1 INTRODUCTION

1.1 Background

1.1.1 Wessex Archaeology (WA) was commissioned by Forewind Ltd. (Forewind) to undertake an archaeological assessment of geophysical data collected along the proposed Dogger Bank Teesside A and B export cable corridor. This work was undertaken as part of the on-going assessments of the Zone in advance of the proposed wind farm development scheme.

1.1.2 As part of the assessment WA undertook an archaeological assessment of geophysical data acquired by Gardline Geosurvey Limited (Gardline) between May and July 2012. This included single-beam and multibeam echo sounder, sidescan sonar, pinger and boomer sub-bottom profiler and magnetometer data. This report includes an assessment of the survey results together with any historical data.

1.2 Aims and Objectives

1.2.1 The aim of this report was to undertake an archaeological assessment of geophysical survey data acquired from the Dogger Bank Teesside Export Cable Corridor. The objectives were as follows:

- *To assess the geophysical survey data acquired by Gardline and provided by Forewind in order to identify any material of archaeological and cultural heritage significance present within the Dogger Bank Teesside Export Cable Corridor;*
- *To identify any evidence for palaeolandscapes present within the Dogger Bank Teesside Export Cable Corridor;*
- *To compare the geophysical interpretation with any desk based assessments, historical data, and known archaeological sites in the vicinity of the Dogger Bank Teesside Export Cable Corridor;*
- *To implement mitigation measures for any archaeological or cultural heritage assets identified within the Dogger Bank Teesside Export Cable Corridor;*

2 METHODOLOGY

2.1 Data Sources

2.1.1 A number of data sources were consulted during the archaeological assessment of the proposed Dogger Bank Teesside Export Cable Corridor, these included:

- *Geophysical survey datasets acquired in 2012;*
- *United Kingdom Hydrographic Office (UKHO) Wreck and Obstruction Database for records of known shipwrecks and navigational hazards from historic and modern charts;*
- *Maritime records held by the National Record of the Historic Environment (NHRE). Including shipping and aircraft casualties and archaeological monuments and findspots;*
- *Written sources including academic papers;*
- *Modern Admiralty and geological charts relevant to the Study Area;*

- *Aggregate Sustainability Levy Fund (ASLF) projects including England's Shipping and the Importance of Shipwrecks.*

2.1.2 Any sites, either previously recorded in the above data sources, or identified during this geophysical assessment which are located outside the Study Area are deemed beyond the scope of works of the current project and are subsequently not included in this report.

2.1.3 The geophysical data comprised single-beam and multibeam echosounder, sidescan sonar, pinger and boomer sub-bottom profiler, magnetometer and backscatter datasets. Each of these were assessed for their quality and rated using the following criteria:

Table 1: Criteria for assigning data quality rating

Data Quality	Description
Good	Data which are clear and unaffected by weather conditions or sea state. The dataset is suitable for the interpretation of standing and partially buried metal wrecks and their character and associated debris field. These data also provide the highest chance of identifying wooden wrecks and debris.
Average	Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.
Variable	This category contains datasets with the quality of individual lines ranging from good to average to below average. The dataset is suitable for the identification of standing and some partially buried metal wrecks. Detailed interpretation of the wrecks and debris field is likely to be problematic. Wooden wrecks are unlikely to be identified.

2.1.4 The sidescan sonar data have been rated as "Good" using the above criteria. The data quality and positioning was found to be of a high standard and suitable for archaeological assessment.

2.1.5 The magnetometer data have been rated as "Good" using the above criteria.

2.1.6 The multibeam bathymetry data have been rated as "Good" using the above criteria. The data quality and resolution of 1m was found to be of a good standard and suitable for archaeological assessment of objects and debris remains over 1m in size.

2.1.7 The sub-bottom profiler (pinger and boomer) data have been rated as "Good" using the above criteria, with shallow geological features clearly visible along the length of the Export Cable Corridor.

2.1.8 The backscatter data have been rated as "Variable" using the above criteria. The data quality was rather inconsistent and for a section of the cable route option only georeferenced .tiff images were assessed which could not be adjusted or manipulated.

2.2 Geophysical Data – Technical Specifications

2.2.1 The geophysical datasets were acquired by Gardline between May and July 2012 onboard survey vessels M.V. *Tridens 1* and M.V. *Ivero*, with Titan surveys conducting the inshore operations between 8th June and 28th July on board the MV *Titan Endeavour* (Gardline Geosurvey Limited 2013a). The data collected consisted of single-beam and multibeam echo sounder, sidescan sonar, magnetometer and backscatter datasets.

2.2.2 The multibeam echosounder used on board the MV *Ivero* was a Kongsberg Simrad EM3002D and on board the MV *Tridens 1* a Kongsberg Simrad EM710. All of the depths recorded were reduced to LAT using GNSS height data processed using PPP (precise point positioning) techniques and the UKHO VORF model. The multibeam bathymetry data were digitally recorded and provided to WA as *.XYZ* files. The MV *Titan Endeavour* used a GeoSwath Plus bathymetry system which was operated at 250 kHz designed for depths of up to 100m and a single-beam echosounder, Odom Hydrotrac Mark III with a dual frequency transducer with 210 kHz frequency. The data were digitally recorded and provided to WA as *.XYZ* files.

