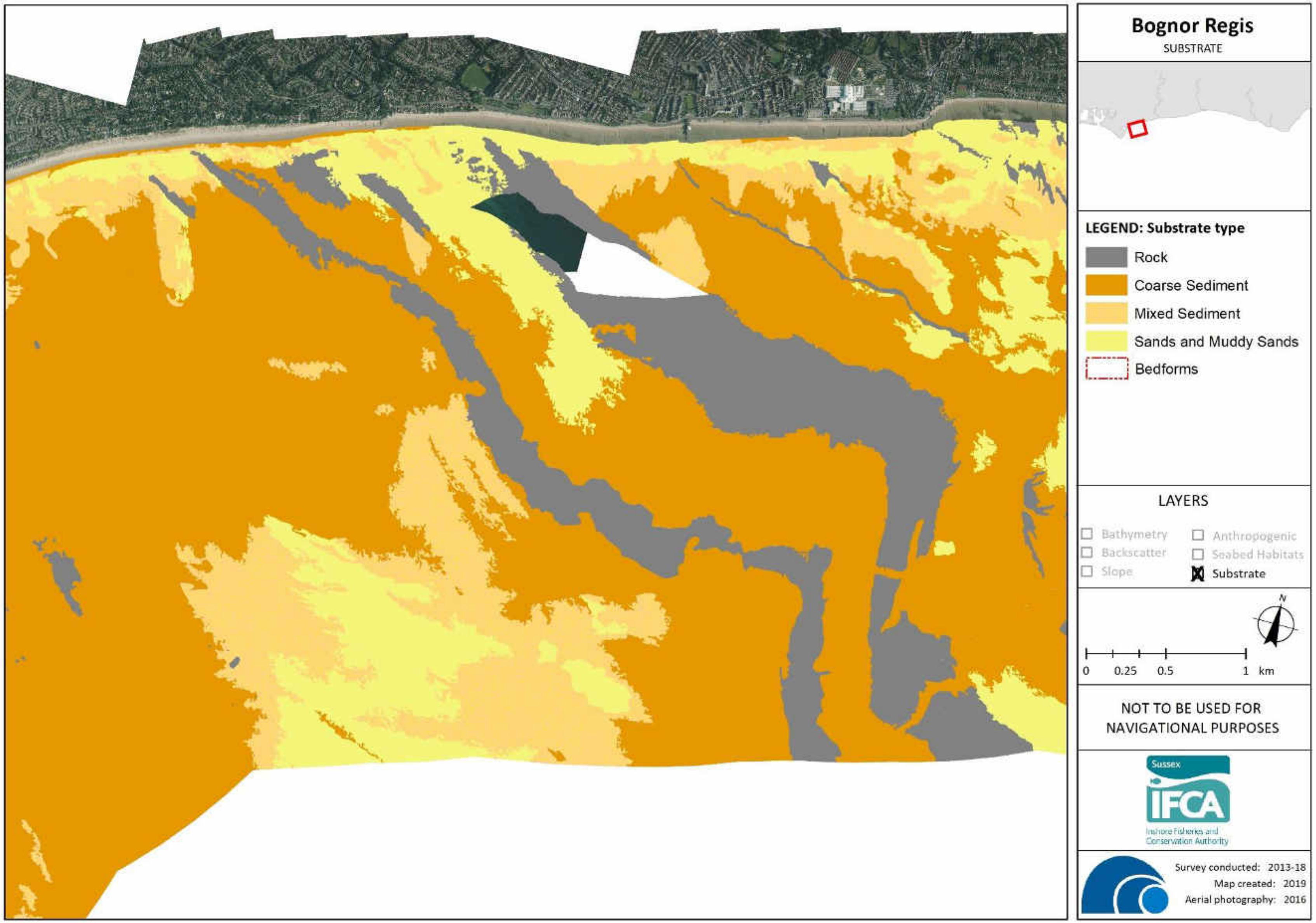

Bognor Regis
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0
0.25
0.5
1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Bognor Regis
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR
NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Bognor Regis
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


C
D
Bognor Regis
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Bognor Regis
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral. Coarse Sediment
Sublittoral. Mixed Sediment
Littoral. Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Bognor Regis
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Pagham Harbour to Selsey

The shoreline in this section continues the steep gravel backed beach leading into a shallow gradient foreshore extending offshore. One of the main features of this section of coastline is Pagham Harbour which is a designated Marine Conservation Zone (MCZ) as well as a Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI).

The entrance to Pagham Harbour is continuously changing and the small delta can clearly be seen in the hillshade and bathymetry. The delta cannot be distinguished in the backscatter implying it’s formed from similar sediment to the surrounding *Littoral* and *Sublittoral coarse sediment*. However, immediately offshore from the delta is an area of finer *Sublittoral mixed sediment* which indicates the settling of finer sediments from suspension. The aerial photography from 2016 shows that Pagham Spit has breached halfway along its length which means the seabed along this small stretch of nearshore coastline may have changed dramatically from this 2016 data.

The littoral zone is much wider along this section of coastline indicating a lower energy environment provided by the shelter Selsey Bill provides from prevailing winds and wave energy. The majority of the seabed in this section is flat and undulating *Sublittoral coarse sediment*. Groundtruthing grabs indicate the seabed is either gravel or sandy gravel. Combined with video grabs in the area, they indicate the seabed is a mixture of gravel and large pebbles mixed with mobile coarse sediment.

Throughout this section of seabed small areas of depression are located throughout the seabed which are clearly highlighted by the slope map. These depressions range in from 1.5 – 4 m in depth; Figure 10 shows the cross-section of one of the depressions. Some of these depressions appear on the backscatter indicating either a different sediment type or a thin veneer of sediment covering underlying bedrock.

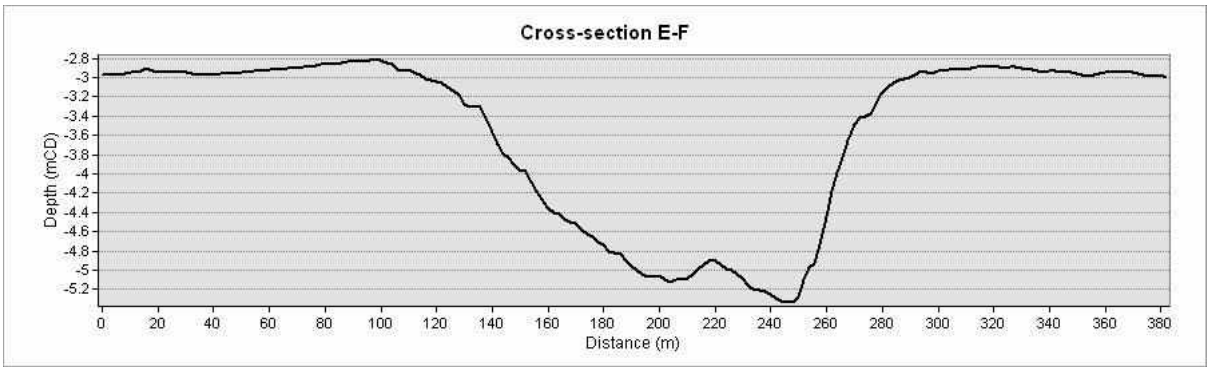
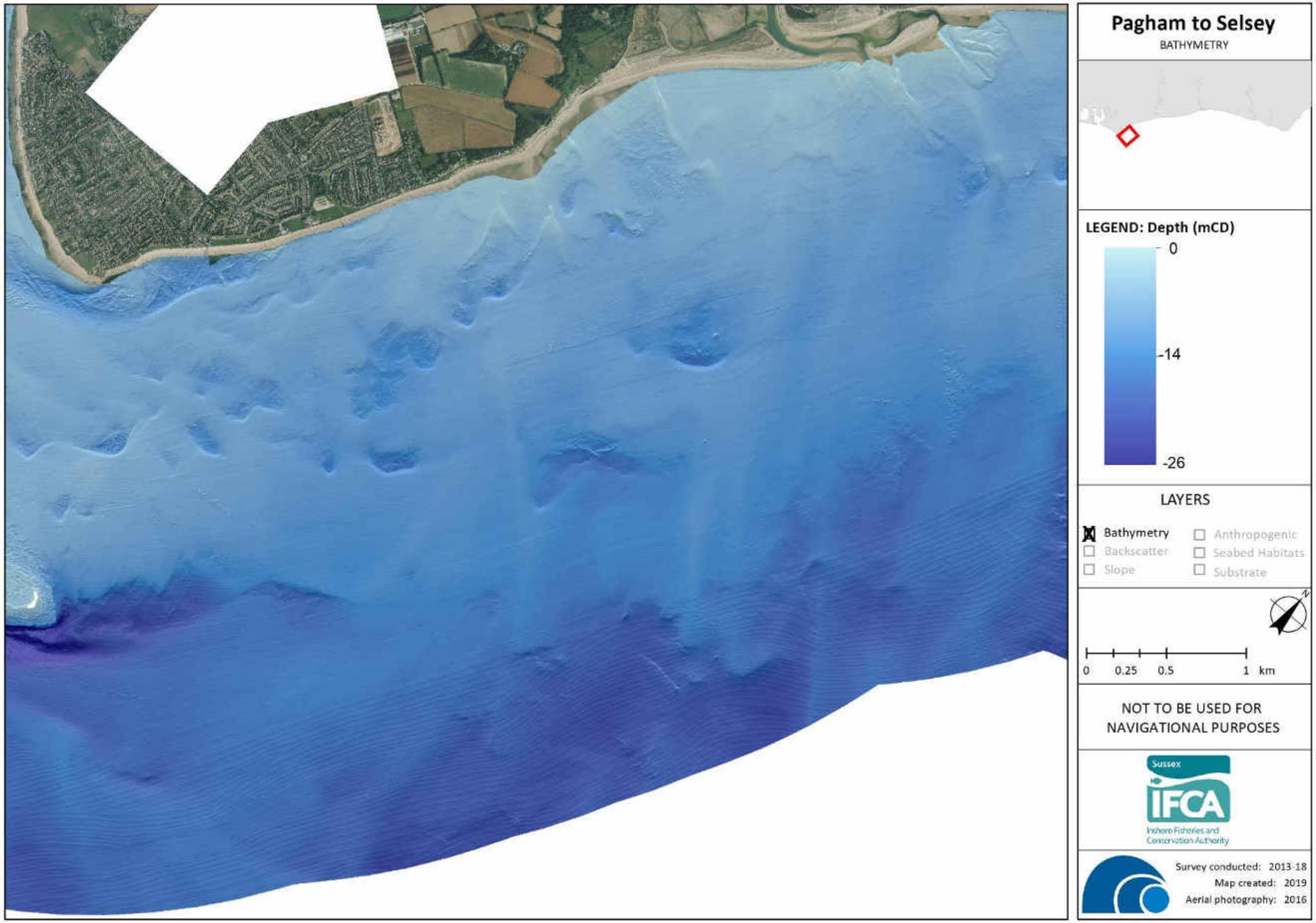


Figure 10: Cross-section illustrating change in depth across a depression in the seabed

