Partners in UK offshore wind

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Preliminary Environmental Information Report

Volume 4, annex 13.1: Marine archaeology technical report

Image of an offshore wind farm

April 2023
Final

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
Rev01	Draft for Client review	RPS	bpEnBW		02/01/23
Rev02	Addressing client comments	RPS	bpEnBW		01/02/23
Rev03	Final	RPS	bpEnBW	bpEnBW	15/02/23

Prepared by:	Prepared for:
RPS	**Morgan Offshore Wind Ltd.**

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Glossary

Term	Meaning
Gazetteer	A geographical index or dictionary.
Glaciolacustrine	Sediments deposited into lakes that have come from glaciers are called glaciolacustrine deposits. These lakes include ice margin lakes or other types formed from glacial erosion or deposition. Sediments in the bedload and suspended load are carried into lakes and deposited.
Glaciomarine	An environment containing both glacial ice and marine water.
Nadir	The lowest or most unsuccessful point.
Palaeoenvironmental	An environment of a past geological age.

Acronyms

Acronym	Description
AAIs	Areas of Archaeological Importance
AD	Anno Domini
ADS	Archaeology Data Service
AEZ	Archaeological Exclusion Zone
AMAPs	Areas of Maritime Archaeological Potential
BC	Before Christ
BGS	British Geological Survey
BLF	Bardsey Loom Formation
BP	Before Present
BULSI	Build, Use, Loss, Survival, and Investigation
CBF	Cardigan Bay Formation
CPT	Cone Penetration Test
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ES	Environmental Statement
FBF	Caernarfon Bay Formation
HE	Historic England
HSC	Historic Seascape Characterisation
LGM	Last Glacial Maximum
MCA	Maritime and Coastguard Agency
MBES	Multi-beam Echo Sounder
MCAA	Marine and Coastal Access Act
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MOD	Ministry of Defence
MPS	Marine Policy Statement
NMRW	National Monuments Record Wales
NRHE	National record of the Historic Environment
ORR	Offshore Regional Report
PAD	Protocol for Archaeological Discoveries
PEIR	Preliminary Environmental Information Report
PWA	The Protection of Wrecks Act
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
RoW	Receiver of Wreck
RSL	Relative sea level
SBP	Sub-bottom Profiler
SLIPs	Sea level index points
SSS	Side Scan Sonar
STG	St George's Channel Formation
UHRS	Ultra High Resolution Seismic
UKHO	United Kingdom Hydrographic Office
USBL	Ultra Short Baseline
UXO	Unexploded Ordnance
WCPS	West Coast Palaeolandscape Study
WIS-A	West Irish Sea Formation A
WIS-B	West Irish Sea Formation B
WSI	Written Scheme of Investigation

Units

Unit	Description
%	Percentage
km	Kilometres
km^2	Square kilometres
m	Metres
nm	Nautical miles (distance; 1nm = 1.852km)

1 MARINE ARCHAEOLOGY TECHNICAL REPORT

1.1 Introduction

1.1.1.1 This marine archaeology technical report presents baseline information in relation to the Morgan Offshore Wind Project: Generation Assets (hereafter, Morgan Generation Assets) in the east Irish Sea region in order to inform the Preliminary Environmental Information Report (PEIR) process. The scope of the Morgan Generation Assets marine archaeology technical report covers the Morgan Array Area.

1.1.1.2 The aim of this Morgan Generation Assets marine archaeology technical report is to provide an overview of the archaeological baseline associated with the Morgan Generation Assets.

1.1.1.3 The objectives of this report are to:

- Summarise the potential for submerged prehistoric archaeology to be encountered within the Morgan Generation Assets marine archaeology study area (Figure 1.1)
- Identify known maritime and aviation sites and based on the maritime history of the Morgan Generation Assets marine archaeology study area and the wider area, assess the potential for the existence of unknown sites and materials within the limits of the Morgan Generation Assets marine archaeology study area
- Present site-specific geophysical data from surveys across the Morgan Generation Assets marine archaeology study area that identify anomalies of archaeological interest and characterise these anomalies integrating the results of the site-specific data, with the findings of the desktop study described above
- Review available site-specific geophysical data of the Morgan Generation Assets marine archaeology study area for sediments of archaeological and paleoenvironmental interest and integrate the results with the findings of the desktop study.

1.2 Legislation, policy and guidance

1.2.1 Overview

1.2.1.1 This section sets out the legislation, policy, guidance and any development plans relevant to marine archaeology in the context of offshore renewable energy development.

1.2.1.2 With regard to marine licensing UK territorial waters is classed as the area of sea within the limits 12nm of the territorial coastline. This also includes any area of sea beyond 12nm, that is within the Exclusive Economic Zone (EEZ) and the UK sector of the continental shelf (up to 200nm). This excludes the waters of any devolved administration.

1.2.1.3 Beyond the UK's territorial waters archaeology is generally subject to international legislation and policy, with two exceptions:

- The Merchant Shipping Act 1995
- The Protection of Military Remains Act 1986.

1.2.1.4 Outside the UK territorial waters the regulation and reporting of marine archaeology is governed by international legislation and guidance, such as the United Nations Convention on the Law of the Sea 1982 (UNCLOS, 1982), the European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (the Valletta Convention) and the United Nations Educational, Scientific and Cultural Organisation's Convention on the Protection of Underwater Cultural Heritage 2001 (UNESCO, 2001).

1.2.2 Legislation

Protection of Wrecks Act 1973

1.2.2.1 Section one of the Protection of Wrecks Act 1973 (PWA) states that wrecks and wreckage of historical, archaeological or artistic importance can be protected by way of designation and that is an offence to carry out certain activities in a defined area surrounding a wreck that has been designated, unless a licence for those activities has been obtained. Section two of PWA provides protection for wrecks that are designated as dangerous due to their contents and is administered by the Maritime and Coastguard Agency (MCA) through the Receiver of Wreck (RoW).

Ancient Monuments and Archaeological Areas Act 1979 (as amended)

1.2.2.2 This Act is primarily land based, but in recent years it has also been used to provide some level of protection for underwater sites. Scheduled Monuments and Areas of Archaeological Importance (AAIs or their equivalent) are afforded statutory protection by the Secretary of State, and consent is required for any works. The law is administered by the Secretary of State within the Department of Culture, Media and Sport generally via their statutory advisor's.

Protection of Military Remains Act 1986

1.2.2.3 Under the Protection of Military Remains Act 1986, all aircraft that have crashed in military service are automatically protected. Maritime vessels lost during military service are not automatically protected although the Ministry of Defence (MOD) has powers to protect any vessel that was in military service when lost. The MOD can designate 'controlled sites' around wrecks whose position is known and can designate named vessels as 'protected places' even if the position of the wreck is not known. It is not necessary to demonstrate the presence of human remains at either 'controlled sites' or 'protected places'. The provisions of the Protection of Military Remains Act 1986 regarding Controlled Sites are applicable in international waters, though they are only enforceable with respect to British-controlled ships, British citizens and British companies.

The Merchant Shipping Act 1995

1.2.2.4 This Act details the procedures for determining the ownership of maritime finds that turn out to be 'wreck' offshore, onshore including the intertidal zone of UK territorial waters. It includes all craft, parts of these, their cargo or equipment. If any maritime finds are brought onshore the RoW must be notified, and the finds must be kept until

the RoW determines ownership or requests that they be given to the RoW. The act is administered by the MCA.

1.2.2.5 Beyond the 12nm limit the Merchant Shipping Act 1995 covers wreck found or taken into possession outside UK waters and stipulates that, if brought into UK waters, finds must be reported to the RoW.

1.2.3 Policy

Marine Policy Statement 2011

1.2.3.1 The Marine Policy Statement (MPS) was published by all UK governments in March 2011 as part of a system of marine planning across UK seas. The MPS is the overarching framework for preparing Marine Plans and making decisions affecting the marine environment. The MPS also states that Marine Plans must ensure a sustainable marine environment that will protect heritage assets.

1.2.3.2 Section 2.6.6 of the MPS relates to the historic environment in marine planning and advises that heritage assets should be conserved through marine planning in a manner appropriate and proportionate to their significance. It advises that when considering the significance of a heritage asset and its setting, the marine plan authority should take into account the particular nature of the interest in the assets and the value they hold for this and future generations.

1.2.3.3 Designated archaeological assets in coastal/intertidal zones and inshore/offshore waters may include scheduled monuments, designated wrecks and sites designated under the Protection of Military Remains Act 1986. Non-designated archaeological assets of equivalent status should be considered under the same policy principles as designated archaeological assets.

1.2.3.4 Where the loss of the whole or material part of an archaeological asset's significance is justified, suitable mitigation measures should be put in place.

1.2.4 Guidance

1.2.4.1 There are a number of guidance documents that are relevant to marine archaeology in the context of offshore renewable development, which have been considered in the production of this technical report, these include:

- International:
  - The World Heritage Convention 1972
  - United Nations Convention on the Law of the Sea 1982
  - International Council of Monuments and Sites (ICOMOS) Charter on the Protection and Management of Underwater Cultural Heritage 1996 (the Sofia Charter)
  - UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001
  - European Convention on the Protection of the Archaeological Heritage (Revised) 1992 (the Valletta Convention)
  - European Directive for Environmental Impact Assessments (2014/52/EU)
  - Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee (JNAPC) 2006).
- UK:
  - Code of Conduct (Chartered Institute for Archaeologists, 2014)
  - Standard and Guidance for Historic Environment Desk Based Assessment (Chartered Institute for Archaeologists, 2014 (updated 2020))
  - COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007a)
  - Offshore Renewables protocol for Archaeological Discoveries (The Crown Estate, 2010)
  - Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2010)
  - Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (The Crown Estate, 2021).

1.3 Methodology

1.3.1 Morgan Generation Assets marine archaeology study area

1.3.1.1 The Morgan Generation Assets marine archaeology study area consists of the Morgan Array Area with an additional 2km buffer. This is shown in Figure 1.1. This was used as the search area for obtaining records from relevant archive databases. This wider Morgan Generation Assets marine archaeology study area allows for a greater understanding of the wider archaeological baseline environment, with the dual purpose of enabling any archaeological trends within the region to be recognised and to allow any archaeological sites identified to be represented in a broader archaeological context.

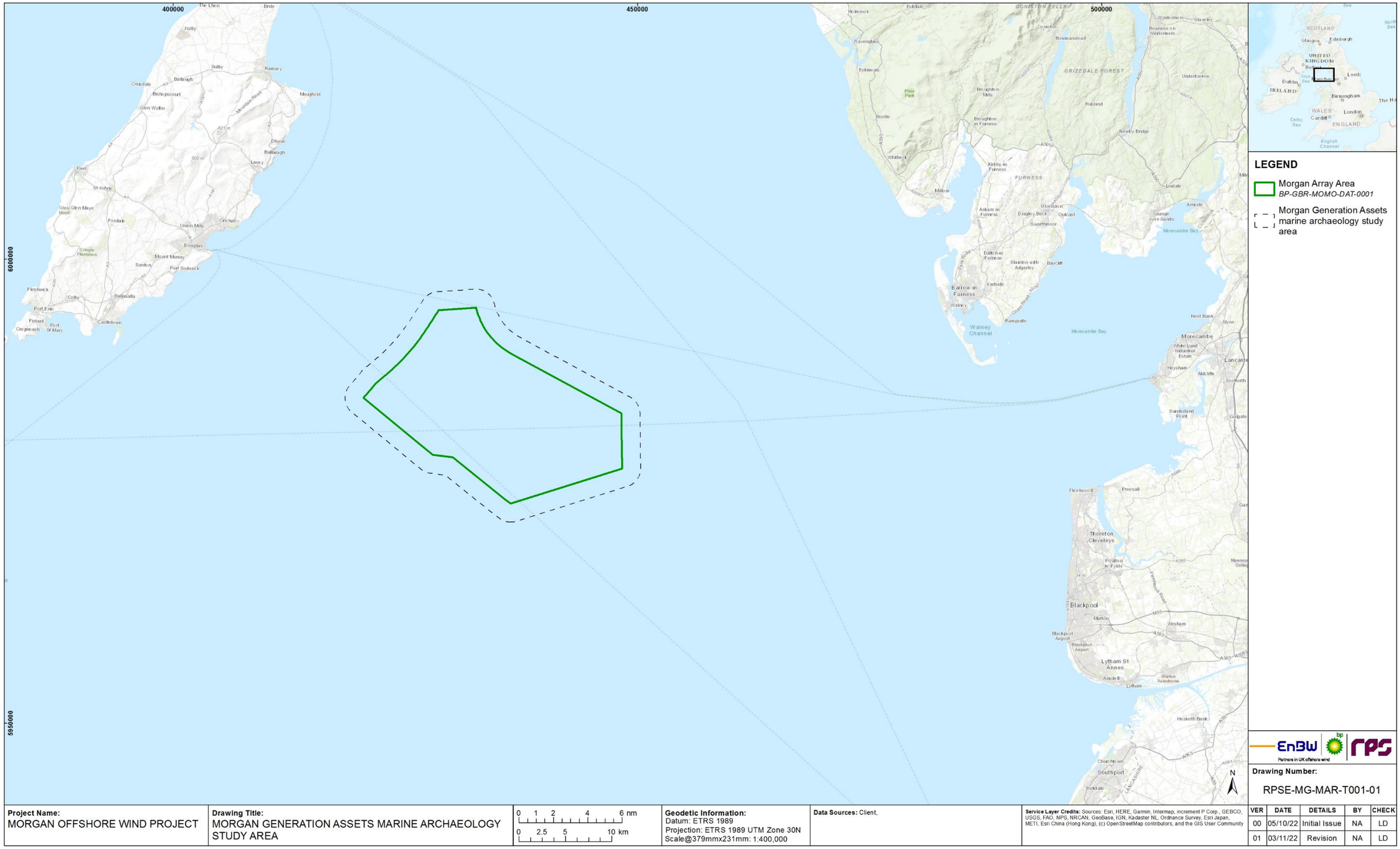


Figure 1.1: Morgan Generation Assets marine archaeology study area.

1.3.2 Desktop study

1.3.2.1 Marine archaeology is considered within the following categories:

- Submerged prehistoric archaeology: This includes paleochannels and other inundated terrestrial landforms that may preserve sequences of sediment of paleoenvironmental interest, Palaeolithic and Mesolithic sites and artefacts
- Maritime archaeology: relates generally to craft or vessels and any of their associated structures and/or cargo
- Aviation archaeology: this comprises all military and civilian aircraft crash sites and related wreckage.