2.2.3 The sidescan sonar equipment used onboard vessels M.V. *Tridens 1* and M.V. *Ivero* was an Edgetech 4200FS 120/410kHz which output to Coda and a thermal recorder. The range set for this survey was 125m with the fish being flown at approximately 10m above the seabed. The data were digitally recorded and provided to WA as *.xtf* files.

2.2.4 The magnetometer used onboard vessels M.V. *Tridens 1* and M.V. *Ivero* was a Geometrics G-882. The magnetometer is towed behind the sonar fish at a fixed distance of 10m. The data were digitally recorded and provided to WA as *.CSV* files.

2.2.5 Due to the high amount of fishing activity occurring in the inshore area no sidescan sonar or magnetometer equipment could be towed behind the survey vessel between KP0.0 – KP24.0 across the southern corridor. To offset this, backscatter data were extracted from the multibeam data on board the MV *Titan Endeavour* by Titan Environmental Surveys Limited and also on board the M.V. *Ivero* to establish the nature of seabed features across this extent of the cable route. The data were digitally recorded and provided to WA as both *.xtf* files and georeferenced *.tiff* images.

2.2.6 The sub-bottom profiler data were acquired using a hull mounted pinger on board the M.V. *Tridens 1* and M.V. *Ivero*, and by a surface towed boomer and trailing hydrophone receiver on board the M.V. *Titan Endeavour*. The data were digitally recorded and supplied to WA as raw and processed *.seg* (pinger) and *.sgy* (boomer) files.

2.2.7 Primary positioning used onboard vessels M.V. *Tridens 1* and M.V. *Ivero* for the survey was the Fugro Starfix DGNSS system utilising Aberdeen, Rogaland, Shannon and Leidschendam as the reference stations. Secondary navigation utilised the EGNOS (European Geostationary Navigation Overlay Service) satellite based augmentation system (SBAS) (Gardline Geosurvey Limited, 2013a). All positions were recorded and expressed as WGS84 UTM Zone 31N.

2.2.8 The MV *Titan Endeavour's* primary positioning was provided by a Trimble SPS852 GPS receiver operating in Real Time Kinematic (RTK) mode via mobile phone. When RTK was not available the Trimble SPS852 was configured to receive differential corrections from the satellite transmitted EGNOS (European Geostationary Overlay Service). Secondary positioning was provided by a Hemisphere Crescent VS110 DGPS receiver with differential corrections from the IALA beacon at Flamborough Head. All positions were recorded and expressed as WGS84 UTM Zone 31N.

2.3 Geophysical Data – Processing

2.3.1 The sidescan data were processed by WA using Coda Geosurvey software. This allowed the data to be replayed with various gain settings in order to optimise the quality of the images. The data were initially scanned to give an understanding of the geological nature of the site and were then interpreted for any objects of possible anthropogenic origin. This involves creating a database of anomalies within Coda by tagging individual features of possible archaeological potential, recording their positions and dimensions, and acquiring an image of each anomaly for future reference.

2.3.2 A mosaic of the sidescan sonar data is produced during this process to assess the quality of the sonar towfish positioning. The survey lines are smoothed, and the navigation corrected with *.cnv* files provided by the survey company. This process allows the position of anomalies to be checked between different survey lines and for the layback values to be further refined if necessary.

2.3.3 The form, size and/or extent of an anomaly is a guide to its potential to be an anthropogenic feature and therefore of archaeological interest. A single small but prominent anomaly may be part of a much more extensive feature that is largely buried. Similarly, a scatter of minor anomalies may define the edges of a buried but intact feature, or it may be all that remains as a result of past impacts from, for example, dredging or fishing.

2.3.4 The backscatter data were provided to WA as both *.xtf* files and georeferenced *.tiffs*. The *.xtf* files were replayed in Coda software and were scanned and assessed for both the understanding of the geological nature of the seabed and for identifying any possible objects and wreck of archaeological significance. One section of the nearshore cable route was assessed using only the georeferenced *.tiff* images; these were put into GIS and the contrast was adjusted to some degree. Again the geological nature of the seabed in this area was interpreted and any anomalies of archaeological significance recorded.

2.3.5 The magnetometer data were processed by WA using Geometrics MagPick software in order to identify any discreet magnetic contacts which could represent buried metallic debris or structures such as wrecks. No anomalies less than 5nT were recorded.

2.3.6 The software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map. The data were first smoothed to try and eliminate any observed spiking. A trend was then fitted to the resulting data, and the trend values subtracted from the smoothed values. This was carried out in an attempt to remove natural variations in the data (such as diurnal variation in magnetic field strength and changes in geology). The processed data were then gridded to produce a map of magnetic anomalies, and individual anomalies tagged and images taken in a similar process to that undertaken for the sidescan sonar data.