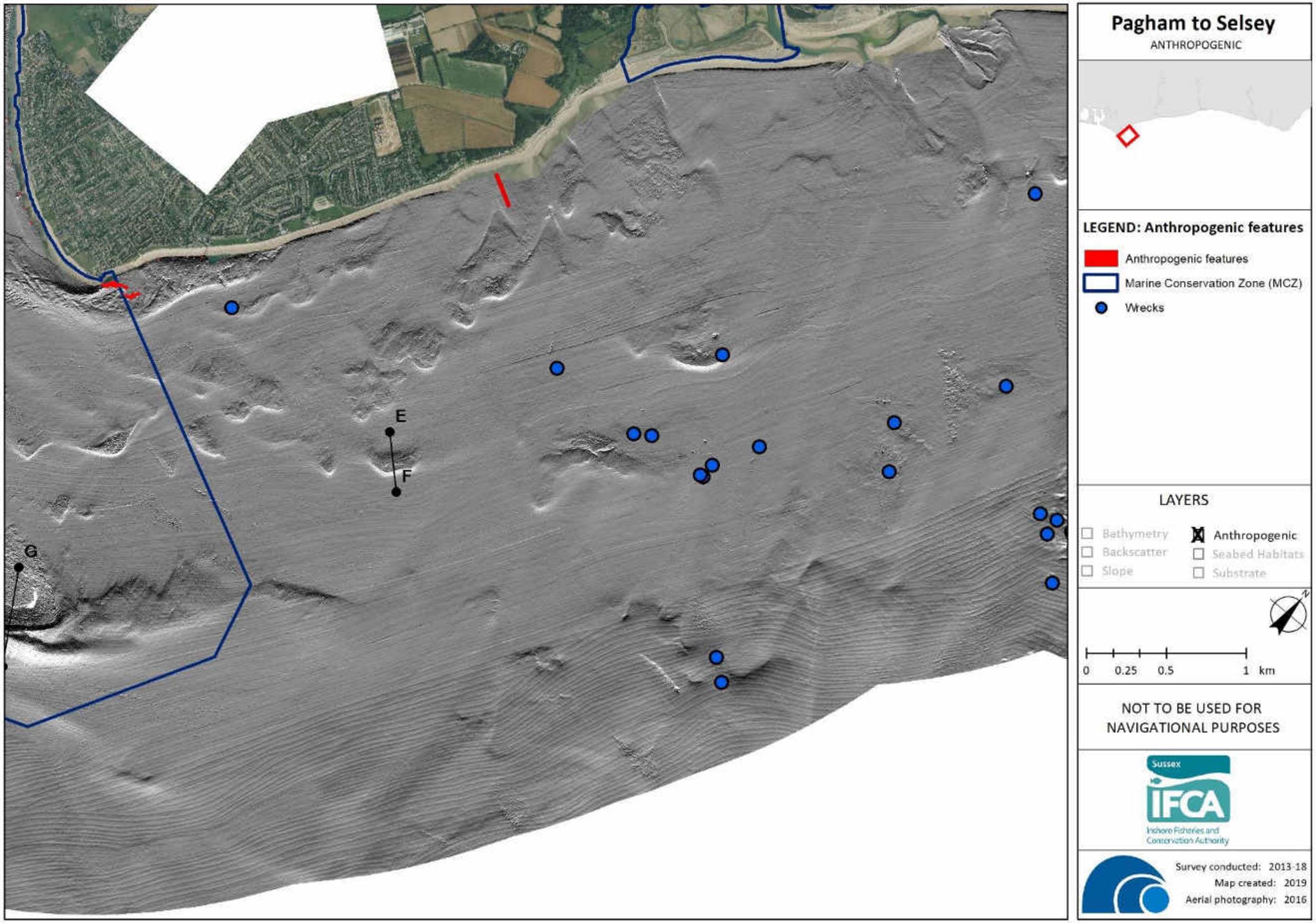
Groundtruthing points show historical evidence of Kelp in the area between 1993 - 2012. These points are distributed throughout this area.

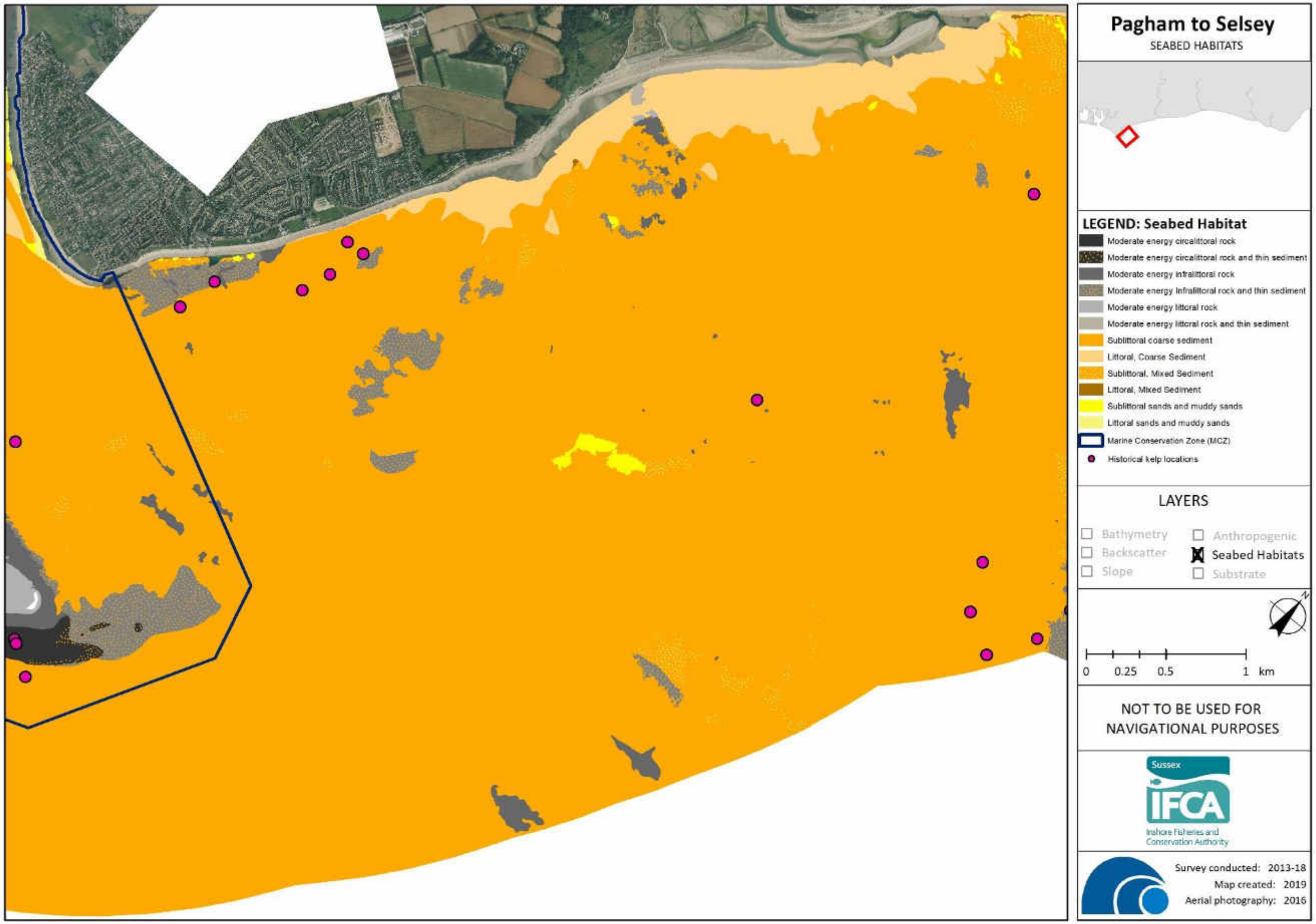
15 wrecks are evident in this area but due to the coarse sediment no bedforms or scouring are apparent in the surrounding areas.

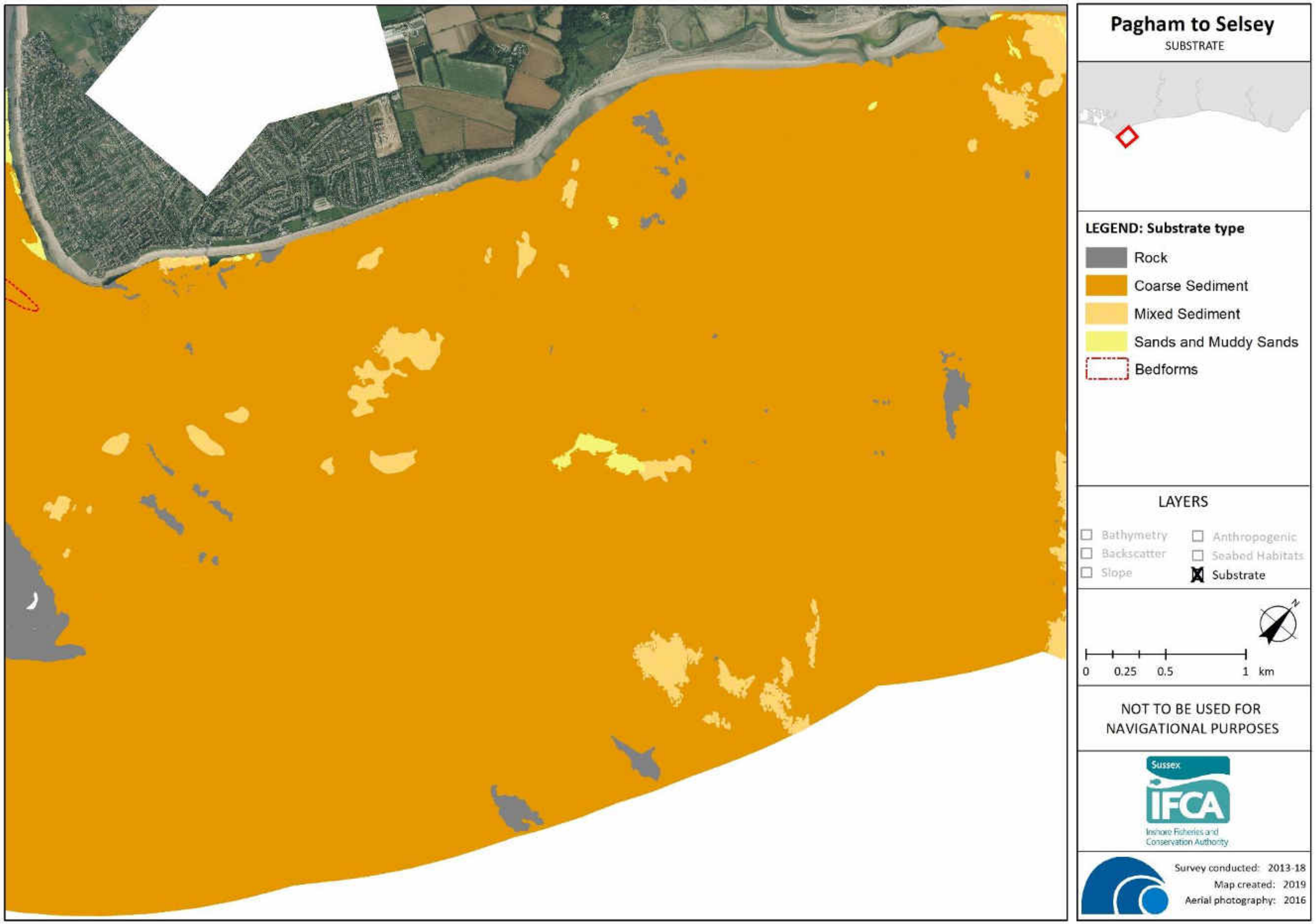

Pagham to Selsey
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0
0.25
0.5
1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Pagham to Selsey
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Pagham to Selsey
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


E
F
G
Pagham to Selsey
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Pagham to Selsey
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Subtidal coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Pagham to Selsey
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

Selsey Bill

The prominent headland of Selsey Bill creates large currents in the surrounding water column. The seabed surrounding Selsey Bill has a number of interesting features, including the Mixon Hole, and provides a diverse number of habitats. The west side of Selsey Bill is exposed to the prevailing wind direction and exposed to large waves. Flooding was a common occurrence before the Medmerry realignment scheme in September 2013. Tidal currents can be up to 2.2 knots during springs and wave heights measured by the Bracklesham Bay wave buoy can exceed 3.0 m during storm conditions.