Data sources

1.3.2.2 A number of sources were consulted in order to inform the desktop study of the Marine archaeology technical report and are provided in Table 1.1. Manx National Heritage were contacted and advised that they hold no records within the Morgan Generation Assets marine archaeology study area.

Table 1.1: Summary of key desktop sources.

Title	Source	Year	Author
UKHO Wreck and Obstructions Data	UKHO	2022	United Kingdom Hydrographic Office (UKHO)
Historic Environment Record Data	National Record of the Historic Environment (NRHE)	2021	Historic England
Historic Environment Record Data	National Monuments Record Wales (NMRW)	2021	Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW)
Historic Seascape Characterisation: The Irish Sea (English Sector)	Archaeology Data Service (ADS)	2011	Historic England
Submerged Landscapes Data	EMODnet Geology	2022	British Geological Survey

1.3.2.3 The data available for the submerged prehistoric archaeology assessment includes:

- Ultra High Resolution Seismic (UHRS) data acquired with a line spacing of 250m with cross lines every 500m, and a vertical resolution of 1m. Collected for the current development
- Shallow Cone Penetration Test (CPT) data
- Legacy boreholes and oil and gas wells
- Ground model outputs, currently based on interpretation of the UHRS data, including:
  - Wood (2022): Technical File Note Preliminary Ground Model Morgan & Mona Windfarm Development Irish Sea
- Five boreholes and 12 cores previously taken within the Morgan Generation Assets marine archaeology study area by the British Geological Society (BGS)
- Seismic surveys previously undertaken within the Morgan Generation Assets marine archaeology study area by the British Geological Society (BGS).

1.3.2.4 Previous development led studies have also been incorporated into the assessment. Geoarchaeological review cores collected within the nearby Walney extension offshore wind farm which lies c. 7.5km to the northeast of the site (MSDS Marine, 2019). Further to this, a review of prehistoric archaeological remains within Strategic Environmental Assessment Area 6 (SEA6) which partially covers the Morgan Generation Assets marine archaeology study area was undertaken in 2005 (Flemming, 2005).

Data structure

1.3.2.5 In order to compile a marine archaeological baseline for the purposes of this Marine archaeology technical report, these sources were compiled into gazetteers.

1.3.2.6 The historic environment records have been classified between records where material is known to be on the seabed and ‘recorded losses’. Recorded losses are events of vessels that are known to have been lost in the area, but with which no accurately located remains are associated.

1.3.2.7 Where multiple entries across the datasets occur that relate to the same archaeological receptor, the coordinates from the UKHO dataset have been used, as they are most frequently updated with the latest survey positions.

1.3.3 Site-specific surveys

1.3.3.1 Survey data were collected across the pre-defined Morgan Array Area of 300km^2 by Gardline between 09 July 2021 and 08 September 2021, and XOcean between 12 June 2021 and 16 March 2022. The data consisted of full coverage by Sidescan Sonar (SSS), Multibeam Bathymetry (MBES), and Sub-bottom Profiler (SBP). Limited Magnetometer data was collected at geotechnical sampling locations as part of the clearance process; however, this data was not available for interpretation at the time of writing.

Technical specifications

1.3.3.2 All geophysical data was collected to a specification that fulfils the requirements of section 3 of Archaeological Written Schemes of Investigation for Offshore Wind Farm Projects (Wessex Archaeology, 2021) and in accordance with the site-specific WSI produced in advance of the geophysical survey campaign (COARS, 2021).

1.3.3.3 Line spacing was approximately 250m across the survey area for SSS and SBP data producing a minimum of 100% coverage, excluding the nadir. MBES data were collected at a line spacing to ensure 100% coverage with sufficient overlap of data. The equipment specification is shown in Table 1.2.

Table 1.2: Mobilised survey equipment.

Contractor	Vessel	Sidescan Sonar	UHRS	Pinger	MBES	USBL
Gardline	Ocean Resolution	Edgetech 4200 122/410kHz	AAE DuraSpark	GeoAcousitcs 5430A	Kongsberg EM2040C	Kongsberg HIPAP 502
XOcean	XO-04, XO-05, XO-06, XO-11	N/A	N/A	N/A	Norbit Winghead B51s	N/A

1.3.3.4 The data were collected to a specification appropriate to achieve the following interpretation requirements:

- Sidescan Sonar: ensonification of anomalies > 0.3m
- Multibeam Bathymetry: ensonification of anomalies > 2.0m
- Sub-bottom Profiler: penetration was achieved up to 200m with a vertical resolution of 1m
- All data were collected and referenced relative to ETRS89 UTM Zone 30N.

1.3.3.5 The SSS used an Ultra Short Baseline (USBL) positioning system to ensure positional accuracy throughout the survey. USBL ensures the actual position of the sensor is recorded, as opposed to when the position is estimated based upon the direction of the vessel and the amount of cable out (layback).

1.3.3.6 Although the accuracy of the USBL system is dependent on the angle, and the distance of the beacon from the transceiver, tolerances of between 0.5m and 2.0m can be achieved.

1.3.3.7 Positional accuracy is further increased through the correlation of the SSS dataset with the MBES dataset.

Data quality

1.3.3.8 The data collected to inform the Morgan Generation Assets archaeological assessment was generally of average to good quality. In areas the SSS data showed interference along the outer edges, likely caused through the simultaneous use of other sensors, this was however largely constrained to the outer edges of the data where the high frequency data did not extend to. The MBES data was affected by motion across much of the survey area, the impacts of which are amplified towards the edge of the data where the distance from the sensor to the seabed is greater. It is not considered that these issues impacted the ability to undertake an effective archaeological assessment.

1.3.3.9 Small offsets were noted in places between the SSS and MBES data, however this is usual and positions for medium and high potential anomalies were always taken from the MBES data.

1.3.3.10 The topography and geology of the Morgan Generation Assets survey extents meant some small areas were obscured by shadow within the SSS data. The MBES data were used to identify any anomalies which may have been hidden.

1.3.3.11 It was possible to view a range of high, medium, and low potential contacts within the survey extents. Overall, the data were deemed suitable for archaeological interpretation. It must be noted that there is always the potential for contacts of archaeological potential to not be visible in the data, this possibility is increased in areas of poor data quality or variable topography.

1.3.3.12 Following data collection navigation and offsets were applied, and the data quality controlled before being delivered to MSDS Marine to carry out the geophysical survey interpretation in the formats presented in Table 1.3.

Table 1.3: Data deliverables.

Sensor	Deliverables
Sidescan Sonar	Navigation corrected, unprocessed high and low frequency lines (.xtf) Georeferenced mosaic at 2m resolution (.tif) Seabed features (.csv)
Multibeam Bathymetry	Navigation corrected, unprocessed points (.pts) Georeferenced mosaic at 2m resolution (.tif) Seabed features (.csv)
Sub-bottom Profiler	Navigation corrected, unprocessed lines (.sgy) Navigation corrected, processed lines (.sgy) Horizon grids and unit interpretations (.grd/.shp)

1.3.3.13 In addition, MSDS Marine were provided with operations and interpretations reports produced by the survey contractor and an SSDM geo-database containing all information, and data, relating to the survey campaigns.

Processing

1.3.3.14 The archaeological assessment of data was undertaken by a qualified and experienced maritime archaeologist with a background in geophysical and hydrographic data acquisition, processing, and interpretation.

1.3.3.15 Following delivery of the required datasets, an initial review was undertaken to gain an understanding of the geological and topographic make-up of the survey area. Within the extent of the survey area the potential for variations in the seabed are high and can affect the interpretation of anomalies.

1.3.3.16 Whilst this report focuses on those anomalies identified within the boundaries of the Morgan Array Area the purpose of the assessment is to characterise the historic environment and therefore all of the data collected was assessed even that which extend beyond the limits of the Morgan Array Area.

Sidescan sonar

1.3.3.17 SSS is considered the best tool for the identification of anthropogenic anomalies on the seabed due to the ability to ensonify small features and as such forms the basis of any archaeological assessment of data. SSS data in .xtf format were imported into Chesapeake SonarWiz 7.9 software, navigation and positioning were checked and

corrected where required, and optimal gains were applied to ensure the consistent presentation of data.

1.3.3.18 Data were reviewed on a line by line basis, and all anomalies of potential anthropogenic origin identified and recorded. Records include at a minimum an image of the anomaly, dimensions, and a description. An archaeological potential was assigned to the anomaly following the criteria outlined in Table 1.4 below.

1.3.3.19 Following assessment of the individual lines, a mosaic was created and a Geotiff exported to allow for the checking of positional accuracy against the MBES data and to identify the extents of any anomalies that may have extended past the limits of individual lines.

Multibeam bathymetry

1.3.3.20 Due to the minimum anomaly detection size of MBES data being larger than that of SSS data, the primary use during archaeological assessment, outside of seabed characterisation, is the corroboration of anomalies identified within other datasets and the visualisation of anomalies that may otherwise be obscured by shadow.

1.3.3.21 Navigation corrected, but unprocessed, MBES data were provide to MSDS Marine as .xyz files, the data were imported in QPS Fledermaus where it was gridded and a hill-shaded surface applied, shading was adjusted to ensure the optimal presentation of data. The resulting 3-Dimensional image was viewed on a block by block basis, and all anomalies of potential anthropogenic origin identified and recorded.

1.3.3.22 Records include, at a minimum, an image of the anomaly, dimensions, and a description. An archaeological potential was assigned to the anomaly following the criteria outlined in Table 1.4 below. Where the interpretation of an anomaly was unclear, the data were imported into point cloud visualisation software such as Cloud Compare, in order to view the un-gridded data. The gridded surface image was exported as a Geotiff to allow further assessment alongside other datasets.

Table 1.4: Criteria for the assessment of archaeological potential.

Potential	Characterisation
Low	An anomaly potentially of anthropogenic origin but that is unlikely to be of archaeological significance. Examples may include discarded modern debris such as rope, cable, chain, or fishing gear; small, isolated anomalies with no wider context; or small boulder-like features with associated magnetometer readings
Medium	An anomaly believed to be of anthropogenic origin but that would require further investigation to establish its archaeological significance. Examples may include larger unidentifiable debris or clusters of debris, unidentifiable structures, or significant magnetic anomalies
High	An anomaly almost certainly of anthropogenic origin and with a high potential of being of archaeological significance. High potential anomalies tend to be the remains of wrecks, the suspected remains of wrecks, or known structures of archaeological significance

Assumptions and limitations

1.3.3.23 Data used to compile this report consists of primary geophysical survey data and secondary information derived from a variety of sources, only some of which have been directly examined for the purposes of this assessment. The assumption is made that the secondary data, as well as that derived from other secondary sources, is reasonably accurate.

1.3.3.24 The records held by the UKHO, NRHE and NMRW and the other sources used in this assessment are not a record of all surviving cultural heritage assets, rather a record of the discovery of a wide range of archaeological and historical components of the marine historic environment. The information held within these datasets is not complete and does not preclude the subsequent discovery of further elements of the historic environment that are, at present, unknown. In particular, this relates to buried archaeological features.

1.3.3.25 The interpretation of geophysical and hydrographic data is by its very nature, subjective. However, by using an experienced specialist who can analyse the form, size and characteristics of an anomaly, a reasonable degree of certainty can be achieved. Measurements can be taken in most data processing software, and whilst largely accurate, discrepancies can occur. Where there is uncertainty as to the potential of an anomaly or its origin, a precautionary approach is always taken to ensure the most appropriate mitigation for the historic environment is recommended. There may be instances where a contact may exist on the seabed but not be visible in the geophysical data. This may be due to the anomaly being covered by sediment or being obscured from the line of sight of the sonar, or due to poor quality data.

1.4 Marine archaeological assessment: submerged prehistoric archaeology

1.4.1 Geology and seabed topography

1.4.1.1 The geological processes which form a sequence of seabed deposits provide baseline information to inform an understanding of the Morgan Generation Assets marine archaeology study areas submerged prehistoric archaeological potential. This section therefore describes the seabed geological sequence and seabed topography within the Morgan Generation Assets marine archaeology study area, as a foundation for the sections which follow. It has been informed by a characterisation of the results of the project specific geophysical surveys, as described in section 1.3, and by relevant documentary sources.

1.4.1.2 The Morgan Generation Assets marine archaeology study area lies within the east Irish Sea. Bedrock comprises Triassic material, including the Sherwood Sandstone Group and Mercia Mudstone Group. Erosive events have affected the geomorphology of the Morgan Generation Assets marine archaeology study area. Large-scale valleys have been incised into the Mercia Mudstone bedrock in the east of the Morgan Array Area, whilst the west of the site shows less evidence of glacial phases due to the presence of the stronger Sherwood Sandstone bedrock. The valleys in the east of the Morgan Array Area have been infilled with up to 100m of Devensian glacial till and glaciomarine/lacustrine deposits (Jackson *et al.* 1995). The infilling deposits themselves contain generations of further incisions, likely occurring during the Devensian time period (Wood 2022). Large-scale incisions within the site and wider area, infilled with Devensian material are recorded by the BGS (Jackson et al. 1995) The ground model also identified ribbed moraines and flutes, corresponding with the high number of boulders identified within the units (Wood 2022).

Quaternary sequence

1.4.1.3 Sequences of Quaternary deposits have been recorded in the east Irish Sea comprising Holocene Sediments, deposits of the Surface Sand Formation; Weichselian Sediments, deposits of the Western Irish Sea Formation A (WIS-A), the Western Irish Sea Formation B (WIS-B), the Cardigan Bay Formation (CBF); Saalian to Eemain Sediments, deposits of the CBF; Saalian Sediments, deposits of the St George's Channel Formation (STG); Elsterian Sediments, deposits of the Caernarfon Bay Formation (FBF) and pre-Elsterian Sediments, deposits of the Bardsey Loom Formation (BLF).

1.4.1.4 Seismic data from the Morgan Array Area demonstrates that five Quaternary units overlay the bedrock, including both Pleistocene and Holocene deposits. Together these units average 5-10m thick across the site. However, there are variations in thickness across the Morgan Array Area, with Quaternary deposits entirely absent in some areas, and extending to c.50m in thickness in other areas (Wood 2022). This broadly reflects the findings of BGS sampling and seismic data within the Morgan Array Area (British Geological Survey, 2014).

1.4.1.5 Holocene material varies greatly in thickness across the site, ranging from absent in places to 14m thick in the southeast. The average thickness of these deposits across the site is c.0.5m, though the Holocene sands are absent in many places, and thickest in the southeast of the site (Wood, 2022). The absence of Holocene sands may be due to activities in the area such as fishing, trawling and aggregate dredging as evidenced in the Historic Seascape Characterisation (section 1.5.2.1).