The shoreline around Selsey Bill is exclusively backed by steep gravel beaches with a shallow gradient foreshore made up of fine sediments with coarse sediment and clay regularly appearing. Extensive topographic surveys completed by the Southeast Regional Monitoring Programme confirms this structure in the littoral zone. During the Medmerry realignment scheme, localised areas of the beach eroded substantially revealing the underlying clay bedrock and coarse sediment beneath the fine sediment (Figure 11).

Figure 11: Exposed clay at Medmerry, West Sussex (CCO, 29/10/2014)

At the southern tip of Selsey Bill the littoral zone steeply descends from the beach into a narrow channel scoured into the sediment. The channel has a maximum depth of -4.5 mCD and rises back up to almost 0 mCD and gradually descends offshore. To the west of the channel a crescent shaped bar of *Littoral coarse sediment* is visible and to the east the scoured zone continues as *Moderate energy infralittoral rock* with patches of thicker sediment. Within the scoured area are patches of rock, both natural and manmade structures, and a large wreck.

The BGS marine bedrock 250k layer[9] confirms that Barton Clay and London Group Clay are the underlying bedrock for this area. Clay reefs do not often appear as clearly in backscatter as rocky reefs as the return intensity is lower, but using the depth variability and the hillshade to assess the texture and roughness allows confirmation of a rocky environment. The seabed surrounding Selsey Bill is very shallow, generally less than 5 mCD, with the exception of the Mixon Hole.

The seabed offshore of Selsey Bill is perhaps the most diverse throughout the mapped area and subsequently the Selsey Bill and the Hounds Marine Conservation Zone (MCZ) is located in the

[9] http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html#

area and highlighted on the maps. The underlying clay groups here are regularly exposed and form large reefs and outcrops which support a large variety of marine fauna and flora.

The most striking of these is the large reef located directly to the south of Selsey Bill where the reef gradually becomes exposed and on the south side drops off from -4 mCD to -22 mCD in less than 20 m (Figure 12). Clay reefs do not often appear as clearly in backscatter as rocky reefs as the return intensity is lower but using the depth variability and the hillshade the texture and roughness of the clay reefs is clearly illustrated.

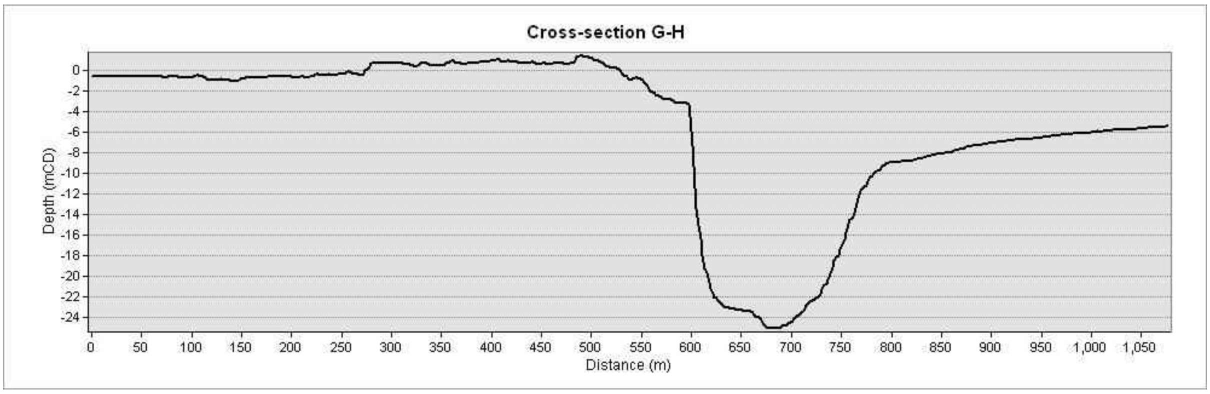


Figure 12: Cross-section illustrating change in depth across the Mixon Hole

The sediment to the east of Selsey Bill is a continuation of the undulating *Sublittoral coarse sediment* that started at Bognor Regis. The coarse sediment descends from approximately -0.8 mCD to – 4 m CD. The sediment is thinner and coarser here with patches of rocky reefs, classed as *Moderate energy rock*, before the sediment transitions into fine sediments and ascends to -1 mCD (Figure 13). The main bedform feature found in this area is located on this initial slope of *Sublittoral sands and muddy sands*. Three additional small patches of bedforms are found further offshore on areas of sands and muddy sands. These bedforms indicate that Selsey Bill is in a higher energy environment and the lack of fine sediments to the east indicates a higher energy environment than Bracklesham Bay. This is backed up by the wave buoy data which shows that the Worthing wave buoy experiences on average a higher energy environment compared to the Bracklesham Bay wave buoy. The bedforms themselves do not indicate a clear direction of sediment transport.

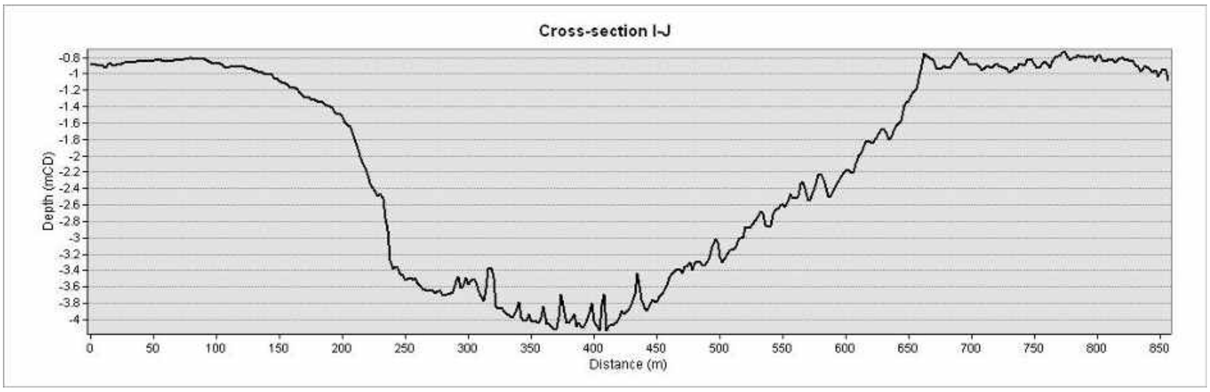


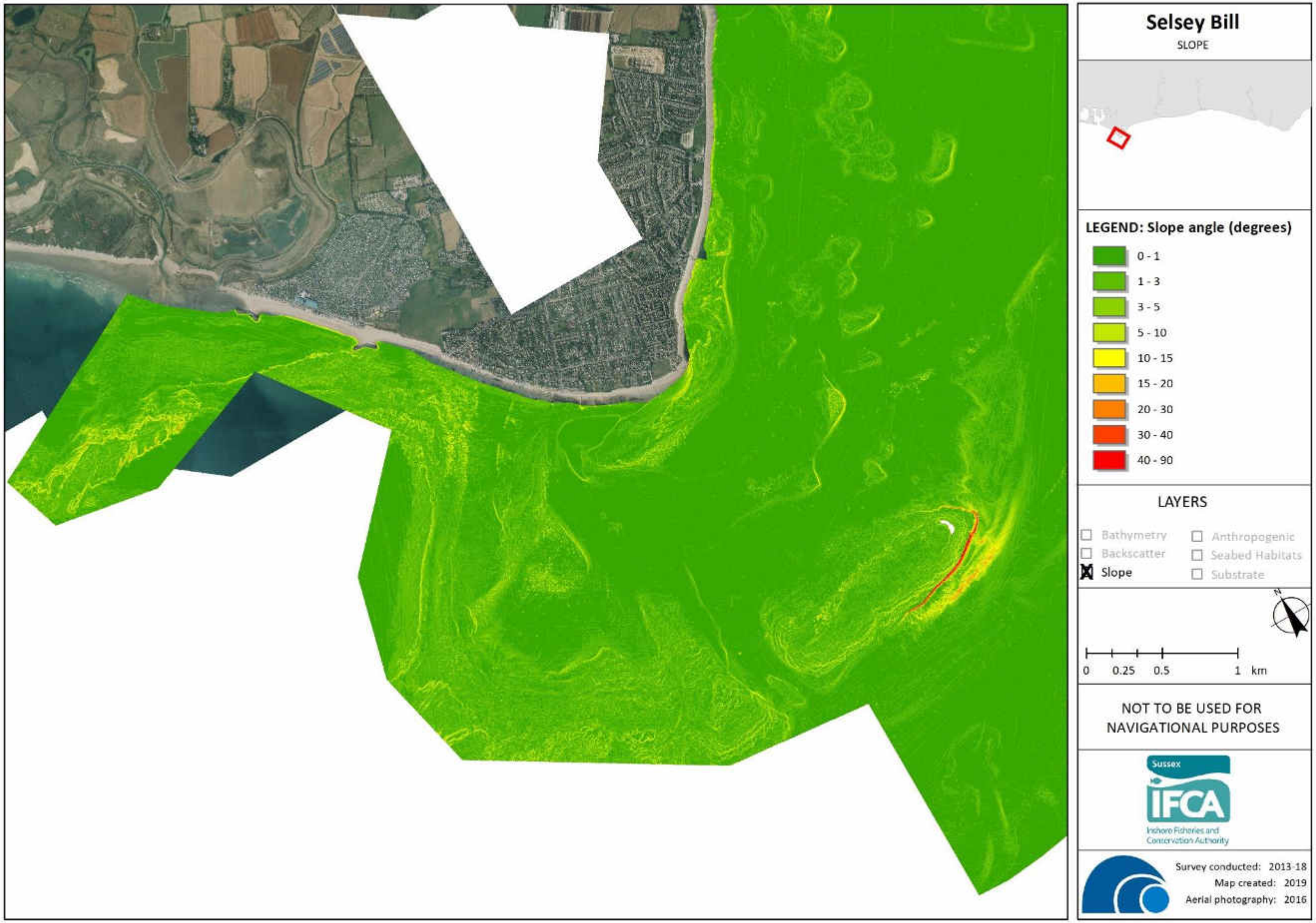
Figure 13: Cross-section illustrating change in depth between two areas of sediment

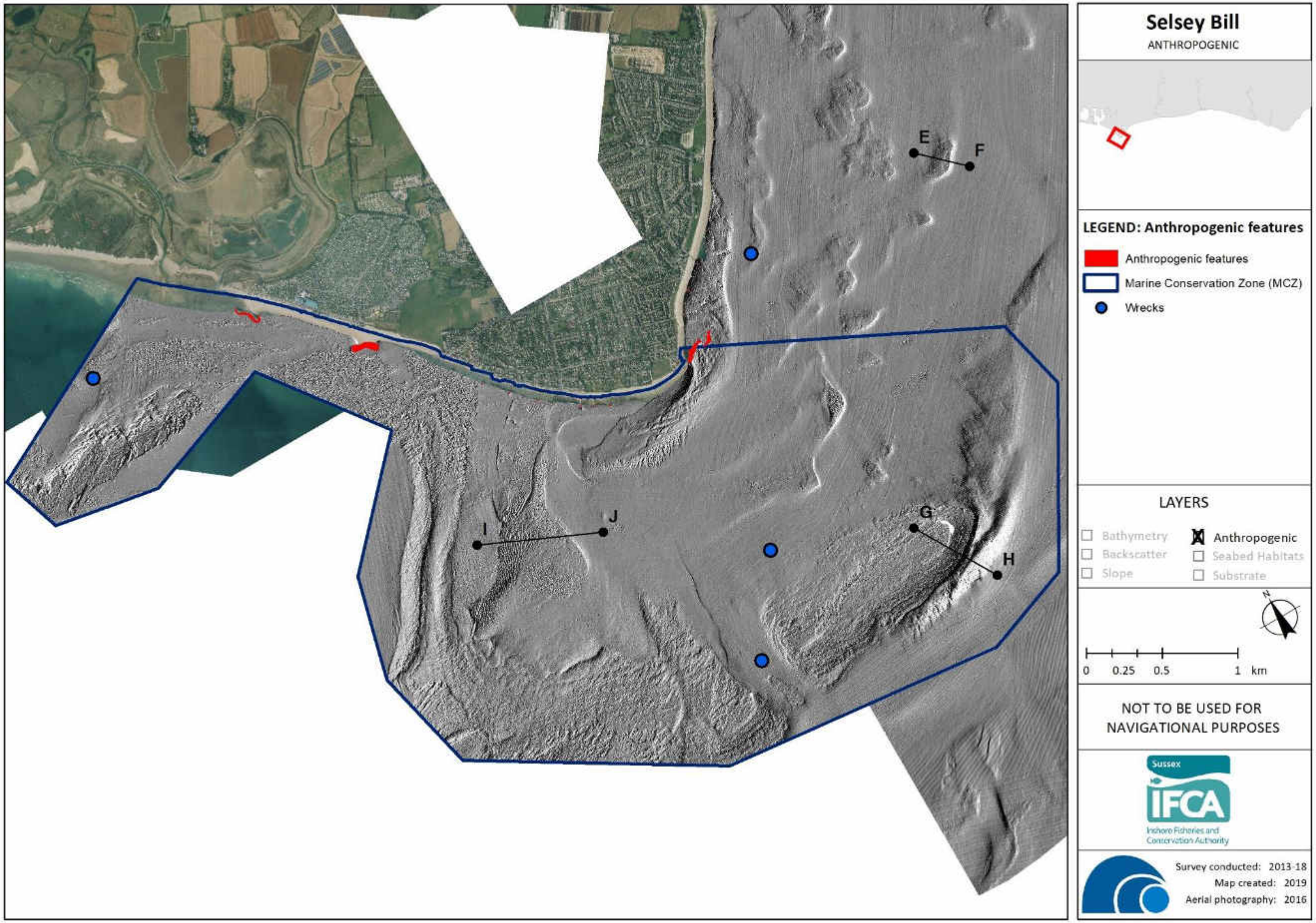
Groundtruthing points show historical evidence of Kelp in the area between 1997 - 2012. The majority of these points are clumped together at the Mixon Hole and close to shore in the shelter provided by Selsey Bill.

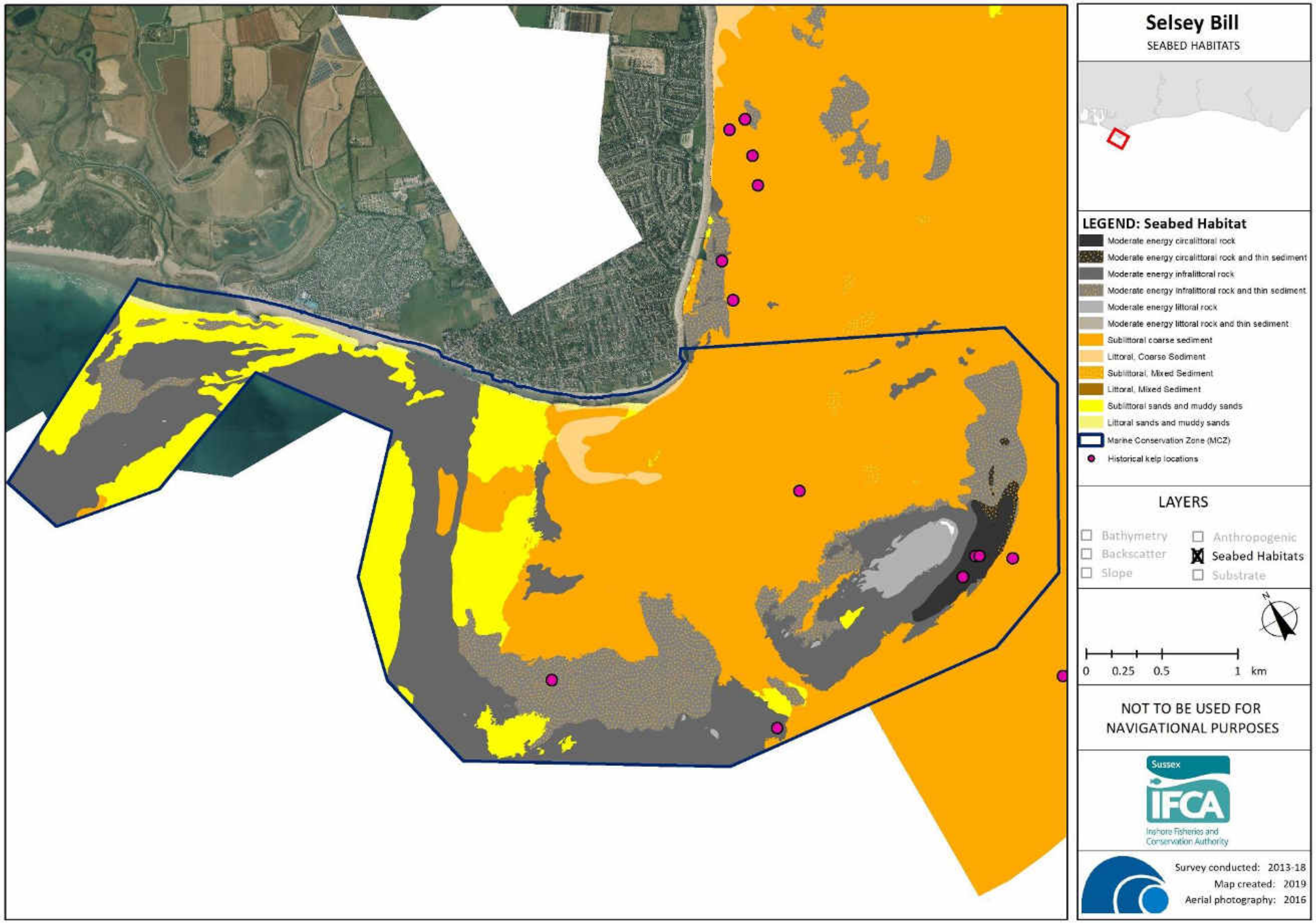
Four wrecks are located around Selsey Bill within the mapped area with some of them clearly visible. Due to the high energy environment and lack of fine sediment there is little scouring around the wrecks to indicate direction of sediment transport.

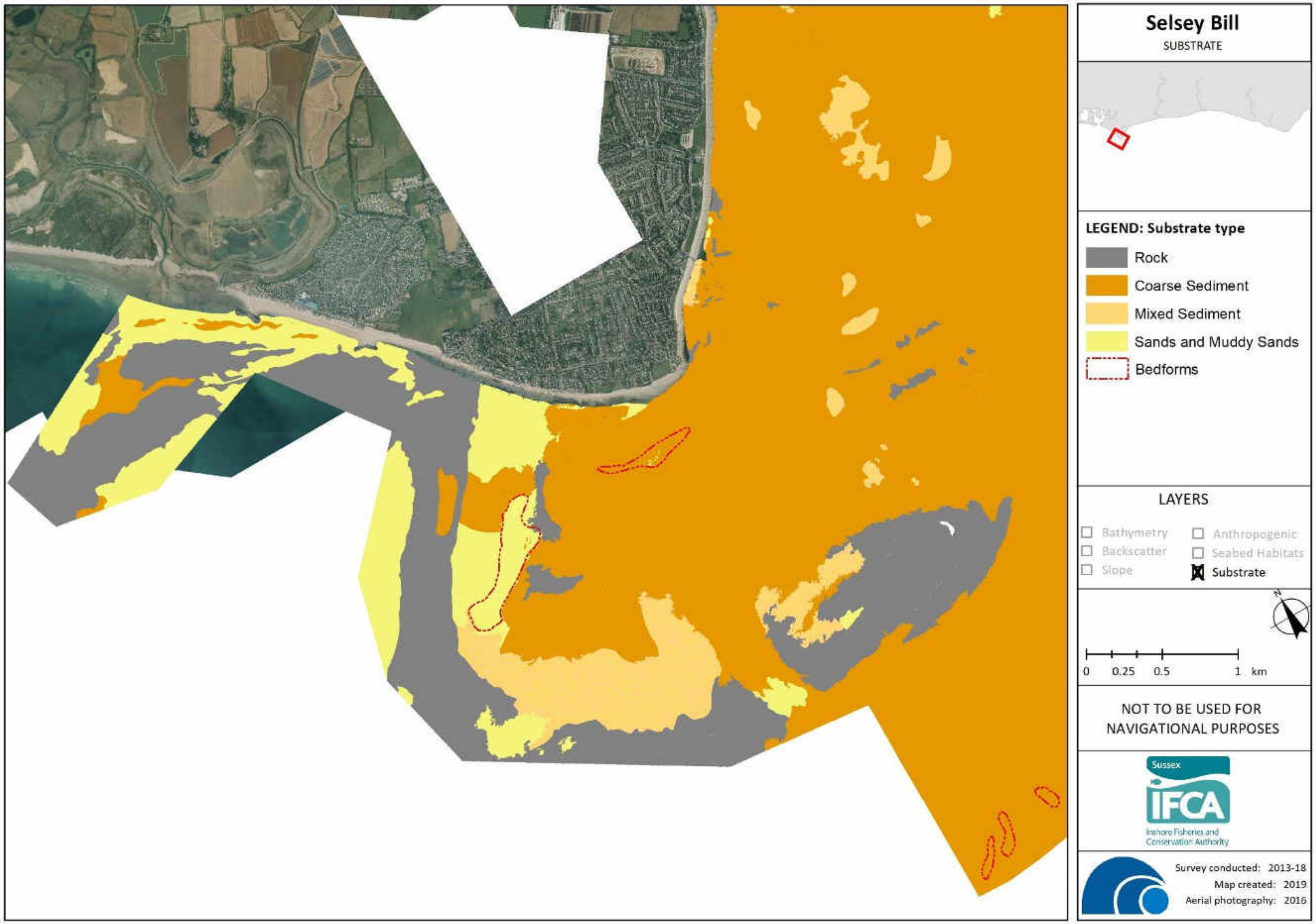

Selsey Bill
BATHYMETRY
LEGEND: Bathymetry (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Selsey Bill
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Selsey Bill
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