1.4.1.6 The Quaternary sequence within the Mona Array Area is shown in Table 1.5 and full details of the deposits can be found in Wood (2022). The information presented in Table 1.5 will be verified through the analysis of geotechnical surveys in the Environmental Statement.

Table 1.5: Quaternary sequence.

Unit	Lithology	Correlated Formulation	Correlated Member	Age	Depositional Environment
I	Loose to dense gravelly sand	Surface Sands	Sediment Layer 1 (SL1) Sediment Layer 2 (SL2)	Holocene	Intertidal to active marine
II	Dense to very dense gravelly sand	Western Irish Sea A	Western Irish Sea - A (WIS-A)	Devensian	Glaciomarine to Marine
III	Low to high strength clay with rare gravel	Western Irish Sea B	Lower Incision Infill	Devensian	Glaciolacustrine to Glaciomarine
IV	Low to high strength clay with rare gravel	Western Irish Sea B		Devensian	
V		Cardigan Bay	Upper Till; OR	Devensian	Glacial to Subglacial
	Extremely high strength clay with rare gravel		Bedded and Infill	Late Wolstonian/Early Ipswichian or Devensian	

1.4.2 Submerged prehistoric archaeology

1.4.2.1 This section characterises the potential for submerged prehistoric archaeology to be present within the Morgan Generation Assets marine archaeology study area. For example, deposits containing archaeological material (e.g., flint tools), or submerged landscapes. This section is informed by the geophysical baseline data and desk-based review of secondary sources cited within the text.

1.4.2.2 The prehistoric period of the UK covers from the earliest hominin occupation (potentially as early as c. 970,000 BP) to the end of the Iron Age and the Roman invasion of Britain in 43 AD. The coastline of the UK underwent dramatic changes during this time, and areas of the seabed that are now fully submerged would have been exposed allowing the opportunity for hominins to exploit and inhabit the landscape. Glacial events including the Anglian (480,000 - 430,000 BP), the Wolstonian (350,000 – 132,000 BP) and the Devensian (122,000 – 10,000 BP) and intervening periods of marine transgression have affected the coastline of the UK and therefore the archaeological potential of these areas.

1.4.2.3 Prehistoric archaeological potential is determined with reference to evidence for human activity in the UK during each period, and the contemporary environment within the site. Depositional environment and post-depositional factors are also key to understanding potential, and as such geological deposits present within the site form an important consideration in understanding archaeological, palaeoenvironmental and palaeolandscape potential. Geological periods referred to in this section are defined by the date ranges presented in Table 1.6. Dates are referred to as BP (Before Present).

Table 1.6: Geological periods.

Period	Date Range	Notes
Holocene	10,000 BP to Present Day	Mesolithic, Neolithic, Bronze Age, Iron Age, Roman, Medieval, Post Medieval and Modern periods. The Holocene is the current time period within the larger geological time scale known as the Quaternary Period.
Devensian from Post Late Glacial Maximum to Late Glacial Interstadial	18,000 BP to 10,000 BP	Coincides with the Late Upper Palaeolithic and the early Mesolithic.
Devensian up to Late Glacial Maximum	c. 73,000 to 18,000 BP	Arrival in the UK of Late Middle Palaeolithic Neanderthals, who were followed approximately 31,000 BP by Early Upper Palaeolithic, anatomically modern humans (Homo sapiens).

Period	Date Range	Notes
Ipswichian (interglacial)	c. 130,000 to c. 115,000 BP	Last interglacial in the UK. Overlaps with the Late Middle Palaeolithic.
Wolstonian	c. 374,000 to c. 130,000 BP	Predominantly Pleistocene glaciation. Incorporates the earliest period of the Late Middle Palaeolithic.

Late middle palaeolithic (186,000- 45,000 BP 184,000–43,000 BC)

1.4.2.4 Deposits representing the final glacial stage of the Wolstonian glaciation are present within the Morgan Generation Assets marine archaeology study area, indicating that the area was subglacial during this period and therefore uninhabitable by humans.

1.4.2.5 While most deposits within the Morgan Generation Assets marine archaeology study area are thought to relate to the Devensian and Holocene periods, Unit V may relate to deposits that are associated with the Cardigan Bay Formation, laid down during the transition into the Ipswichian Interglacial. Improvements in climate during the Ipswichian Interglacial may have allowed for environments which were more conducive to human activity. However, no such activity or deposits associated with human activity have been identified within the UK dating to this period (Marshall *et al*., 2020). The analysis of seismic data from within the Morgan Array Area and evidence from the wider area therefore suggests that deposits representing environments favourable for human occupation dating to the Late Middle Palaeolithic are not likely to be present within the Morgan Generation Assets marine archaeology study area (Jackson *et al*., 1995, Mellett *et al*., 2015 and Wood, 2022).

Upper palaeolithic (45,000-10,000 BP 43,000-8000 BC)

1.4.2.6 The Devensian glaciation coincides with the Upper Palaeolithic and follows the Ipswichian Interglacial, which was the last period of glaciation to affect the UK. Deglaciation may have commenced from c. 20,000 BP with the Morgan Generation Assets marine archaeology study area being ice free by 18,000 BP, although the retreating ice sheet may have been in close proximity at the time near the Isle of Man (c. 40km northwest). Paleoenvironmental potential has been demonstrated through the recovery of floral and faunal remains within Unit III (Jackson *et al*., 1995). However, the proximity of the Morgan Generation Assets marine archaeology study area to areas of glaciation would suggest a very low potential for human occupation or activity, and therefore the presence of submerged prehistoric archaeological material dating to this period.

1.4.2.7 Sea level and landscape changes within the Morgan Generation Assets marine archaeology study area and its surrounding environment during the Upper Palaeolithic are not conclusively understood. Some studies suggest that the Liverpool Bay area would have been an entirely marine environment during this time, whilst other evidence indicates that it would have been a partially terrestrial environment dominated by fluvial systems and related floodplains (Brooks *et al*., 2011, Jackson *et al*., 1995, Mellett *et al*., 2015 and Fitch *et al*., 2011). The West Coast Palaeolandscape Study supports the latter in finding that areas of Liverpool Bay would have been terrestrial following the LGM and therefore capable of supporting human habitation. The date around which the final submergence of the area took place is also not conclusive, with some studies (Brooks *et al*., 2011, (see Figure 1.2) indicating submergence of the Morgan Array Area c. 13,000 BP and others arguing for c. 6000-7000 BP (Fitch *et al*., 20011).

1.4.2.8 Figure 1.2 (Brooks *et al*., 2011; EMODnet Geology, 2019) shows that at 16,000 BP there may have been limited areas of intertidal or terrestrial landscape within the Morgan Generation Assets marine archaeology study area, with final submergence occurring c.13,000 BP. However, these are extremely limited and represent a very low potential for the presence or survival of archaeological material. Even if the theory that the Morgan Generation Assets marine archaeology study area was a partially terrestrial environment during the Upper Palaeolithic is accepted, it would likely not have been a favourable environment for human exploitation. Permafrost would have been present in the area, limiting the growth of vegetation and therefore the availability of resources for human exploitation.

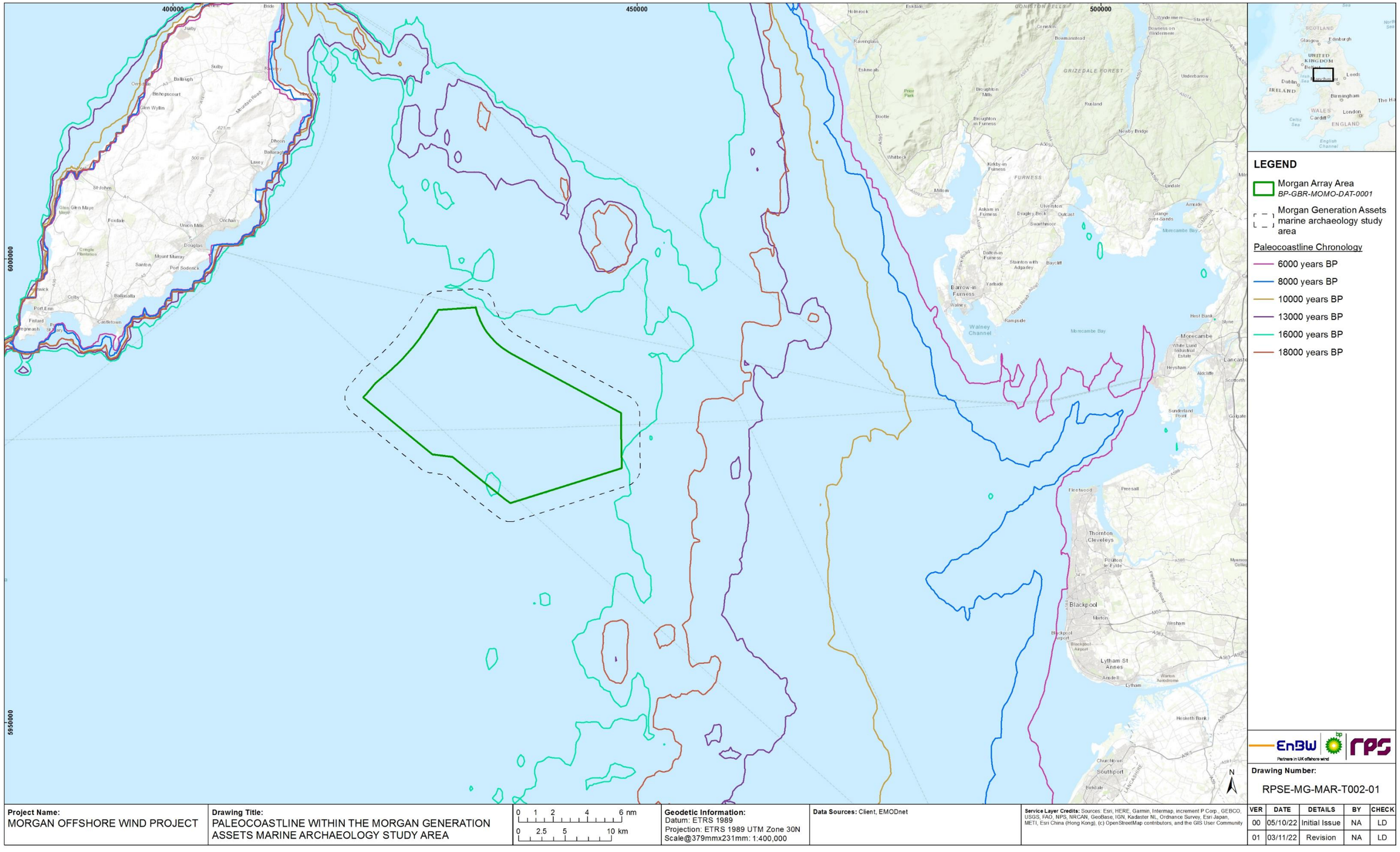


Figure 1.2: Paleocoastlines within the Morgan Generation Assets marine archaeology study area (EMODnet Geology, 2019).

Mesolithic (10,000 – 6000 BP 8000-4000 BC)

1.4.2.9 The debated chronology for the submergence of the Morgan Generation Assets marine archaeology study area is significant for this period as if the earlier date of 13,000 BP is accepted then the area would have been fully submerged by the advent of the Mesolithic and therefore incapable of sustaining human occupation. However, if the later date of 7000 to 6000 BP is accepted then the partially terrestrial environment may well have been inhabited by humans and represent the potential for the survival of archaeological material.

1.4.2.10 Improvements in climate conditions at this time would have brought about environments in which vegetation could thrive. Landscape modelling undertaken by the West Coast Palaeolandscape Study suggests that the Morgan Generation Assets marine archaeology study area would have been partially intertidal during the Mesolithic (Figure 1.3). The intertidal represents an environment that is rich in available resources for human exploitation, access to the sea would provide humans a food source in the form of fish and shellfish. The intertidal zone is also an environment which encourages the growth of vegetation that could be utilised for food and resources. The landscape would have been one of low energy river systems, kettle holes and water-filled incisions, these features may have also been focal points of prehistoric activity and kettle holes have the potential for Mesolithic and palaeoenvironmental assemblages as evidenced at other kettle hole sites in Killerby, North Yorkshire and Slotseng, Denmark (Hunter and Waddington 2018; Noe-Nygaard et al. 2007). The West Coast Palaeolandscape Study indicates that the Morgan Array Area may be situated adjacent to a kettle hole lake (Figure 1.3). Further evidence on the timing of the marine transgression is required in order to fully understand the submerged prehistoric potential of the Morgan Generation Assets marine archaeology study area.

1.4.2.11 The SL1 and SL2 members of the Holocene Surface Sands Formation have been correlated to Unit I, as shown in Table 1.5, and represent the final marine transgression of the Irish Sea. The SL2 member is interpreted as intertidal to marine. Peat within the SL2 member was identified in a BGS borehole c.65 km south of the site (70/07) which is believed to represent a reed swamp dating to 9200 BP (Jackson *et al*., 1995 and Mellett *et al*., 2015). These indicate some potential for both paleoenvironmental and archaeological remains to be present.