E
F
G
H
I
J
Selsey Bill
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Marine Conservation Zone (MCZ)
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Selsey Bill
SEABED HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Selsey Bill
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
0 0.25 0.5 1 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

References

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Populus J., Vasquez M., Albrecht J., Manca E., Agnesi S., Al Hamdani Z., Andersen J., Annunziatellis A., Bekkby T., Bruschi A., Doncheva V., Drakopoulou V., Duncan G., Inghilesi R., Kyriakidou C., Lalli F., Lillis H., Mo G., Muresan M., Salomidi M., Sakellariou D., Simboura M., Teaca A., Tezcan D., Todorova V. and Tunesi L. (2017). EUSeaMap, a European broad-scale seabed habitat map. 174p. http://doi.org/10.13155/49975

Acknowledgements

Valuable groundtruthing and substrate information was kindly provided by JNCC marine recorder, British Geological Survey Geoindex's and the Southeast Regional Coastal Monitoring Programme. The MCA's Civil Hydrography Programme bathymetry data kindly provided by colleagues from the MCA hydrographic team under Open Government Licence.

Annex 1 Confidence Assessment

Remote Technique	3
Remote Coverage	3
Remote Positioning	3
Remote Standards Applied	3
Remote Vintage	3
Biological Groundtruth Technique	2
Physical Groundtruth Technique	2
Groundtruth Positioning	3
Groundtruth Density	2
Groundtruth Standards Applied	3
Groundtruth Vintage	3
Groundtruth Interpretation	2
Remote Interpretation	3
Detail Level	1
Map Accuracy	3
Remote score	100
Groundtruth score	81
Interpretation score	75
Overall score	79

https://webarchive.nationalarchives.gov.uk/20101014084804/http://www.searchmesh.net/confidence/confidenceAssessment.html

Remote Techniques
An assessment of whether the remote technique(s) used to produce this map were appropriate to the environment they were used to survey. If necessary, adjust your assessment to account for technique(s) which, although appropriate, were used in deep water and consequently have a significantly reduced resolution (i.e. size of footprint):
3 = technique(s) highly appropriate
2 = technique(s) moderately appropriate
1 = technique(s) inappropriate

Remote Coverage
An assessment of the coverage of the remote sensing data including consideration of heterogeneity of the seabed. This can be simply achieved in a coverage x heterogeneity matrix, as illustrated below:

		Heterogeneity		
		Low	Moderate	High
Coverage	Poor (large gaps between swaths; Track spacing >100m)	2	1	1
	Moderate (50%; track spacing <100m)	3	2	1
	Good (100%; track spacing <50m)	3	3	3

Remote Positioning & Ground Truthing Position
An indication of the positioning method used for the remote / ground-truth data:
3 = differential GPS
2 = GPS (not differential) or other non-satellite 'electronic' navigation system
1 = chart based navigation, or dead-reckoning

Remote & Ground Truthing Standards Applied
An assessment of whether standards have been applied to the collection of the remote / ground-truth data. This field gives an indication of whether some data quality control has been carried out:
3 = remote / ground-truth data collected to approved standards
2 = remote / ground-truth data collected to 'internal' standards
1 = no standards applied to the collection of the remote / ground-truth data

Remote Vintage & Ground Truthing Vintage
An indication of the age of the remote / ground-truth data:
3 = < 5yrs old.
2 = 5 to 10 yrs old.
1 = > 10 years old

Biological Ground Truthing Technique
An assessment of whether the groundtruthing techniques used to produce this map were appropriate to the environment they were used to survey. Use scores for soft or hard substrata as appropriate to the area surveyed.

<u>Soft substrata predominate</u> (i.e. those having infauna and epifauna) 3 = infauna AND epifauna sampled AND observed (video/stills, direct human observation) 2= infauna AND epifauna sampled, but NOT observed (video/stills, direct human observation) 1 = infauna OR epifauna sampled, but not both. No observation.	<u>Hard substrata predominate</u> (i.e. those with no infauna) 3 = sampling included direct human observation (shore survey or diver survey) 2 = sampling included video or stills but NO direct human observation 1 = benthic sampling only (e.g. grabs, trawls)

Physical Ground Truthing Technique
An assessment of whether the combination of geophysical sampling techniques were appropriate to the environment they were used to survey. Use scores for soft or hard substrata as appropriate to the area surveyed.

<u>Soft substrata predominate</u> (i.e. gravel, sand, mud) 3 = full geophysical analysis 2 = sediments described following visual inspection of grab or core samples (e.g. slightly shelly, muddy sand) 1 = sediments described on the basis of remote observation (by camera).	<u>Hard substrata predominate</u> (i.e. rock outcrops, boulders, cobbles) 3 = sampling included in-situ, direct human observation (shore survey or diver survey) 2 = sampling included video or photographic observation, but NO in-situ, direct human observation 1 = samples obtained only by rock dredge

Ground Truthing Sample Density
An assessment of what proportion of the polygons or classes (groups of polygons with the same 'habitat' attribute) actually contain ground-truth data:
3 = Every class in the map classification was sampled at least 3 times
2 = Every class in the map classification was sampled
1 = Not all classes in the map classification were sampled (some classes have no ground-truth data)

Ground Truthing Interpretation
An indication of the confidence in the interpretation of the groundtruthing data. Score a maximum of 1 if physical ground-truth data but no biological ground-truth data were collected:
3 = Evidence of expert interpretation; full descriptions and taxon list provided for each habitat class
2 = Evidence of expert interpretation, but no detailed description or taxon list supplied for each habitat class
1 = No evidence of expert interpretation; limited descriptions available

Remote Interpretation
An indication of the confidence in the interpretation of the remotely sensed data. (Interpretation techniques can range from 'by eye' digitising by experts to statistical classification techniques):
3 = Appropriate technique used and documentation provided
2 = Appropriate technique used but no documentation provided
1 = Inappropriate technique used

Detail Level
The level of detail to which the 'habitat' classes in the map have been classified:
3 = Classes defined on the basis of detailed biological analysis
2 = Classes defined on the basis of major characterising species or lifeforms
1 = Classes defined on the basis of physical information, or broad biological zones

Map Accuracy
A test of the accuracy of the map:
3 = high accuracy, proven by external accuracy assessment
2 = high accuracy, proven by internal accuracy assessment
1 = low accuracy, proved by either external or internal assessment OR no accuracy assessment made

Annex 2 EUNIS Habitat Classification

Name	Code	Description
Moderate Energy Littoral Rock	A1.2	Moderately exposed shores (bedrock, boulders and cobbles) characterised by mosaics of barnacles and fucoids on the mid and upper shore; with fucoids and red seaweed mosaics on the lower shore.
Littoral Coarse sediment	A2.1	Littoral coarse sediments include shores of mobile pebbles, cobbles and gravel, sometimes with varying amounts of coarse sand. The sediment is highly mobile and subject to high degrees of drying between tides. As a result, few species are able to survive in this environment. Beaches of mobile cobbles and pebbles tend to be devoid of macroinfauna, while gravelly shores may support limited numbers of crustaceans, such as *Pectenogammarus planicrurus.*
Littoral Sand and muddy sand	A2.2	Shores comprising clean sands (coarse, medium or fine-grained) and muddy sands with up to 25% silt and clay fraction. Shells and stones may occasionally be present on the surface. The sand may be duned or rippled as a result of wave action or tidal currents. Littoral sands exhibit varying degrees of drying at low tide depending on the steepness of the shore, the sediment grade and the height on the shore.
Littoral Mixed sediment	A2.4	Shores of mixed sediments ranging from muds with gravel and sand components to mixed sediments with pebbles, gravels, sands and mud in more even proportions. By definition, mixed sediments are poorly sorted.
Moderate Energy Infralittoral Rock	A3.2	This habitat complex occurs on predominantly moderately wave-exposed bedrock and boulders, subject to moderately strong to weak tidal streams. On the bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts
Moderate Energy Circalittoral Rock	A4.2	Mainly occurs on exposed to moderately wave-exposed circalittoral bedrock and boulders, subject to moderately strong and weak tidal streams.
Sublittoral Coarse sediment	A5.1	Coarse sediments including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal

		currents and/or wave action. These habitats are generally found on the open coast or in tide-swept channels of marine inlets. They typically have a low silt content and a lack of a significant seaweed component.
Sublittoral Sand	A5.2	Clean medium to fine sands or non-cohesive slightly muddy sands on open coasts, offshore or in estuaries and marine inlets. Such habitats are often subject to a degree of wave action or tidal currents which restrict the silt and clay content to less than 15%.
Sublittoral Mixed sediment	A5.4	Sublittoral mixed (heterogeneous) sediments found from the extreme low water mark to deep offshore circalittoral habitats. These habitats incorporate a range of sediments including heterogeneous muddy gravelly sands and also mosaics of cobbles and pebbles embedded in or lying upon sand, gravel or mud.

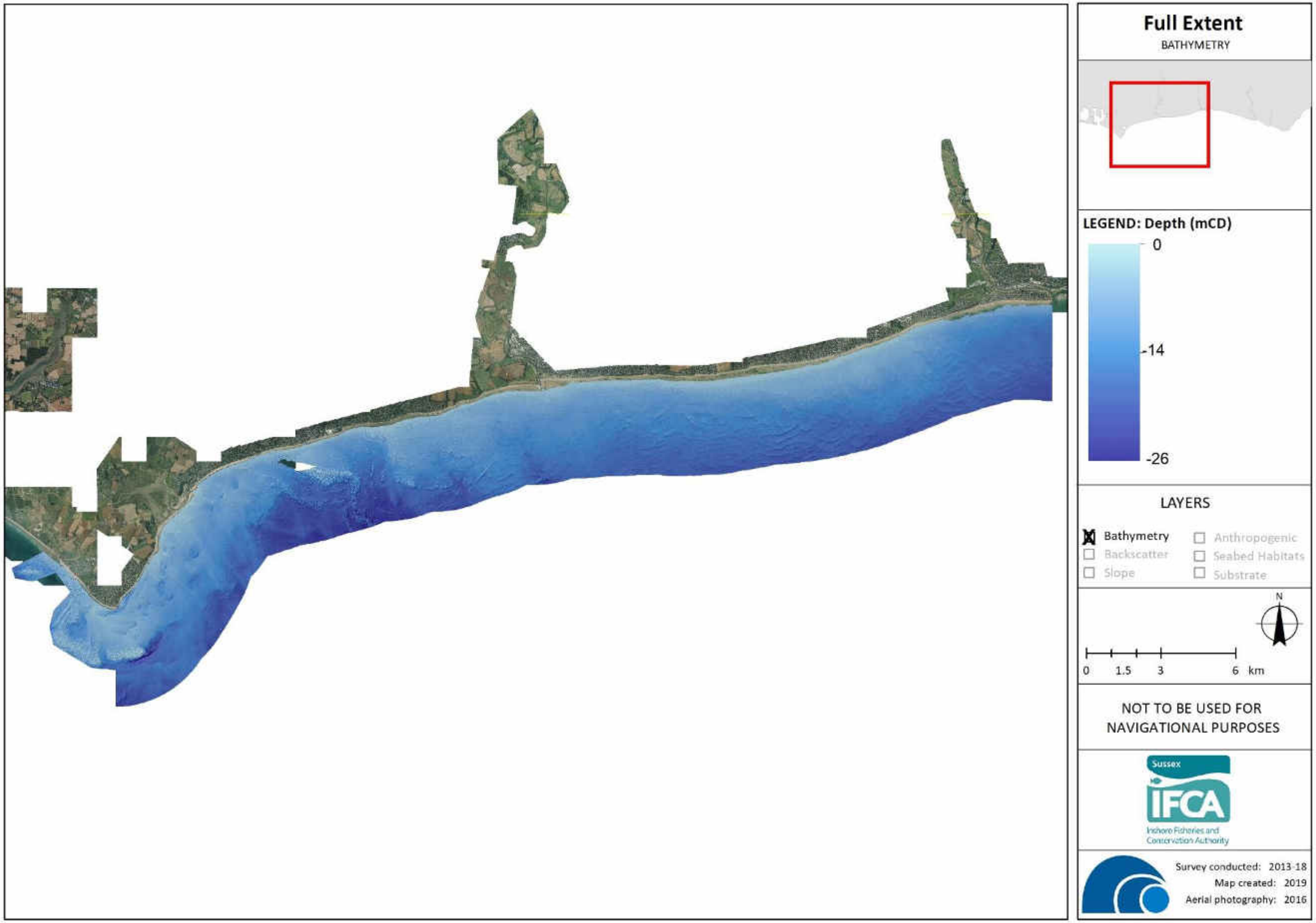
Annex 3 Bathymetry Survey details

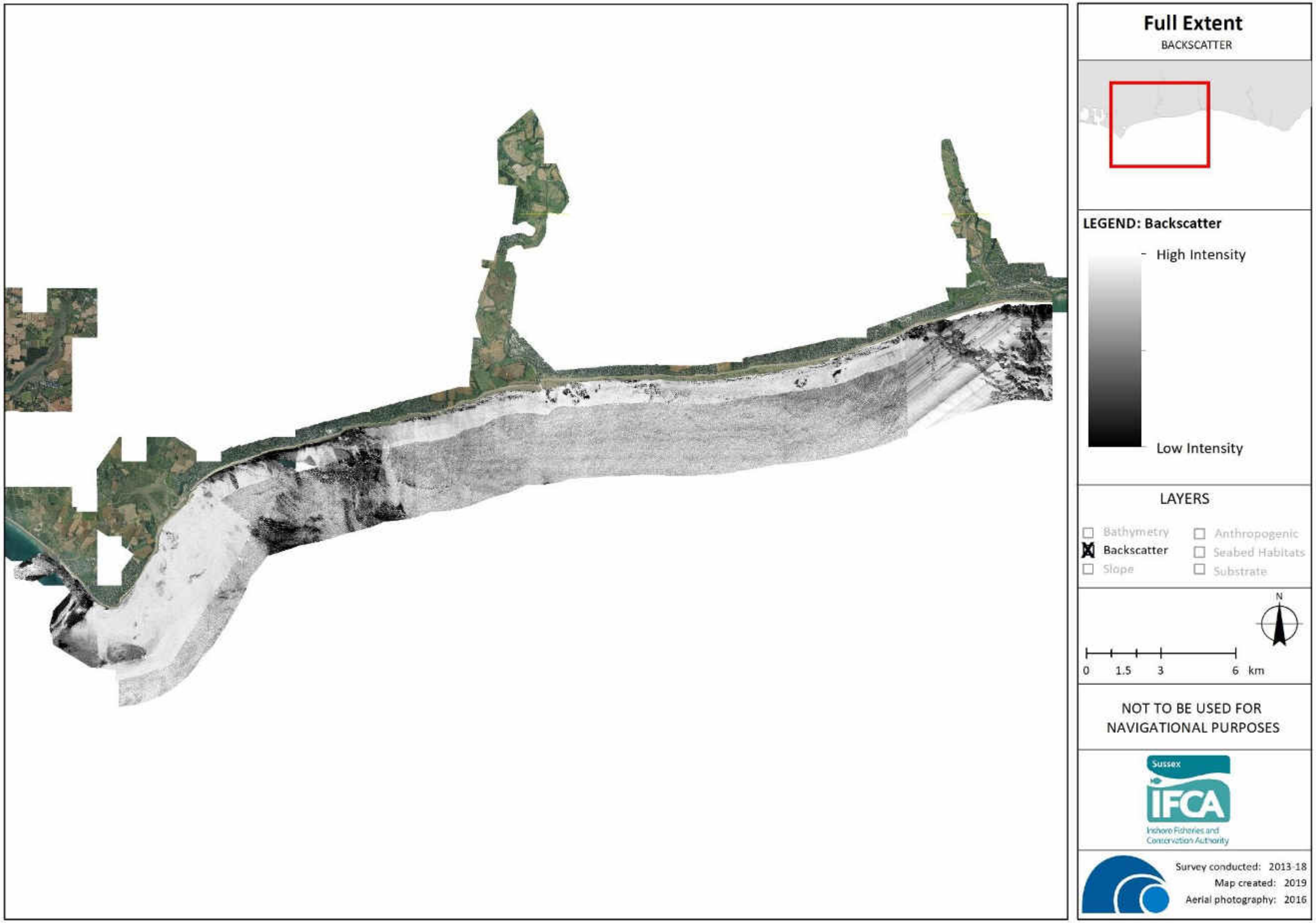
HI number	Survey Period	Contractor	Sensors	Resolution
HI1437	15/05/2013 10/07/2013	NetSurvey	Kongsberg EM2040D / EM3002D Applanix POS/MV	1 m
HI1478	07/12/2015 17/12/2015	Gardline Geosurvey	Kongsberg EM2040D Applanix POS/MV	2 m
HI1524	18/03/2016 06/06/2016	EGS	Kongsberg EM2040C Applanix POS/MV	2 m
HI1561	09/08/2018 24/10/2018	Clinton	Kongsberg EM2040D Seatex Seapath 330	2 m

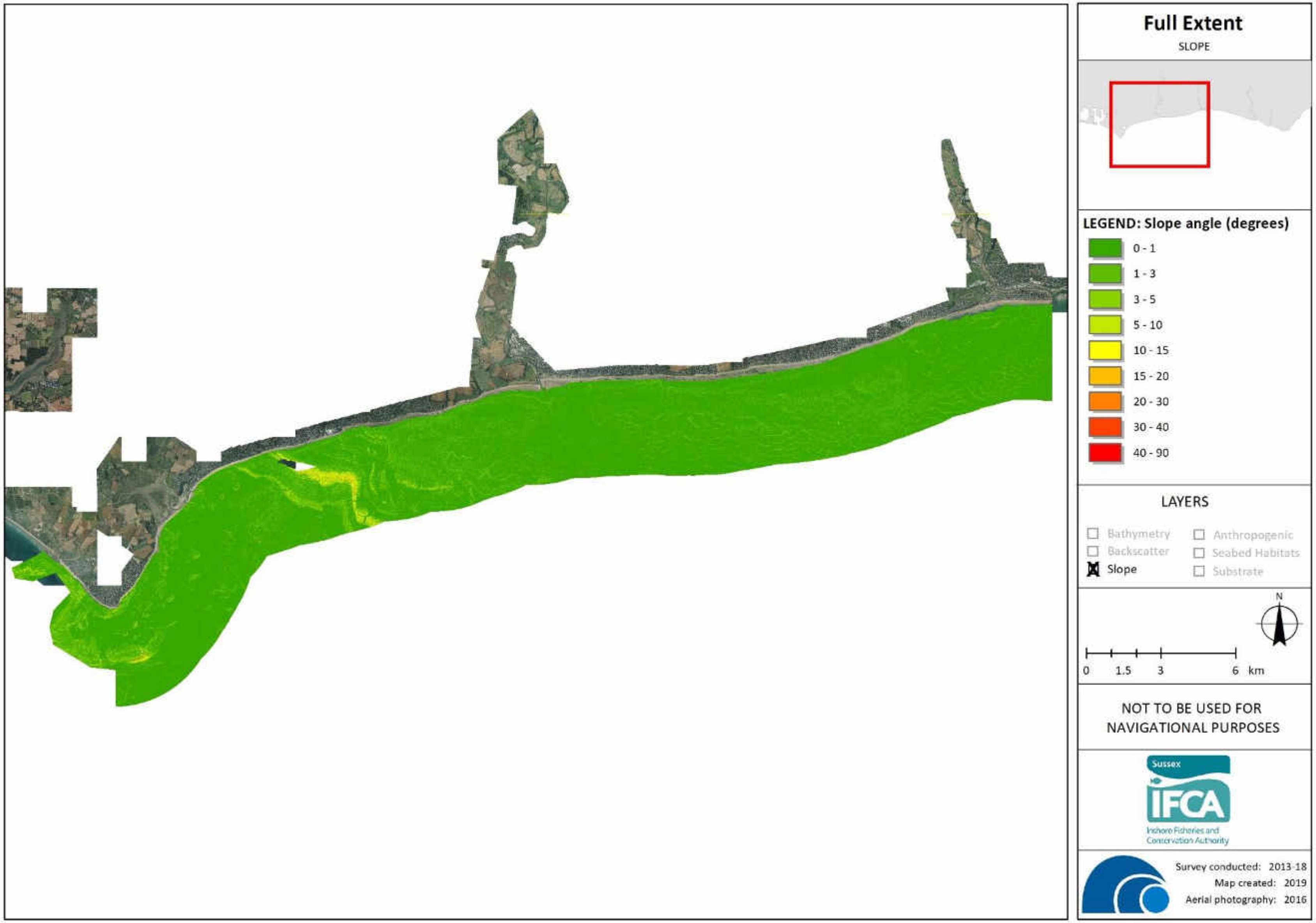
All data sets available through the UK Hydrographic Office via the Admiralty Marine Data Portal