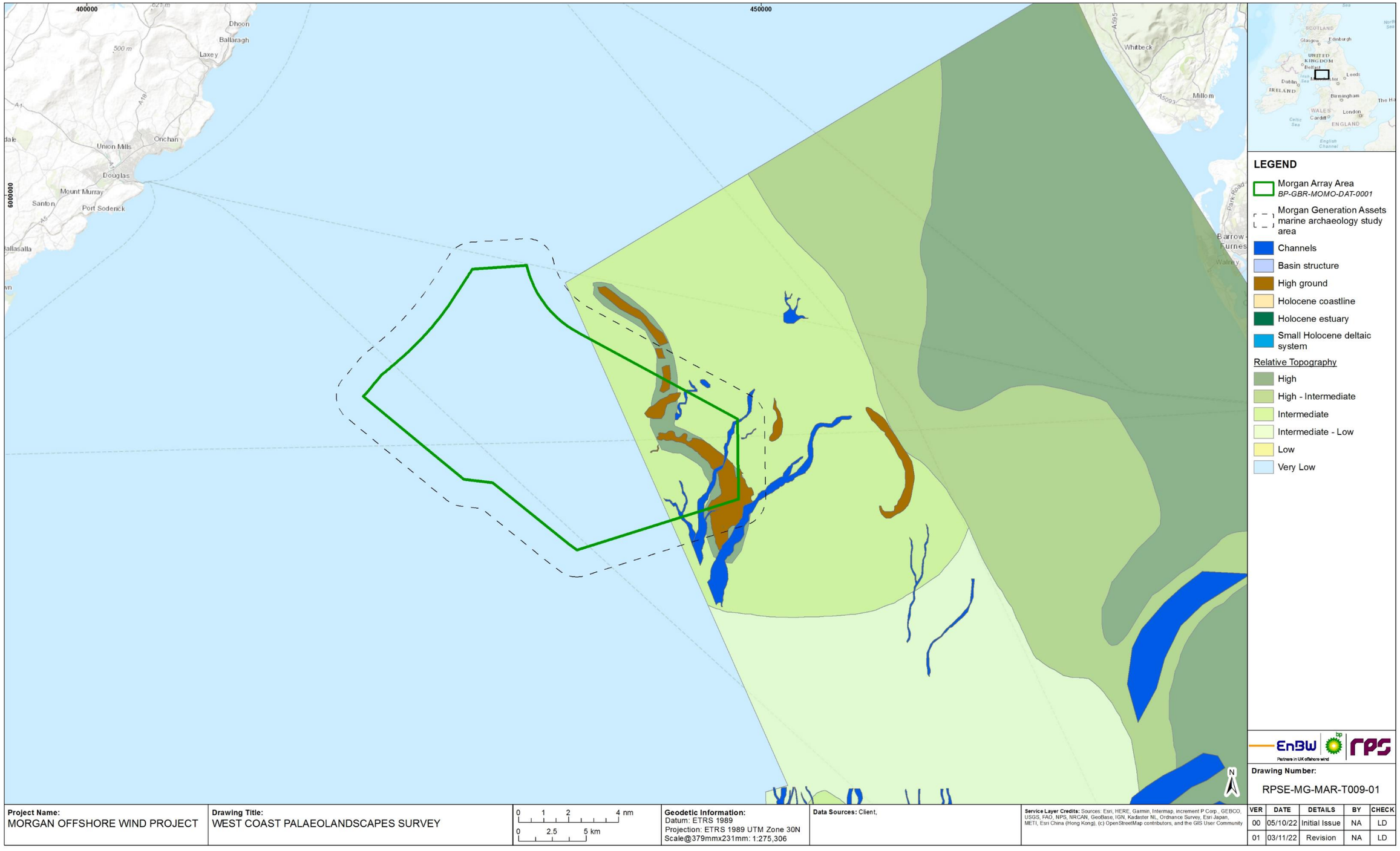


Figure 1.3: West Coast Palaeolandscape Study reconstruction of the Morgan Generation Assets marine archaeology study area.

1.5 Marine archaeological assessment: maritime and aviation archaeology

1.5.1 Maritime archaeological potential

1.5.1.1 The maritime archaeology of the UK is the product of a complex interplay of constantly evolving coastal and marine activities, international links and patterns of shipping, and sea use since the earliest human occupation of the UK during the late Palaeolithic to modern periods. This section reviews the potential presence of maritime archaeology within the Morgan Generation Assets marine archaeology study area associated with these maritime activities, such as ship and aviation wrecks and associated material. Military remains are also covered within the scope of maritime archaeology considered in this section.

1.5.1.2 Through this section, the maritime archaeological record of the Morgan Generation Assets marine archaeology study area has been considered chronologically for the following broad temporal phases as described in Table 1.7. However, as the survival of maritime archaeological evidence during the Palaeolithic and Mesolithic is extremely rare, these chronological periods have been considered under the term Early Prehistoric.

1.5.1.3 Records of known wreck sites and losses in UK waters are biased towards the Post-Medieval and Modern periods and therefore the precise locations of most wrecks pre-dating these periods in UK waters are not known. The majority of known and recorded wreck sites lie relatively close to the coast. The proximity of many historical sailing routes to the coast and the natural hazards of the east Irish Sea can be expected to have been a determining factor in many maritime casualties in the past (Wessex Archaeology, 2008).

1.5.1.4 Archaeology is considered in terms of periods that represent timeframes which are defined and categorised by the culture of the people of the time, notable changes in culture and activities are indicated by changes in chronological periods. Dates are referred to as BC (Before Christ), or AD (anno domini).

1.5.1.5 The chronological periods and their corresponding date ranges that are considered within the report are provided in Table 1.7.

Table 1.7: Overview of British archaeological chronology.

Period	Date Range
Palaeolithic	c. 900,000 to 12,000 BC
Mesolithic	12,000 to 4000 BC
Neolithic	4000 to 2500 BC
Bronze Age	2500 to 800 BC
Iron Age	800 BC to AD 43
Romano-British	AD 43 to 410
Early Medieval	AD 410 to 1066
Medieval	AD 1066 to 1500
Post-medieval	AD 1500 to 1800
19th century	AD 1800 to 1899
Modern	AD 1900 to present day

Early prehistory (Palaeolithic to Mesolithic)

1.5.1.6 There is currently no evidence in the UK for maritime archaeological remains pre-dating the start of the Holocene. However, there are examples from elsewhere in the world which suggest that primitive watercraft were in use by the Middle Palaeolithic period, such as the suggestion that the colonization of Australia approximately 40,000 BP involved island-hopping in or on primitive watercraft (Lourandos,1997).

1.5.1.7 During the Late Upper Palaeolithic (approximately 12,000 BC), it is possible that simple watercraft such as log boats or rafts were used for coastal journeys and fishing within the British Isles (Wessex Archaeology, 2007b and Dunkley, 2016), however no evidence of Palaeolithic sea-faring craft is currently known.

1.5.1.8 The first archaeological evidence for the use of watercraft in the UK dates to the Mesolithic and is from Star Carr in Yorkshire where fragments of a wooden oar have been identified (Van de Noort, 2011 and Wessex Archaeology, 2007b). A late Mesolithic/early Neolithic burial in a partially burnt dugout canoe was found in St. Albans, Hertfordshire in 1988 (Dunkley, 2016). Finds in Germany and Denmark suggest that logboats were used for coastal journeys.

1.5.1.9 Watercraft may have been used in the rivers and estuaries during the Mesolithic for coastal journeys, fishing expeditions, and possibly longer journeys in favourable weather. The evidence of the exploitation of the coastal resource by this period suggests the possible use of watercraft during this period. They are likely to have become increasingly important to the Mesolithic inhabitants with rising sea levels. However due to the paucity of evidence and fluvial activity across the Morgan Generation Assets marine archaeology study area, the potential for the survival of any archaeology associated with the maritime environment from the Palaeolithic and Mesolithic periods is considered low.

Neolithic and Bronze Age

1.5.1.10 No evidence of Neolithic or Bronze Age maritime activity has been recorded within the Morgan Generation Assets marine archaeology study area.

1.5.1.11 Direct archaeological evidence for the exploitation of the marine environment and maritime activity within the Neolithic is rare and limited to logboat finds (Johnstone, 1980; Wilkinson and Murphy, 1995 and Bradley *et al*., 1997) and shell middens containing the faunal remains of deep sea fish (Ellmers, 1996). Little is known of watercraft or vessels from this period and archaeological evidence of them is so rare that all examples of craft would be considered of high value, however the potential for these discoveries within the Morgan Generation Assets marine archaeology study area is low.

1.5.1.12 The Bronze Age (approximately 2200 to 700 BC) was a period of technological innovation and of expansion of trade and exchange networks, facilitated by the introduction of new forms of boats both for ocean and coastal/riverine trade. Clear

advances occurred in maritime technology during this period and an increasingly substantial maritime archaeological record allows a less speculative understanding of maritime culture than for earlier periods.

1.5.1.13 Evidence of Bronze Age maritime activity has been recorded throughout England in the discovery of a number of inland watercraft and sea faring vessels. Five sewn plank boats have been discovered at Ferriby in North Yorkshire known collectively as the Ferriby Boats. The Dover Boat is considered to be the world's oldest sea-faring boat dating to c.3500 BC which was excavated in 1992 during the construction of the A20 road link between Folkstone and Dover. A further eight Bronze Age boats dating to 3000 BC were discovered on the outskirts of Peterborough in 2013 (The Guardian, 2013). No such examples have been recorded in the vicinity of the Morgan Generation Assets marine archaeology study area, however it is possible that similar crafts would have been utilised to traverse the area. The potential for the discovery of maritime archaeology from the Bronze Age is considered to be low.

Iron Age and Romano-British

1.5.1.14 Evidence of Iron Age maritime activity has been discovered in the form of Romano-Celtic boats which are examples of a new form of ship construction that was emerging in northwest Europe at the time. In 1962 the remains of a seagoing trading vessel named the Blackfriars boat were excavated in London (Marsden, 1994). Slightly closer to the Morgan Generation Assets marine archaeology study area, a smaller example of a Romano-Celtic boat named the Barlands Farm boat was discovered in the Severn estuary and is considered to have also been capable of coastal and sea journeys (Lawer and Nayling 1993).

1.5.1.15 The Poole logboat is one of the largest logboats to have been discovered in Britain and radiocarbon dating has dated it to c.295 BC, making it an excellent example of Iron Age watercraft (Poole Museum). The discovery of boats such as these indicates that maritime transport was an important part of Iron Age life, however the organic construction materials used mean that the potential for the survival of Iron Age maritime archaeology within the Morgan Generation Assets marine archaeology study area is low.

1.5.1.16 The County Hall ship, discovered in London and dendrochronologically dated to the 3rd century AD is an example of a boat demonstrating a typically Mediterranean construction method, however the dendrochronological evidence shows that it was constructed in Britain during the Roman period (Marsden, 1974). The ship was carvel built, with the planks being held together by mortice and tenon joints. Roman maritime evidence has also been discovered in Wales, in Porth Felen, Gwynedd a lead anchor stock was recovered (Boon, 1977).

1.5.1.17 The Roman occupation of Britain was by necessity a maritime endeavour, which would have required continuous transportation of resources and people to the military and civilian sites established by the Romans. Sites such as these can be found along Liverpool Bay and therefore it stands to reason that there would have been substantial Roman maritime traffic in this area. However, as stated above, the use of organic construction materials means that the potential for the survival of maritime archaeology material from this period is low to moderate with the exception of areas where peat survives, as peat creates an anaerobic environment which facilitates the preservation of organic material.

Early medieval and medieval

1.5.1.18 The early medieval period marks a change in ship construction techniques evidenced within the archaeological record and coinciding with the end of the Roman occupation in the 5th century AD and an increasing Anglo-Saxon presence in the form of Norse and Danish Vikings. Influences on ship construction came from Scandinavian connections and with them the increased emphasis on clinker construction. Several examples have been discovered in Britain, including the Snape boat grave (5th to 6th century AD), the famous Sutton Hoo (7th century AD) and Graveney boat (8-9th century AD).

1.5.1.19 The Snape boat grave derives its name from its location of discovery at Snape Common, near Aldeburgh in East Anglia. It is clinker-built and about 15m long (Bruce and Mitford, 1952).

1.5.1.20 The Sutton Hoo boat burial is arguably one of Britain's most important archaeological discoveries. Found near Woodbridge, Suffolk and dating to the 7th century AD, it is a clinker built vessel and was over 27m long. The Sutton Hoo boat burial formed part of a horde of grave goods, the study of which radically re-evaluated ideas on Anglo-Saxon technology. The Graveney boat discovered in Kent is an 8th-9th century AD clinker built vessel of about 14m long. The Graveney boat is particularly unique in that it is an example of a trading vessel as opposed to the high-status warships of the previous examples (Fenwick, 1978). All of these boats would have been capable of sea-voyages and indicate an increase in long-distance trade and exploration during this time. A trend that continues to increase during the medieval period.

1.5.1.21 With the medieval period came a boom in maritime trade across Europe and further afield with the establishment of several trading confederations such as the Hanseatic league at this time. Trading networks across Europe expanded during the medieval period and several important trade routes emerged. Trade expanded across the Irish Sea at this time also, with Dublin becoming an increasingly important commercial port, contributing to the maritime transportation of goods through the Irish Sea.

1.5.1.22 Increased demand for goods meant that ship construction advanced rapidly during this period to accommodate larger cargoes. Examples of types of boats dating from early medieval and medieval include larger clinker-built merchant vessels called keels, cogs and possibly reverse clinker-built vessels termed hulks (Friel, 2003). Examples of trading vessels from this period include the Magor Pill, a 12th century clinker built vessel with a cargo of iron ore found on the banks of the Severn Estuary near Newport, in South Wales and the protected wreck located at Pwll Fanog in the Menai Strait, Gwynedd. The remains of a clinker built boat with a cargo of slate which was found by divers in 1976, with subsequent research giving a probable fourteenth or fifteenth century date for the vessel (Fenwick and Gale, 1998).

1.5.1.23 The rapid technological advances in ship construction during the medieval period can also be attributed to increased military campaigns. This is particularly true in the Irish Sea where the campaigns of Edward I and Edward II against the Scots in the fourteenth century were supplied with men and resources from Ireland. Due to the large increase of maritime traffic that would have occurred in the Irish Sea during the early medieval and medieval period, the potential for the discovery of archaeological remains dating from this period is considered to be moderate.

Post medieval and modern

1.5.1.24 The post-medieval and modern periods present the greatest potential for unrecorded archaeology to be discovered. The increasing incorporation of metal structural elements into vessel designs during this period means that wrecks for the 19th and early 20th centuries are also often more visible on the seabed than their wooden predecessors. They are visible to bathymetric and geophysical survey, and also generate strong magnetic anomalies, and this greater visibility is reflected in the increased number of known wrecks (i.e. those that have been located on the seabed) in contrast to earlier periods.

1.5.1.25 International trade with ports around the Irish Sea becomes increasingly important in the post medieval period. An example of an international trade ship that was discovered in the Irish sea is the Tal-y-Bront or Bronze Bell wreck which is thought to be a Genoese wreck depicted on an Admiralty chart from the eighteenth century close to Sarn Badrig reef. The wreck was discovered in Cardigan Bay, south of the Morgan Generation Assets marine archaeology study area with a cargo of uncut blocks of Italian Carrera marble. The wreck site has undergone several archaeological investigations and was designated in 1978 (Wessex Archaeology, 2005).

1.5.1.26 Another designated wreck from the post medieval period is located closer to the south of the Morgan Generation Assets marine archaeology study area. The wreck of the Royal yacht *Mary* sank when it struck the Skerries off Anglesey in 1675. The *Mary* was built by the Dutch East India Company (VOC), purchased by the City of Amsterdam, and given to Charles II upon his restoration to the throne. It was used for royal duties for a year and was then employed as a transport vessel for officials between Dublin and Chester. The wreck was discovered in 1971 by divers and was designated as a protected wreck in 1974 under the Protection of Wrecks Act 1973.