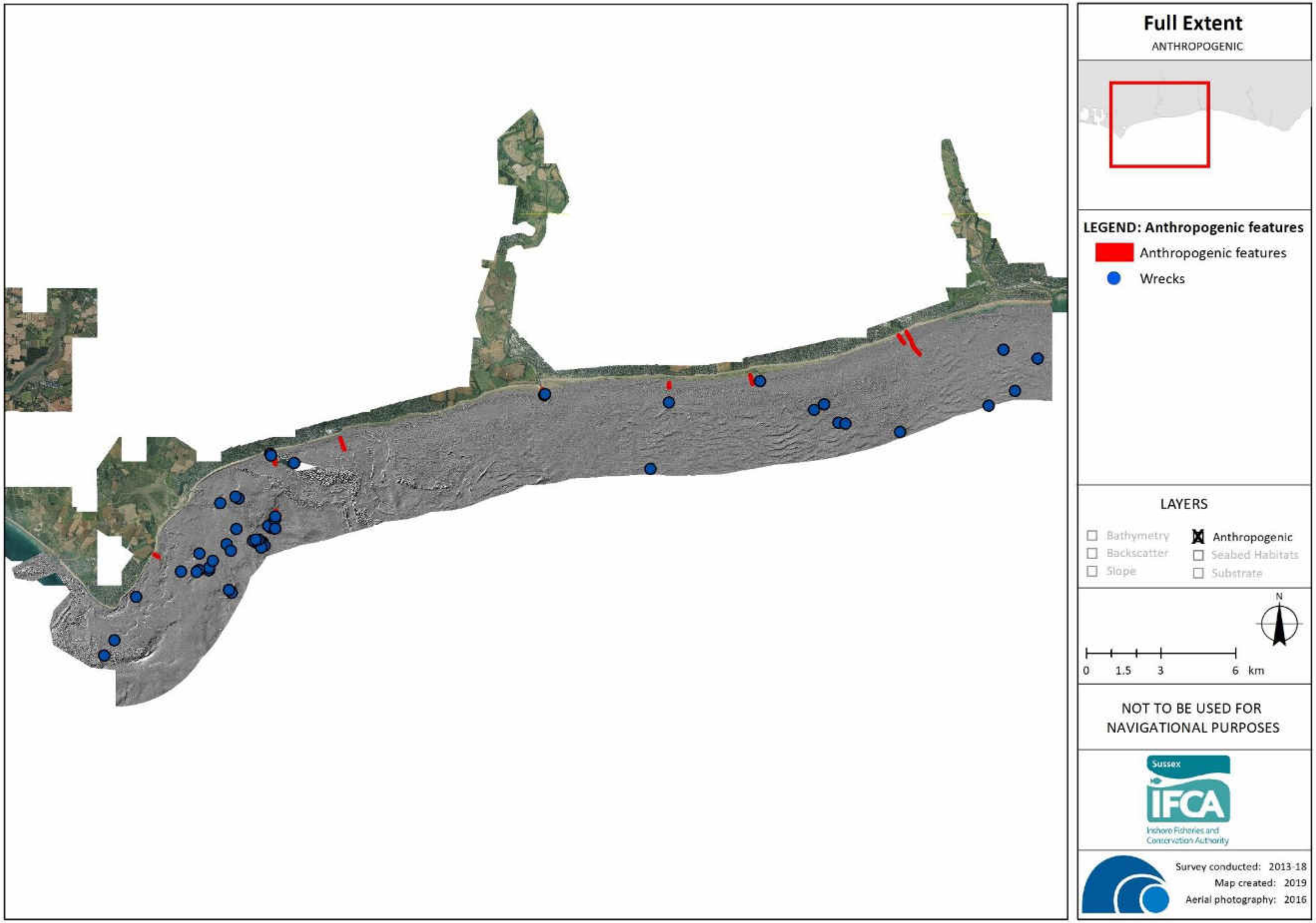
https://data.admiralty.co.uk/portal/apps/webappviewer/index.html?id=02dfdb1d1dd64ff9ba9109b3c3f1d7e1

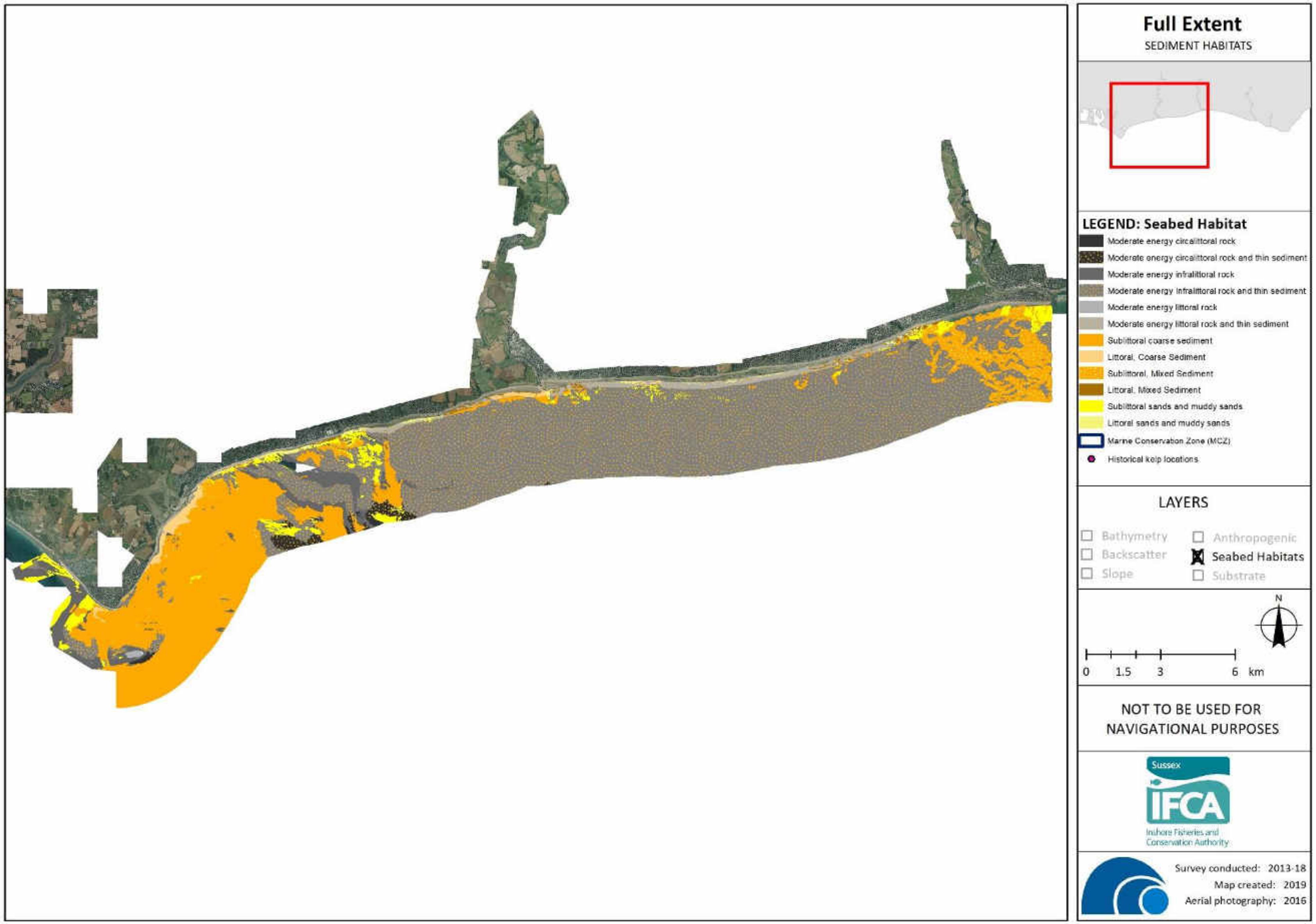
Annex 4 Full Maps

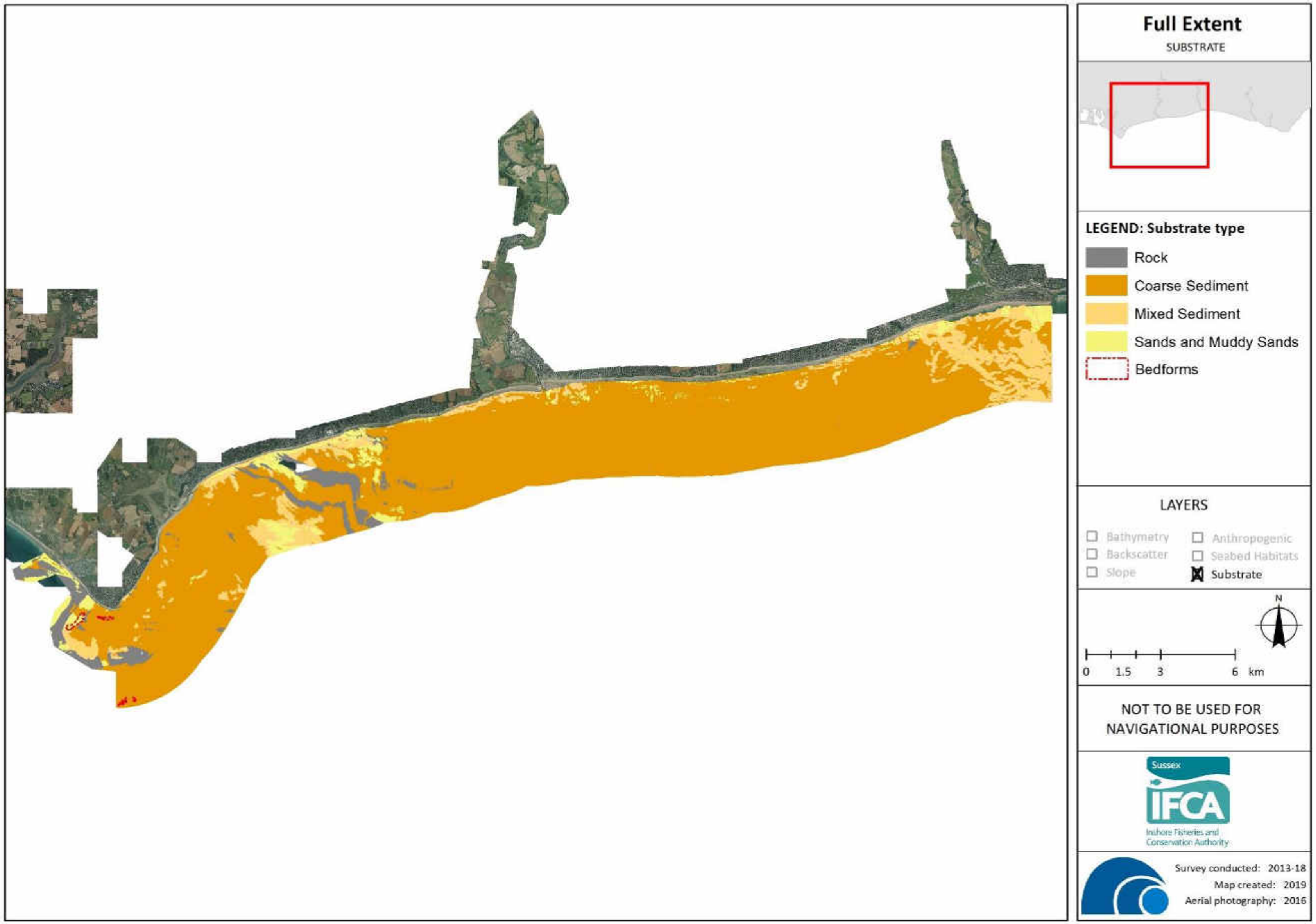

Full Extent
BATHYMETRY
LEGEND: Depth (mCD)
0
-14
-26
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

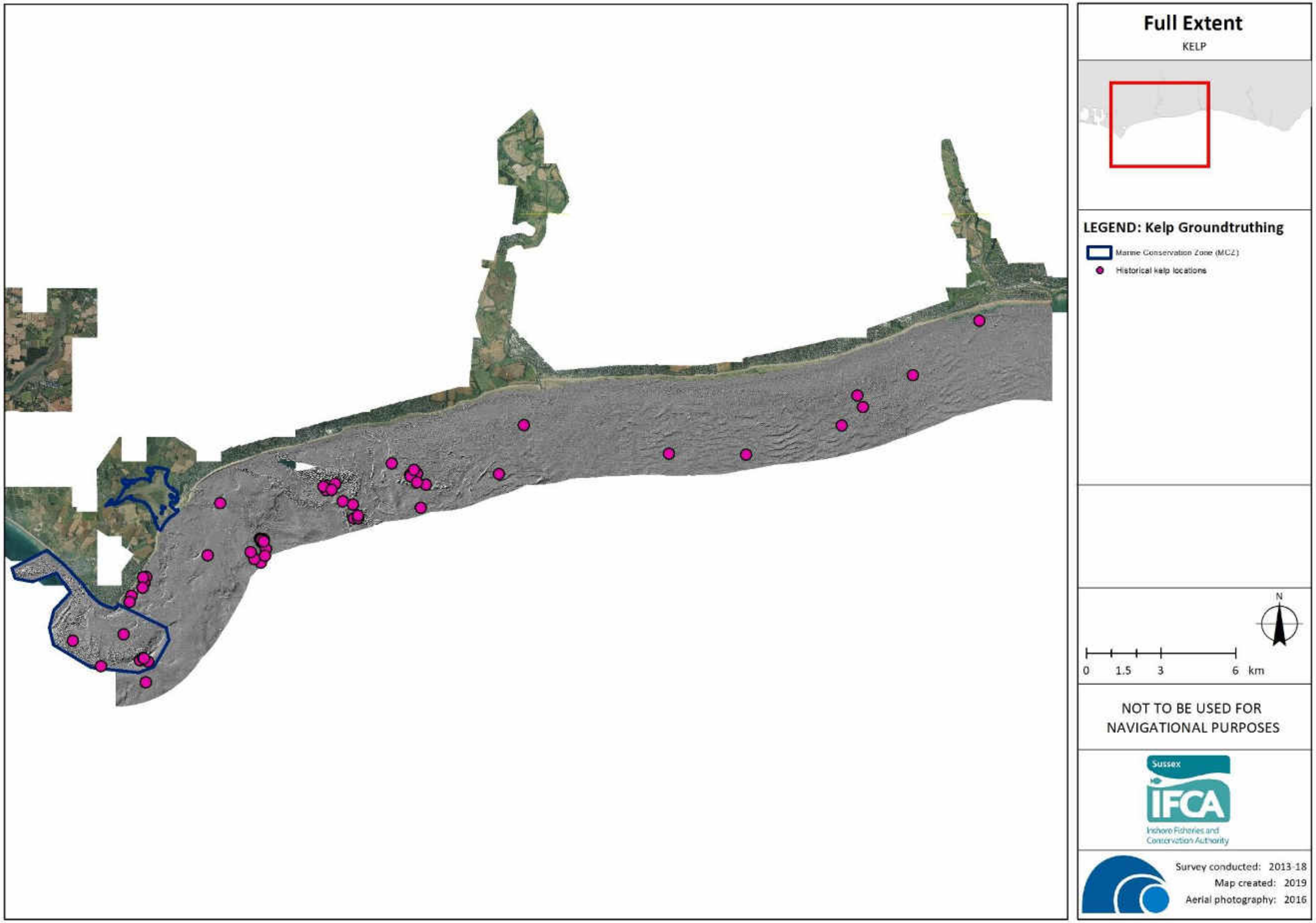

Full Extent
BACKSCATTER
LEGEND: Backscatter
High Intensity
Low Intensity
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Full Extent
SLOPE
LEGEND: Slope angle (degrees)
0 - 1
1 - 3
3 - 5
5 - 10
10 - 15
15 - 20
20 - 30
30 - 40
40 - 90
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016

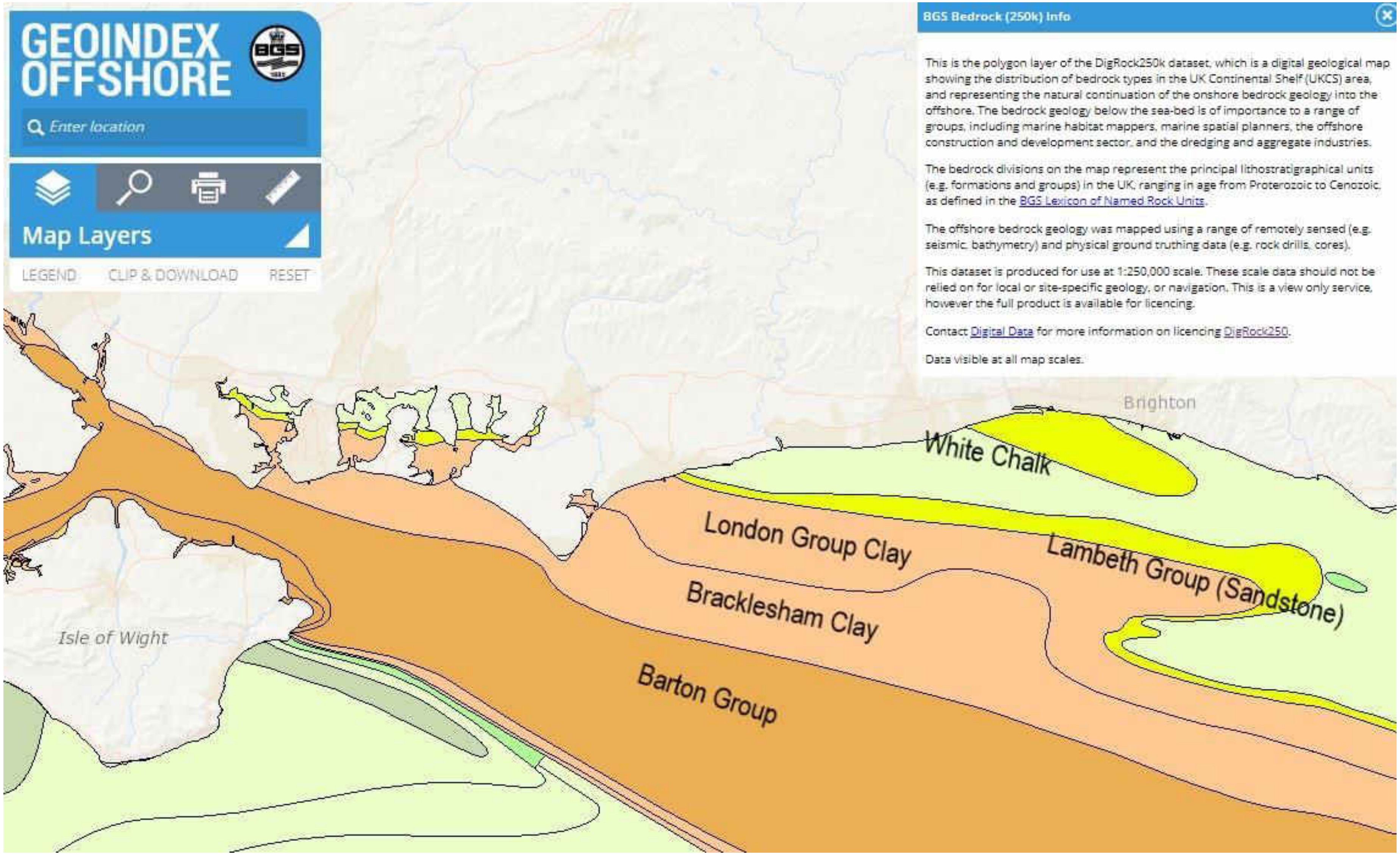

Full Extent
ANTHROPOGENIC
LEGEND: Anthropogenic features
Anthropogenic features
Wrecks
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Full Extent
SEDIMENT HABITATS
LEGEND: Seabed Habitat
Moderate energy circalittoral rock
Moderate energy circalittoral rock and thin sediment
Moderate energy infralittoral rock
Moderate energy infralittoral rock and thin sediment
Moderate energy littoral rock
Moderate energy littoral rock and thin sediment
Sublittoral coarse sediment
Littoral, Coarse Sediment
Sublittoral, Mixed Sediment
Littoral, Mixed Sediment
Sublittoral sands and muddy sands
Littoral sands and muddy sands
Marine Conservation Zone (MCZ)
Historical kelp locations
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Full Extent
SUBSTRATE
LEGEND: Substrate type
Rock
Coarse Sediment
Mixed Sediment
Sands and Muddy Sands
Bedforms
LAYERS
Bathymetry
Backscatter
Slope
Anthropogenic
Seabed Habitats
Substrate
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Full Extent
KELP
LEGEND: Kelp Groundtruthing
Marine Conservation Zone (MCZ)
Historical kelp locations
N
0
1.5
3
6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex
IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


Full Extent
SEDIMENT GRABS
LEGEND: Sediment Type
N/A
Coarse sediment
Mixed sediment
Sands and Muddy Sands
N
0 1.5 3 6 km
NOT TO BE USED FOR NAVIGATIONAL PURPOSES
Sussex IFCA
Inshore Fisheries and Conservation Authority
Survey conducted: 2013-18
Map created: 2019
Aerial photography: 2016


GEOINDEX
OFFSHORE
Enter location
Map Layers
LEGEND
CLIP & DOWNLOAD
RESET
BGS Bedrock (250k) Info
This is the polygon layer of the DigRock250k dataset, which is a digital geological map showing the distribution of bedrock types in the UK Continental Shelf (UKCS) area, and representing the natural continuation of the onshore bedrock geology into the offshore. The bedrock geology below the sea-bed is of importance to a range of groups, including marine habitat mappers, marine spatial planners, the offshore construction and development sector, and the dredging and aggregate industries.
The bedrock divisions on the map represent the principal lithostratigraphical units (e.g. formations and groups) in the UK, ranging in age from Proterozoic to Cenozoic, as defined in the BGS Lexicon of Named Rock Units.
The offshore bedrock geology was mapped using a range of remotely sensed (e.g. seismic, bathymetry) and physical ground truthing data (e.g. rock drills, cores).
This dataset is produced for use at 1:250,000 scale. These scale data should not be relied on for local or site-specific geology, or navigation. This is a view only service, however the full product is available for licencing.
Contact Digital Data for more information on licencing DigRock250.
Data visible at all map scales.
Brighton
White Chalk
London Group Clay
Lambeth Group (Sandstone)
Bracklesham Clay
Barton Group
Isle of Wight