1.5.1.27 Trade between England and Ireland increased during the 16th century as England produced larger quantities of coal, a resource which was scarce in Ireland. This growth in trade led to the establishment and expansion of ports such as Mayport on the Solway Firth to the north of the Morgan Generation Assets marine archaeology study area.

1.5.1.28 During the 18th century there was also increased military activity from France, who planned a series of, ultimately unsuccessful, invasions of Ireland and Wales in 1759, 1796 and 1797. This led to a substantial increase of traffic in the Irish Sea, not just from the French but also in the form of British ships to stave off the threat of invasion and protect shipping and trade interests in the area.

1.5.1.29 From the 18th century onwards, records were kept of ship losses, with records becoming more detailed from the 19th century. Rapid industrialisation in the 18th and 19th centuries revolutionised shipbuilding, introducing technological innovation that precipitated fundamental changes in maritime technology. By the end of the 19th century with the advent of the steam engine, the introduction of iron hulls and the development of the screw propeller had wrought major transformations on ships and shipping (Lambert, 2001). Although steam and steel came to dominate shipping during the 19th century, there remained a strong local core of maritime activity around much of the coast of the UK which retained the more traditional, often wooden vessel types.

1.5.1.30 The potential for the discovery of unknown maritime archaeology from the post medieval and modern periods within the Morgan Generation Assets marine archaeology study area is high.

Modern military remains

1.5.1.31 The maritime archaeological record of the 20th century until the present day is dominated by remains associated with the two World Wars. Warships, submarines and U-boats along with cargo vessels, personnel transport vessels and aircraft, comprise the losses during this period.

1.5.1.32 The first World War saw the advent of the use of submarines in European waters, following their widespread usage in the American Civil War. Shipping activity around Britain was targeted by enemy submarines and a great number of vessels were lost this way.

1.5.1.33 During both World Wars submarine activity was extensive in the Irish Sea. There are a total of seven U-boat wrecks from the Second World War located in the Irish Sea. There are a further two Allied losses designated under the Protection of Military Remains Act 1986 present within the Irish Sea, HMS H5 and SS Rutherglen were both lost in a collision with each other off Angelsey. Closest to the Morgan Generation Assets marine archaeology study area, the HMS H5 was lost off Anglesey after being rammed by a British cargo ship the SS Rutherglen during U-boat manoeuvres. The submarine was mistaken for a U-boat, and all hands were lost.

1.5.1.34 Advances in maritime technology during the second World War meant an increase in naval offenses, this means that there was a substantial increase in recorded losses from this period, and therefore the potential for the discovery of unknown maritime archaeology from both World Wars is considered to be high.

1.5.2 Historic seascape characterisation

1.5.2.1 In 2009 English Heritage (now Historic England) commissioned an Historic Seascape Characterisation (HSC) An HSC follows the same principles as Historic Landscape Characterisation, and is designed to complement marine and coastal planning, this is with particular regard to the statutory responsibilities of Historic England.

1.5.2.2 The assessment of HSC furthers the principles of the European Landscape Convention by characterising ‘seascape’ as a subset of ‘landscape’ which is defined as ‘an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors’ (Council of Europe, 2000: Article 1). HSC assessment is the identification and interpretation of the historic dimension of the present day coastal and marine environment (Natural England, 2012).

1.5.2.3 The Irish Sea HSC covers coastline and territorial waters of the northwest region of England, with the adjacent UK Controlled Waters. The boundaries are defined by the national border with Wales in the south, the border between UK and Isle of Man to the west, and the national border with Scotland to the north. Therefore, HSC is available for most of the Morgan Generation Assets marine archaeology study area, it can be reasonably assumed that the areas of the Morgan Generation Assets marine archaeology study area that are within Welsh territorial waters can be characterised similarly. The utilisation and exploitation of the east Irish sea has been summarised in the marine archaeological baseline (section 1.5.1).

1.5.2.4 The HSC method characterises historic trends and process that have shaped the marine archaeological environment to provide information for the sustainable management of English marine and coastal environments. The marine environment is considered in four ‘levels’: the sea surface, the water column, the sea floor and the

sub-sea floor. The results are available in GIS compatible downloads from the Archaeology Data Service which allows key characteristics within the Morgan Generation Assets marine archaeology study area to be identified. These are presented in Table 1.8.

Table 1.8: HSC within the Morgan Generation Assets marine archaeology study area.

Present broad Character Types	Present Character Sub-Types
Cultural Topography	fine sediment plains
Industry	Energy
Fishing	Modern fishing grounds for shellfish dredging and bottom trawling
Navigation	Modern navigation activity – navigation routes, maritime debris
	Modern navigation hazards – maritime debris, wreck hazards, drying hazards, shoals and flats
Communications	Telecommunications – submarine cables

1.5.2.5 Historical cultural processes which have shaped the character of the Morgan Generation Assets marine archaeology study area are predominantly related to fishing and navigation activity indicating a high presence of maritime traffic in the area and therefore a high potential for maritime archaeology.

1.5.3 Navigation hazards

1.5.3.1 In 2009 Bournemouth University (commissioned by English Heritage, now Historic England) undertook the project Mapping Navigational Hazards as Areas of Maritime Archaeological Potential. Historical records of shipwreck data were analysed in combination with areas of seabed with where sediments are conducive to the preservation of archaeological material, frequency of hydrographic surveys and high-traffic marine environments, such as around ports and harbours. These combined factors were considered Areas of Maritime Archaeological Potential (AMAPs).

1.5.3.2 Liverpool Bay, Morecambe Bay and their approaches have been considered AMAPs due to historically high maritime traffic and an offshore sandy seabed. Therefore, there is a high potential for archaeological wreck sites within and close to the Morgan Generation Assets marine archaeology study area.

1.5.4 Maritime recorded losses

1.5.4.1 Only one recorded loss has been identified within the NMRW data. Record number 240004 is the record of the *Sunrise* a 24' wooden sailing smack (a type of traditional fishing boat) captured by a German submarine and scuttled. All four crew were taken prisoner, with three survivors being put on the ships boat where they made their way to Whitehaven. No further details are given. The record states that no archaeological remains are confirmed at the location. The wreck has not been identified during surveys, nor in the geophysical data, but may correspond with UKHO 5477, a record of a possible wreck site situated outside of the Morgan marine archaeology study area.

1.5.4.2 Recorded losses represent maritime and aviation losses that are known to have occurred in the vicinity but to which no specific location can be attributed. Recorded losses are often grouped with reference to a geographic, hydrographic or other point of reference, making the positional data of these records unreliable. However, they do provide information on the historical marine traffic of the general region and therefore the archaeological potential. Recorded losses may be attributed to unknown anomalies identified by the geophysical survey or they may be positioned outside the Morgan Generation Assets marine archaeology study area.

Aviation archaeology potential

1.5.4.3 Thousands of military and civilian aircraft casualties have occurred in UK waters since the advent of powered flight in the early 20th century. The bulk of these are casualties of World War II and most are concentrated off the south and southeast coasts of England. However, there is evidence for substantial numbers of aircraft casualties in the east Irish Sea (Wessex Archaeology, 2008).

1.5.4.4 Whilst the aviation archaeology record is potentially very large, the ephemeral nature of aircraft wrecks ensures that many sites remain unknown and unrecorded. In addition, although records of aircraft losses at sea are extensive, they are seldom tied to an accurate position, which further complicates any assessment of the likely presence of aircraft wreckage on any particular area of the seabed.

1.5.4.5 Since World War II, despite the volume of both military and civilian air traffic, there have been few aviation losses off the west coast of England and north Wales, in the vicinity of the Morgan Generation Assets The potential for post-war aircraft remains to be discovered within the Morgan Generation Assets marine archaeology study area for the transmission assets is therefore considered to be low. Civilian aircraft wrecks are not subject to protection under the terms of the Protection of Military Remains Act 1986.

1.5.5 Aviation archaeology

1.5.5.1 One record relating to a potential aircraft crash site was returned from the UKHO (5418) and NRHE (909495) data within the Morgan Generation Assets marine archaeology study area and considered 'live' by the UKHO. This relates to aircraft wreckage reported by divers in 1991. No wreck, or material of anthropogenic origin was identified within the geophysical data at the stated position.

1.5.6 Overview of potential

1.5.6.1 An overview of the marine archaeological potential within the Morgan Generation Assets marine archaeology study area is presented in Table 1.9.

Table 1.9: Overview of marine archaeological potential.

Receptor	Potential	Value
Submerged prehistoric archaeology	Low	Local/Regional/National
Paleoenvironmental evidence	Low	Local/Regional/National
Early prehistoric maritime evidence	Low	National
Bronze Age maritime evidence	Low	National

Receptor	Potential	Value
Iron Age and Roman maritime evidence	Low to Moderate	National
Early medieval and medieval maritime evidence	Moderate	Regional/National
Post medieval and modern maritime evidence	Good	Local/Regional/National
Modern military remains	Good	Local/Regional/National

1.5.7 Designated, known and recorded wrecks

1.5.7.1 No designated sites have been identified within the datasets for the Morgan Generation Assets marine archaeology study area.

1.5.7.2 Within the UKHO data there are 12 entries that relate to wreck sites within the Morgan Generation Assets marine archaeology study area and one that corresponds to the aircraft discussed in section 1.5.5. Of these seven are considered 'live', the further five are all listed as 'dead' indicating that no remains of these wrecks are currently visible on the seabed. This has been confirmed by the geophysical survey and the wrecks are not considered to survive at these locations. Full details of these sites are presented in Appendix A and their recorded locations shown in Figure 1.4.

1.5.7.3 Of the seven entries, five have been located by the site-specific geophysical survey and are discussed fully in section 1.5.8, their locations are shown in Figure 1.4.

1.5.7.4 The remaining two wrecks are those of the *Malaguena* (UKHO 58669), a fishing vessel sank in August 2000 whilst under tow by the tug *Wendy Ann* from the Isle of Man to Millom. The vessel consisted of a decommissioned hull. The record lies outside the extents of the geophysical data, and 896 m outside of the Morgan Array Area, therefore it is considered that the wreck may survive at this location but will not be considered further in this assessment. Secondly the *Peveril* (UKHO 7460, NMRW 240647), a British steam ship sunk on 16th September 1899 following a collision with the British steam ship *Monarch* while on passage from Liverpool to Douglas. The wreck was first recorded following survey in 1991 and confirmed by divers in 1993. In 1995 divers recovered items marked with Isle of Man Steam Packet Co indicating the wreck of the Peveril. The wreck is reported as largely collapsed with the engine and boilers standing 3 m proud of the seabed. The wreck lies outside the extents of the geophysical data and 385 m outside of the Morgan Array Area, therefore it is considered that the wreck may survive at this location but will not be considered further in this assessment. The locations of these wrecks are shown in Figure 1.4.

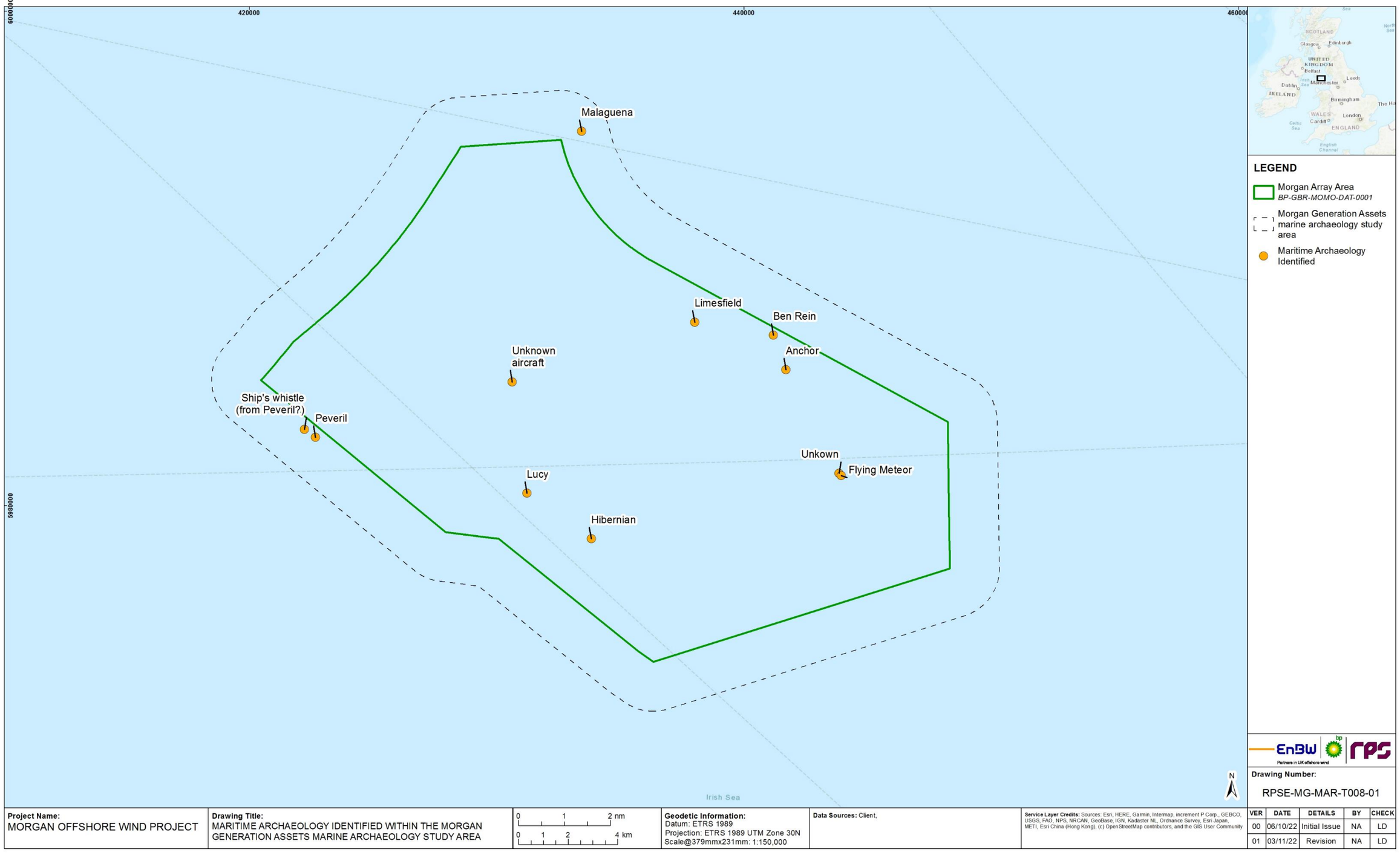


Figure 1.4: Maritime archaeology identified within the desktop data.

1.5.8 Geophysical seabed features assessment results

1.5.8.1 52 anomalies of potential archaeological interest were identified within the Morgan Array Area. Of these, five are considered to be high potential anomalies, five are of medium potential and 42 have been classed as low potential anomalies. The distribution of these can be seen in Figure 1.5. Full details of the anomalies of archaeological interest identified during the geophysical survey are presented in Appendix B.

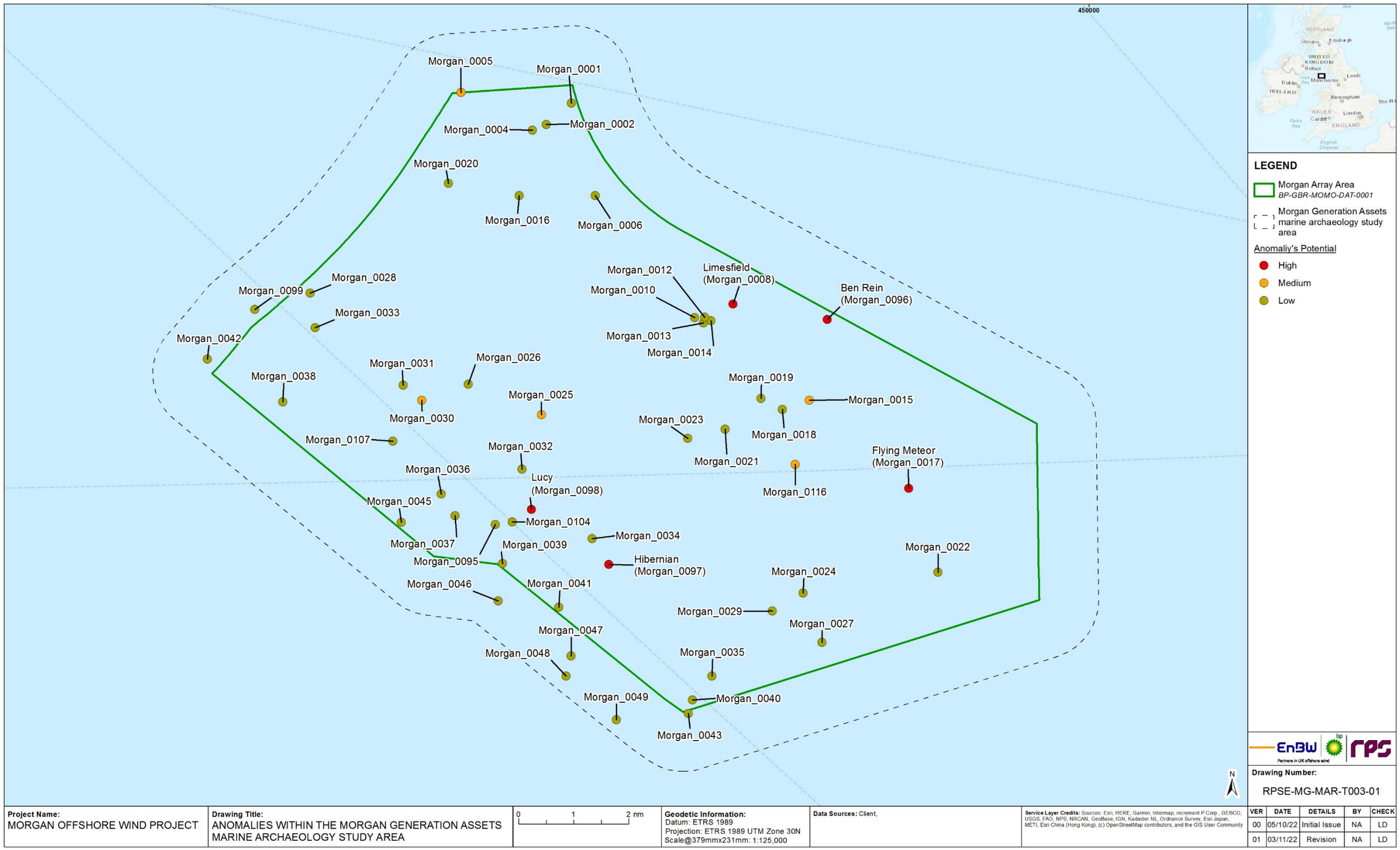


Figure 1.5: Geophysical Anomalies within the Morgan Generation Assets marine archaeology study area.

Low potential anomalies

1.5.8.2 The 42 low potential anomalies predominantly represent likely geological features, modern debris such as chain, cable or rope and linear feature. None of these are considered to represent material of archaeological potential and are therefore not considered further within this report.

Medium potential anomalies

1.5.8.3 The five medium potential anomalies are presented below in Table 1.10 and the distribution is shown in Figure 1.6.

1.5.8.4 Anomalies that could represent either geological or archaeological features have been classed as medium potential anomalies and these range from potential debris to potential wreck.

Table 1.10: Medium potential anomalies.

ID	Category	Description
Morgan_005	Seabed disturbance	Morgan_005 (Figure 1.7) lies approximately 5m to the north of the Morgan Array Area. The anomaly has been interpreted as an area of seabed disturbance measuring 33.7m x 16.2m with a measurable height of 0.2m. Whilst likely a geological feature, a number of small features within the constraints may indicate anthropogenic material.
Morgan_0015	Unidentified debris	Morgan_0015 (Figure 1.7) lies to the east of the Morgan Array Area approximately 3 km from the northeast boundary. The anomaly measures 12.6m x 7.3m with a measurable height of 0.4m and is made up of at least three smaller features. The anomaly is largely incoherent, but potentially represents material of anthropogenic origin.
Morgan_0116	Potential debris	Morgan_0116 (Figure 1.7) lies to the east of the Morgan Array Area approximately 5km from the northeast boundary. The anomaly measures 16.4m, with a measurable height of 2.3m, at the widest point it measures 6.4m and is a prominent irregular mound. The form of the anomaly is unusual within the surrounding geology and potentially represents material of anthropogenic origin.
Morgan_0025	Potential wreck	Morgan_0025 (Figure 1.7) lies towards the centre of the Morgan Array Area approximately 11.2km east of the west most corner. The anomaly is characterised by a number of incoherent features covering an area 23.2m x 8.7m, with a measurable height of 1.2m. The form of the anomaly is not consistent with other geological features in the vicinity and may represent anthropogenic debris.
Morgan_0030	Potential debris	Morgan_0030 (Figure 1.7) lies in the west of the Morgan Array Area, approximately 7.1km east of the west most corner. The anomaly is in an area of poor data, and is only visible in the MBES data as a small depression. However, the SSS shows the anomaly as a number of linear striations in a depression measuring 13.9m x 3.2m, with a measurable height of 0.4m. Although potentially geological in origin, the linear form of the anomaly combined with the poor data means a precautionary medium potential rating is appropriate.

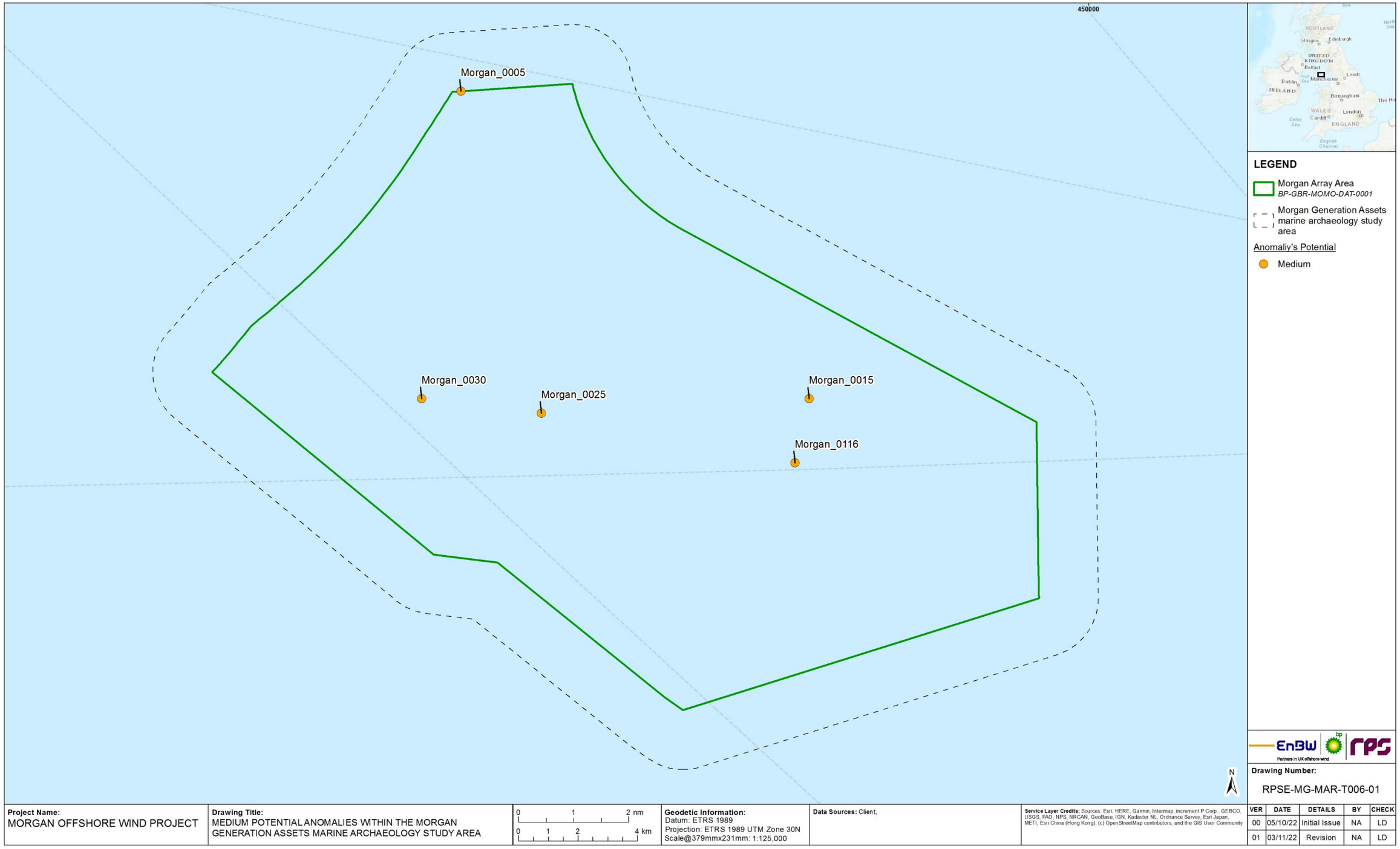
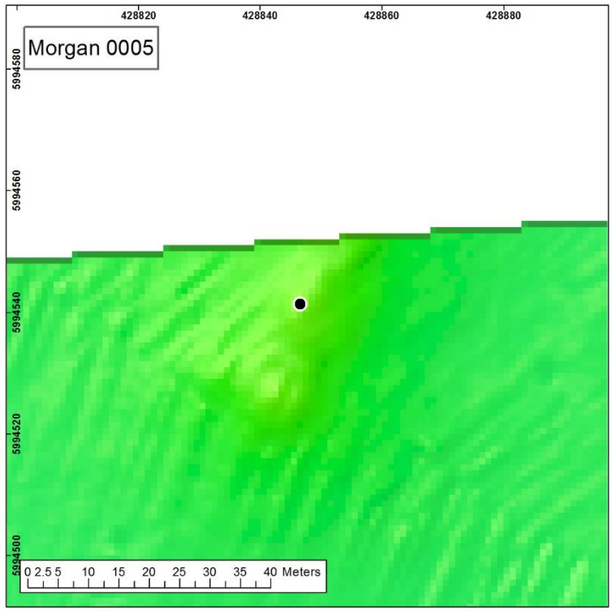
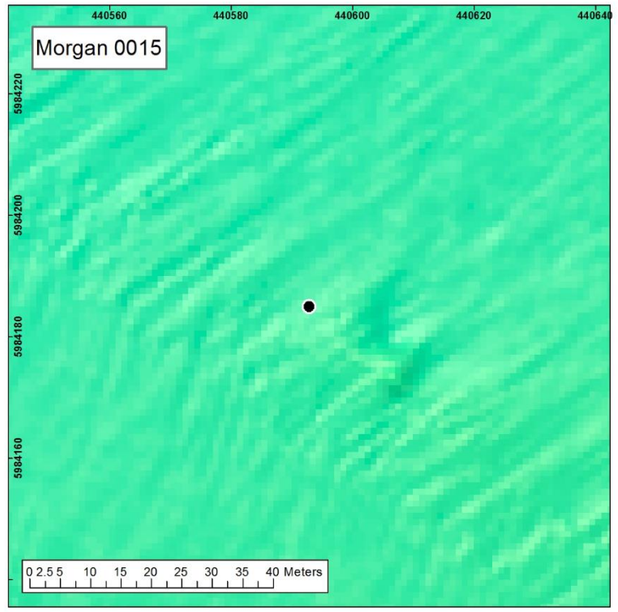
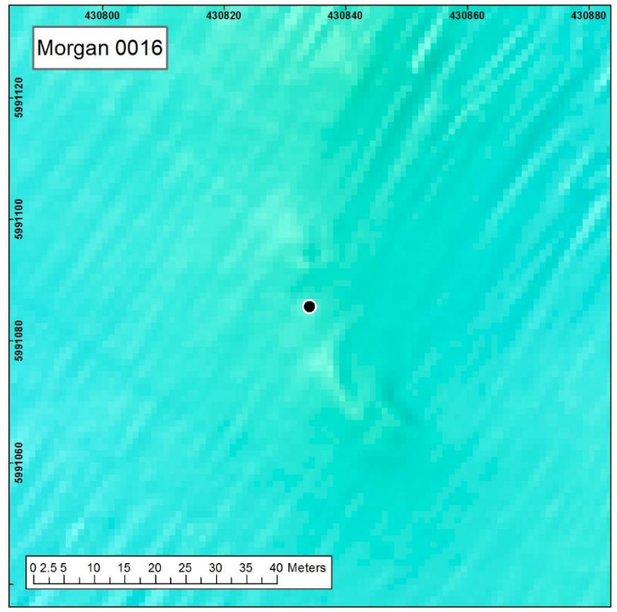
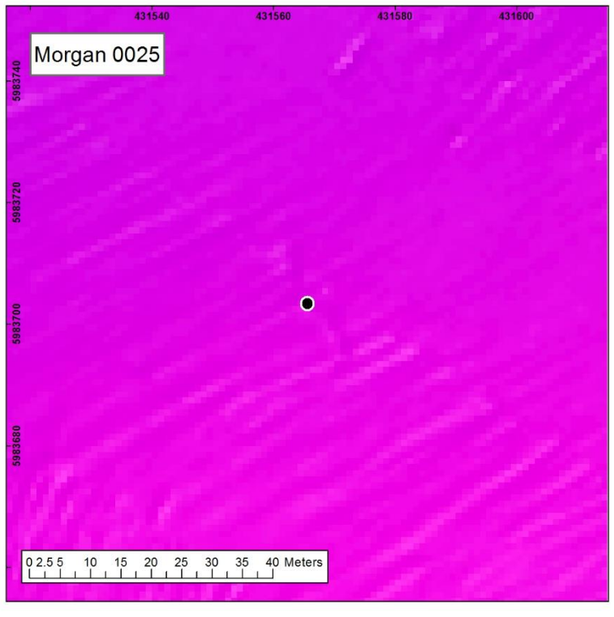


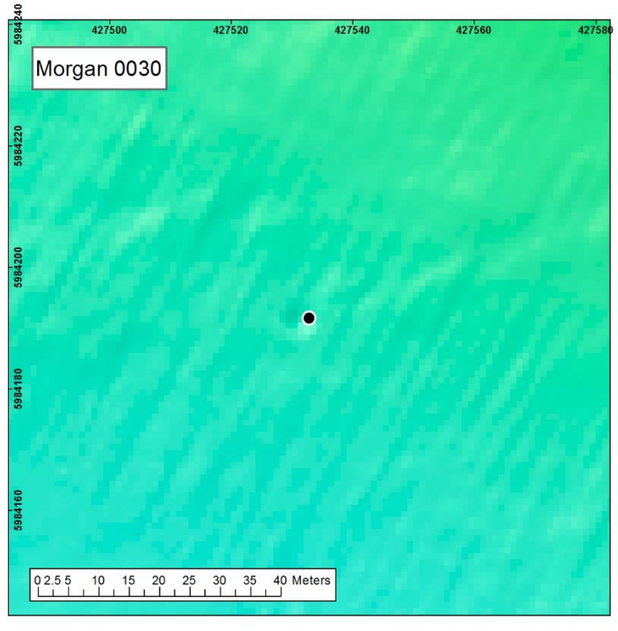
Figure 1.6: Distribution of medium potential anomalies within the Morgan Generation Assets marine archaeology study area.







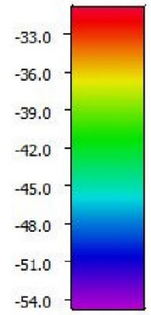




LEGEND

- Archeological Anomaly

Bathymetry - Depth Below LAT



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Drawing Number: RPSE-MG-MAR-T007-03

Project Name: MORGAN OFFSHORE WIND PROJECT	**Drawing Title:** MEDIUM POTENTIAL ANOMALIES WITHIN THE MORGAN GENERATION ASSETS MARINE ARCHAEOLOGY STUDY AREA	**Geodetic Information:** Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@379mmx231mm: 1:1,000	**Data Sources:** Client, Gardline	**Service Layer Credits:** Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

VER	DATE	DETAILS	BY	CHECK
00	05/10/22	Initial Issue	NA	LD
03	14/02/23	Initial Issue	NA	LD

Figure 1.7: Medium potential anomalies within the Morgan Generation Assets marine archaeology study area.

High potential anomalies

1.5.8.5 Five high potential anomalies were identified within the Morgan Generation Assets marine archaeology study area, all five of which have also been recorded within the UKHO as named wrecks. The distribution of these is presented in Figure 1.8.

1.5.8.6 Morgan_008 (Figure 1.9) lies towards the northeast of the Morgan Array Area, approximately 1.4 km south of the northeast edge. The anomaly is visible in both the SSS and MBES data and is recorded by the UKHO and NRHE as the *Limesfield* (UKHO 5463, NRHE 909403). A British steamship sunk by submarine UB57 on 7th February 1918 whilst on passage from Belfast to Preston with a cargo of cotton waste. There were no reported casualties. The wreck was originally recorded as a fastener by the Dutch Hydrographic Office in 1971 and confirmed as a wreck in 1991. Subsequent investigations by divers, including the recovery of the bell in 1995, confirmed the wreck as that of the *Limesfield*.

1.5.8.7 The anomaly is visible in the data as a prominent feature measuring 48.8 m x 9.0 m with a measurable height of 4.8 m. The form of the feature is characteristic of a wrecked vessel. The wreck appears to be lying upright and is largely intact with the bow facing towards the northeast. Slight scour is visible around the wreck to the northeast, with accumulation along the west side. The coherent form of the wreck suggests either steel construction or a wreck of wooden construction of more recent origin.

1.5.8.8 Morgan_0017 (Figure 1.9) lies in the east of the Morgan Array Area, approximately 4.3 km west of the east boundary. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO and NRHE as the *Flying Meteor* (UKHO 8250, NRHE 909493). A British paddle steamer tug built in 1864 and sank on 13th March 1874 whilst towing the barque *Ravenbourne* from Liverpool to Troon. The crew of the Flying Meteor boarded the *Ravensbourne* which returned to Liverpool. The wreck was first recorded in 1991 as a fastener, and then amended to an isolated rock. In the same year divers noted the remains of a wreck. In 2000 divers identified the wreck as a paddle steamer tug, with the recovery of a wheel boss identifying it as the *Flying Meteor.* In 2001 divers reported the wreck to be well covered in shingle with the highest point being the paddle wheel boxes.

1.5.8.9 The anomaly is visible in the MBES data as an incoherent mound in amongst a number of sand waves, within the SSS data the anomaly is still largely incoherent, but more wreck like in form. The anomaly consists of a number of parallel linear features in a broad wreck like shape over an area 28.9m x 9.9m with a measurable height of 1.7m. The wreck appears in poor condition, with very little evidence of scour or accumulation.

1.5.8.10 Morgan_0096 (Figure 1.9) lies approximately midway along the northeast edge of the Morgan OWF Array Area, approximately 290 m south-west of the boundary. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO and NRHE as the *Ben Rein* (UKHO 5462, NRHE 909472). A British carrier built in 1905 and sunk by submarine UB57 on 7 February 1918. The crew were allowed to leave the vessel on a small boat and no casualties were reported. The vessel was on passage to Belfast from Liverpool with a general cargo. The wreck was originally recorded as a fastener by the Dutch Hydrographic Office in 1971 and confirmed as a wreck in 1996. The wreck was dived on multiple occasions in 1997 where soap was observed packed into the hull, and a bell recovered bearing the inscription Starling. A further dive in 1998 reported crates containing waxed paper.

1.5.8.11 The anomaly is visible in the data as a coherent wreck in amongst sandwaves and measuring 34.5m x 7.6m and with a measurable height of 2.8m. The wreck appears largely intact and likely lying upright. Scour, or a disturbance in the sand waves, is visible to the northeast which is likely the stern.

1.5.8.12 Morgan_097 (Figure 1.9 lies towards the south of the Morgan Array Area, approximately 5.6 km north-northwest of the most southerly point. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO, NRHE and NMRW (UKHO 7458, NRHE 909402, NMRW 506875). As the wreck of the *Hibernian*, a British steam ship built in 1875 and lost on 12 August 1894 following a collision with the British paddle steamer Prince of Wales whilst on passage from Garston to Glasgow. Of the ten crew, two were lost. The wreck was first identified in 1991 with divers recovering the ships wheel bearing the name of the builders of the *Hibernian* in 1993. The most recent diver accounts from 1996 report the wreck as very broken up and partially buried with the boilers at the highest point.

1.5.8.13 The anomaly is visible in the MBES data as an incoherent mound with low lying debris to the south-east, within the SSS data the anomaly is still largely incoherent, but more wreck like in form with significant height amidships. The anomaly consists of a number of parallel linear features in a broad wreck like shape over an area 48.9m x 19.7m with a measurable height of 3.7m. The wreck appears in poor condition, with evidence of scour extending to the northeast.

1.5.8.14 Morgan_0009 (Figure 1.9) lies towards the south of the Morgan Array Area, approximately 2.3 km northeast of the southern boundary. The anomaly is visible in the SSS and MBES data and is recorded by the UKHO and NMRW (UKHO 7459, NMRW 506874). Identified as the wreck of the *Lucy*, a small British steam ship built in 1899 and sunk on the 21 July 1910 whilst on passage from Weston Point to Douglas with a cargo of moulding. All four crew were recovered. The wreck was first identified in 1991, the bell was recovered in 2006 confirming the identity as the *Lucy*. The divers reported the wreck as very low lying with the engine and boiling protruding above the seabed by 4m.

1.5.8.15 The anomaly is visible in the MBES data as a prominent and irregular mound, increasing in prominence to the west. Within the SSS data the anomaly is characterised by incoherent features and a large mound to the west, the anomaly covers an area 24.7m x 8.9m with a measurable height of 5.8m. The form of the anomaly is clearly of anthropogenic origin, and the size likely indicates the remains of a wrecked vessel. Scour is visible extending to the northeast.

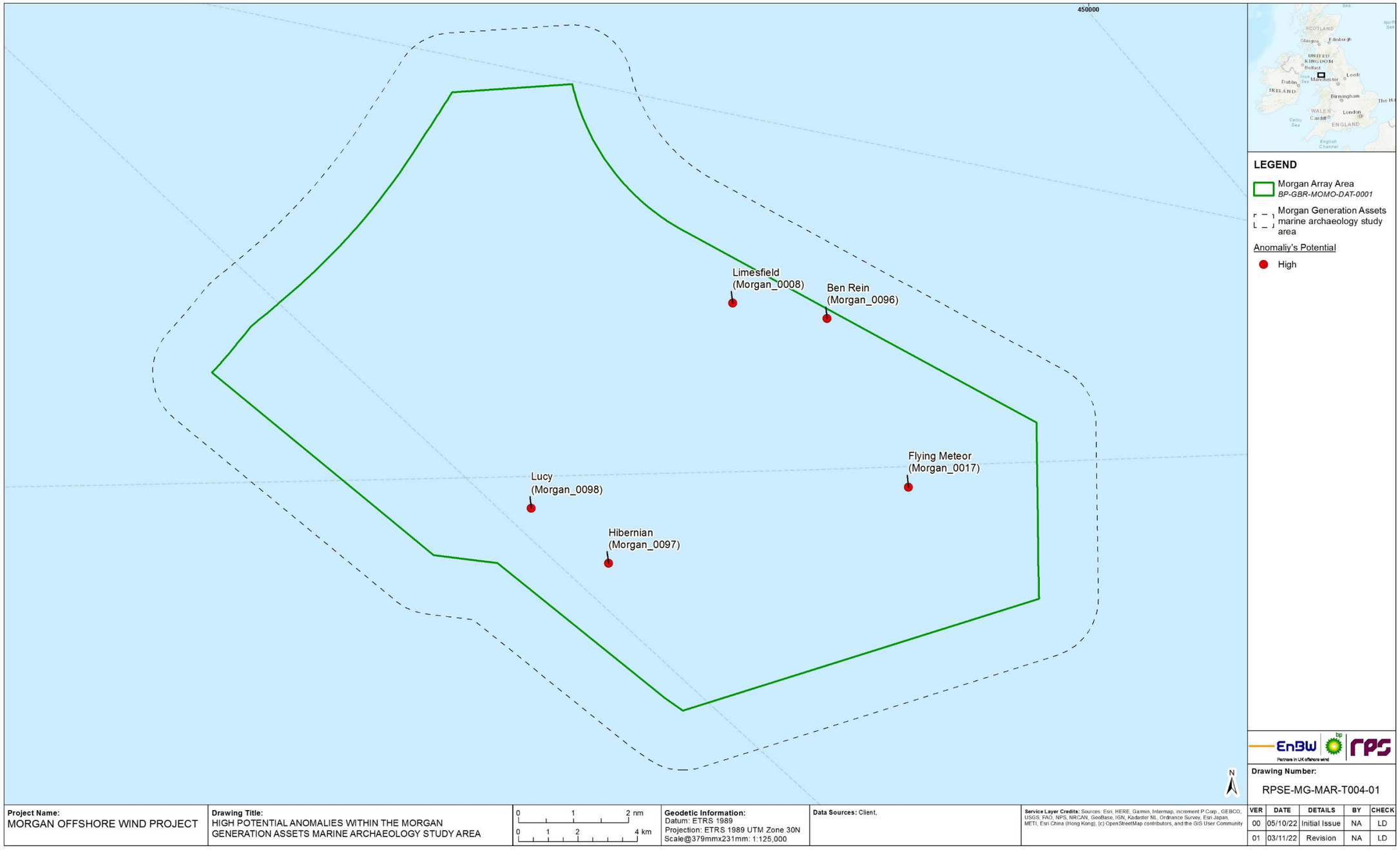
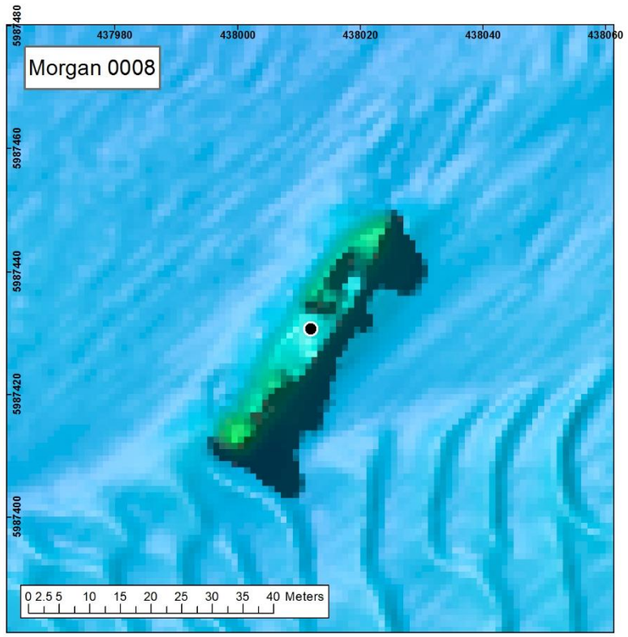
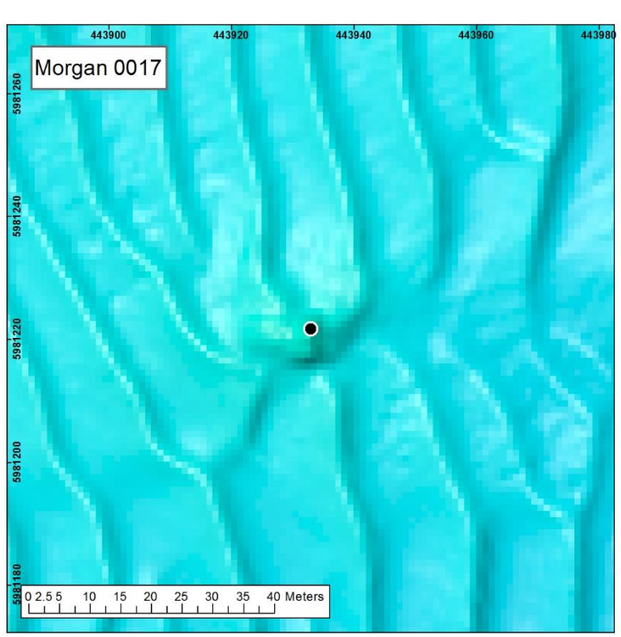
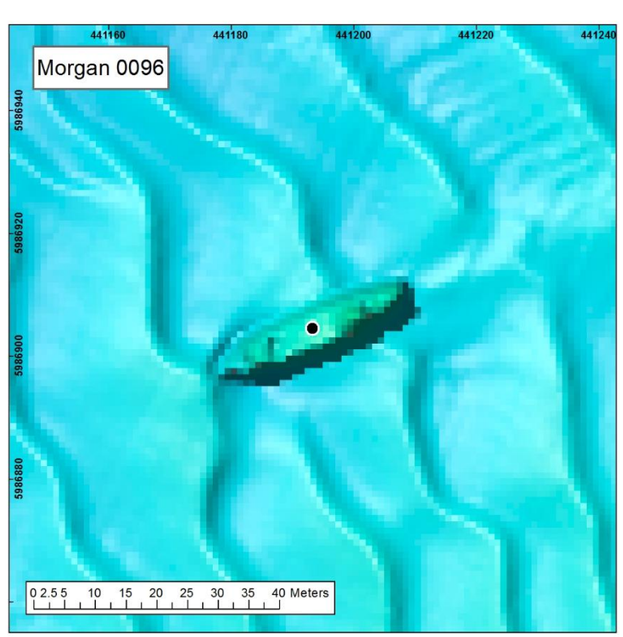
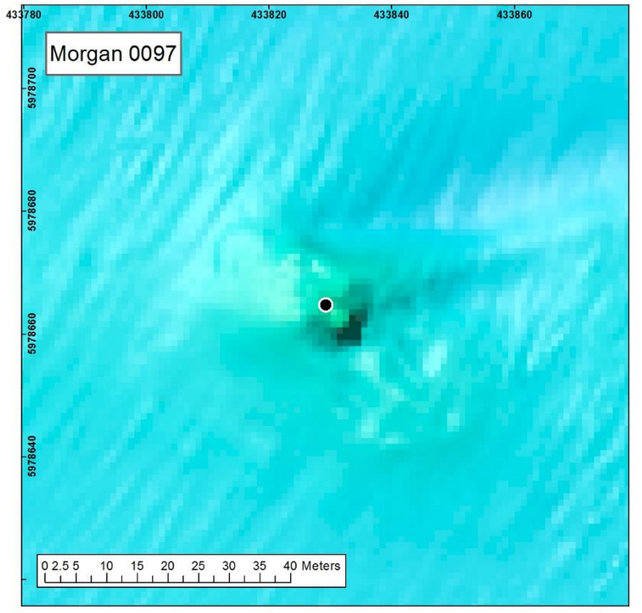


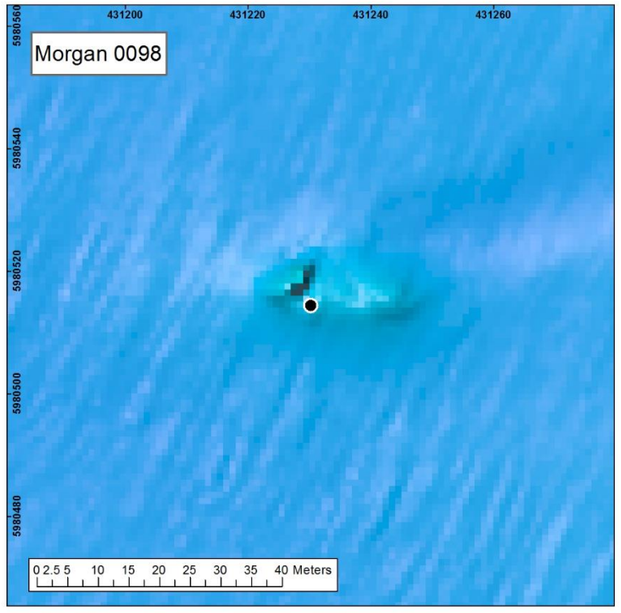
Figure 1.8: Distribution of high potential anomalies within the Morgan Generation Assets marine archaeology study area.

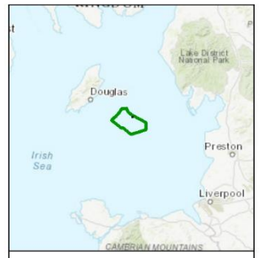








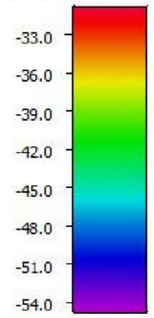




LEGEND

- Archeological Anomaly

Bathymetry - Depth Below LAT



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Drawing Number:
RPSE-MG-MAR-T005-02

Project Name:	Drawing Title:		Geodetic Information:	Data Sources:	Service Layer Credits:
MORGAN OFFSHORE WIND PROJECT	HIGH POTENTIAL ANOMALIES WITHIN THE MORGAN GENERATION ASSETS MARINE ARCHAEOLOGY STUDY AREA		Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@379mmx231mm: 1:1,000	Client, Gardline	Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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00	05/10/22	Initial Issue	NA	LD
02	10/02/23	Initial Issue	NG	LD

Figure 1.9: High potential anomalies within the Morgan Generation Assets marine archaeology study area.

1.6 Summary

1.6.1 Submerged prehistoric archaeology

1.6.1.1 The potential for the survival of submerged prehistoric archaeology within the Morgan Generation Assets marine archaeology study area is predominantly confined to the Upper Palaeolithic and Mesolithic periods. Geophysical survey data has identified deposits that may indicate that areas within the Morgan Generation Assets marine archaeology study area were a terrestrial or intertidal environment during these periods. However, the environment in this area is unlikely to have been favourable for human occupation, making the potential for the survival of archaeological material low. The current geophysical surveys and studies such as the West Coast Palaeolandscape Study support the theory that the northeast of the Morgan Array Area would have been part of a terrestrial or intertidal environment until c.6000 BP and therefore suitable for human activity. The proposed analysis of site investigation geotechnical surveys will help to further characterise the nature of the prehistoric environment in the Morgan Generation Assets marine archaeology study area.

1.6.2 Maritime and aviation archaeology

1.6.2.1 Geophysical surveys have identified five high potential anomalies and five medium potential anomalies within the Morgan Generation Assets marine archaeology study area. All five high potential anomalies can be correlated with records held by either the UKHO, NMRW or NRHE. Three of the identified wrecks, the *Flying Meteor*, *Hibernian* and the *Lucy* date to the 19th century, and two, the *Limesfield* and *Ben Rein* were casualties of the German submarine UB57 during WWI.

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Appendix A: Gazetteer of maritime archaeology identified within the desktop data

Name	UKHO	NRHE	NMRW	X	Y	Description
Anchor	4560	-	-	441703.8	5985507	Find
Malaguena	58669	-	-	433437.4	5995145	A small motorised fishing vessel lost in 2000
Peveril	7460	-	240647	422681.3	5982769	The Peveril was a steamship owned by the Isle of Man Steam Packet Company. On 16 September 1899, it was returning to Douglas from Liverpool when it was in collision with the British steamship Monarch and sank.
Ship's whistle (from Peveril?)	-	-	240772	422235.5	5983095	Find
Unknown aircraft	5418	909495	-	430634.9	5985017	Possible remains of an aircraft.
Unknown	8250	909493	-	443842.7	5981316	Broken remains of a vessel, probably a trawler.

Appendix B: Gazetteer of potential anomalies within the Morgan Array Area

Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L	W	H
Ben Rein (Morgan_0096)	High	441193.3	5986904	5462	909472	-	Wreck	34.53	7.61	2.77
Flying Meteor (Morgan_0017)	High	443932.9	5981222	8250	909493	-	Wreck	28.85	9.87	1.69
Hibernian (Morgan_0097)	High	433829.1	5978665	7458	909402	506875	Wreck	48.9	19.7	3.67
Limesfield (Morgan_0008)	High	438011.8	5987431	5463	909403	-	Wreck	48.75	9.04	4.76
Lucy (Morgan_0098)	High	431230.2	5980514	7459	-	506874	Wreck	24.73	8.92	5.81
Morgan_0001	Low	432568.7	5994192	-	-	-	Potential debris	3.43	1.18	0.44
Morgan_0002	Low	431726.2	5993474	-	-	-	Potential debris	6.32	1.62	0.39
Morgan_0004	Low	431264.4	5993280	-	-	-	Chain, cable or rope	16.85	15.46	0.19
Morgan_0005	Medium	428856.5	5994556	-	-	-	Seabed disturbance	33.72	16.2	0.22
Morgan_0006	Low	433383.7	5991079	-	-	-	Likely geological	59.47	14.55	0
Morgan_0010	Low	436720.8	5986970	-	-	-	Potential debris	8.79	6.04	1.17
Morgan_0012	Low	437057.8	5986980	-	-	-	Potential debris	9.85	6.34	1.21
Morgan_0013	Low	437021.4	5986788	-	-	-	Potential debris	7.63	6.3	0.86
Morgan_0014	Low	437270.6	5986868	-	-	-	Linear feature	14.63	0.4	0
Morgan_0015	Medium	440592.8	5984185	-	-	-	Unidentified debris	12.55	7.34	0.39
Morgan_0016	Low	430815.2	5991084	-	-	-	Linear feature	13	0.39	0.22
Morgan_0018	Low	439679.7	5983879	-	-	-	Debris	3.24	2.75	0.51
Morgan_0019	Low	438957.1	5984251	-	-	-	Likely geological	3.14	0.53	1.16
Morgan_0020	Low	428434.9	5991489	-	-	-	Likely geological	4.42	1.57	0.23
Morgan_0021	Low	437751.6	5983211	-	-	-	Potential debris	3.74	0.75	0.29
Morgan_0022	Low	444923.1	5978390	-	-	-	Chain, cable or rope	23.39	0.88	0
Morgan_0023	Low	436488.2	5982903	-	-	-	Potential debris	7.24	2.22	0
Morgan_0024	Low	440377.8	5977691	-	-	-	Likely geological	35.99	0.56	0.26
Morgan_0025	Medium	431565.5	5983703	-	-	-	Potential debris	23.2	8.71	1.17
Morgan_0026	Low	429097.6	5984725	-	-	-	Debris	4.48	0.87	0.38
Morgan_0027	Low	441016.5	5976030	-	-	-	Potential debris	3.53	1.59	0.45
Morgan_0028	Low	423776.6	5987800	-	-	-	Debris	5.24	1.57	1.84
Morgan_0029	Low	439342.4	5977091	-	-	-	Linear feature	7.41	0.56	0.17
Morgan_0030	Medium	427532.8	5984192	-	-	-	Unidentified debris	13.86	3.22	0.41

MORGAN OFFSHORE WIND PROJECT: GENERATION ASSETS

Name	Potential	X	Y	UKHO	NRHE	NMRW	Description	L	W	H
Morgan_0031	Low	426909.3	5984696	-	-	-	Potential debris	31.27	4.55	0.92
Morgan_0032	Low	430908	5981869	-	-	-	Chain, cable or rope	40.12	0.47	0.2
Morgan_0033	Low	423940.6	5986633	-	-	-	Potential debris	2.64	1.22	0.81
Morgan_0034	Low	433270.5	5979528	-	-	-	Fishing gear	190.82	0.39	0
Morgan_0035	Low	437304.6	5974904	-	-	-	Likely geological	12.63	2.75	0.57
Morgan_0036	Low	428192.5	5981034	-	-	-	Potential debris	4.67	0.74	0.44
Morgan_0037	Low	428660.5	5980302	-	-	-	Potential debris	4.5	0.56	0.51
Morgan_0038	Low	422857.2	5984137	-	-	-	Chain, cable or rope	11.42	0.06	0.16
Morgan_0039	Low	430254.2	5978691	-	-	-	Potential debris	3.7	3	0
Morgan_0040	Low	436645.5	5974091	-	-	-	Chain, cable or rope	107.64	0.23	0.2
Morgan_0041	Low	432153.4	5977221	-	-	-	Debris	3.18	2.48	1.38
Morgan_0042	Low	420313.3	5985573	-	-	-	Unidentified debris	4.64	0.39	0.67
Morgan_0043	Low	436516.5	5973643	-	-	-	Debris	5.03	1.57	0.4
Morgan_0045	Low	426841.8	5980082	-	-	-	Seabed disturbance	11.43	6.77	0
Morgan_0046	Low	430106.7	5977432	-	-	-	Potential debris	5.71	3.16	0.57
Morgan_0047	Low	432566.7	5975583	-	-	-	Linear feature	18.08	3.87	1.24
Morgan_0048	Low	432388.9	5974904	-	-	-	Chain, cable or rope	30.58	0.15	0.16
Morgan_0049	Low	434092.2	5973434	-	-	-	Potential debris	2.01	0	0.51
Morgan_0095	Low	430011.1	5980005	-	-	-	Potential debris	2.13	0.26	0.3
Morgan_0099	Low	421916.5	5987244	-	-	-	Chain, cable or rope	23.27	0.34	0.08
Morgan_0104	Low	430580	5980092	-	-	-	Likely geological	1.19	0.6	0.43
Morgan_0107	Low	426564.9	5982806	-	-	-	Unidentified debris	2.2	0.12	0.2
Morgan_0116	Medium	440109.5	5982030	-	-	-	Unidentified debris	16.4	6.35	2.3