2.3.7 The sub-bottom profiler data were studied in order to detect any in-filled palaeochannels, ravinement surfaces and peat/fine-grained sediment horizons that may have archaeological potential. An initial interpretation comprising the cable route centre line plus two wing lines was initially undertaken, with additional lines interpreted around any identified features of possible archaeological potential.

2.3.8 The sub-bottom profiler data were processed by WA using Coda Seismic+ software. This software allows the data to be visualised with user selected filters and gain settings in order to optimise the appearance of the data for interpretation. The software then allows an interpretation to be applied to the data by identifying and selecting a sedimentary boundary that might be of archaeological interest.

2.3.9 The sub-bottom profiler data were interpreted with a two-way travel time (TWTT) along the z-axis. In order to convert from TWTT to depth, the velocity of the seismic waves was estimated to be 1,680ms^{-1}. This is a standard estimate for shallow, unconsolidated sediments, and was used to provide consistency with the work previously undertaken in Tranche A (Wessex Archaeology 2013).

2.3.10 The multibeam bathymetry data were analysed to identify any unusual seabed structures that could be shipwrecks or other anthropogenic debris. The data were gridded and analysed using Fledermaus software, which enables 3-D visualisation of the acquired data and geo-picking of seabed anomalies.

2.4 Geophysical Data – Anomaly Grouping and Discrimination

2.4.1 The previous section describes the initial interpretation of all available geophysical datasets which were conducted independently of each other. This inevitably leads to the possibility of any one object being the cause of numerous anomalies in different datasets and apparently overstating the number of archaeological features in the study area.

2.4.2 To address this fact the anomalies were grouped together along with the results of the desk-based study of known archaeological sites. This allows one ID number to be assigned to a single object for which there may be, for example, a UKHO record, a magnetic anomaly and multiple sidescan sonar anomalies.

2.4.3 Once all the geophysical anomalies and desk-based information have been grouped, as discrimination flag is added to the record in order to discriminate against those which are not thought to be of an archaeological concern. For anomalies located on the seabed, these flags are ascribed as follows:

Table 2: Criteria discriminating relevance of seabed features to proposed scheme

Non-Archaeological	**U1**	Not of anthropogenic origin
	U2	Known non-archaeological feature
	U3	Non-archaeological hazard
Archaeological	**A1**	Anthropogenic origin of archaeological interest
	A2	Uncertain origin of possible archaeological interest
	A3	Historic record of possible archaeological interest with no corresponding geophysical anomaly

2.4.4 Similarly, the discrimination flags applied to shallow geological features of possible archaeological potential are ascribed as follows:

Table 3: Criteria discriminating relevance of shallow geological features to proposed scheme

Non-Archaeological	**U2**	Feature of non-archaeological interest
Archaeological	**P1**	Feature of probable archaeological interest, either because of its palaeogeography or likelihood for producing palaeoenvironmental material
	P2	Feature of possible archaeological interest

2.4.5 All of the sites that have been identified along the proposed cable route are presented in ***Appendix 1*** and discussed in this report. Recommendations have been made for mitigation measures should the sites be impacted by the proposed development scheme.

2.4.6 The grouping and discrimination of information at this stage is based on all available information and is not definitive. It allows for all features of potential archaeological interest to be highlighted, while retaining all the information produced during the course of the geophysical interpretation and desk-based assessment for further evaluation should more information become available.

3 RESULTS

3.1 Seabed Features Assessment

3.1.1 A full geophysical assessment of the Dogger Bank Teesside A and B Export Cable Corridor was undertaken by WA (***Figure 16***) and the results described below.

3.1.2 During the archaeological assessment of geophysical data 178 anomalies were interpreted as being of potential archaeological interest. One previously recorded wreck was identified within the development. Additionally, 39 historic records of possible archaeological interest with no corresponding geophysical anomaly identified during the assessment were also recorded in the export cable corridor. These anomalies can be characterised as follows:

Table 4: Sites of archaeological potential within the Dogger BankTeesside Export Cable Corridor

Archaeological Discrimination	Number of Anomalies	Interpretation
A1	1	Anthropogenic origin of archaeological interest
A2	177	Uncertain origin of possible archaeological interest
A3	39	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	217	

3.1.3 Furthermore, these anomalies can be classified by probable type, which can further aid in assigning archaeological potential and importance.

Table 5: Types of anomaly identified within the Dogger Bank Teesside Export Cable Corridor

Anomaly Classification	Number of Anomalies
Recorded Wreck / Obstruction	39
Wreck	1
Debris	45
Debris Field	10
Mound	7
Rope/chain	4
Seafloor Disturbance	2
Dark Reflector	60
Magnetic	49
Total	217

3.1.4 These anomalies are discussed below, and a full gazetteer supplied in ***Appendix 1***. The distribution of the anomalies is illustrated in ***Figure 16***.

3.1.5 There are 40 recorded wrecks and obstructions in total documented within the Dogger Bank Teesside Export Cable Corridor of which only 1 was positively identified and verified in the geophysical survey datasets as a wreck (**70657**).

3.1.6 One previously recorded wreck (**70657**) has been identified within the Dogger Bank Teesside Export Cable Corridor, this wreck was identified within the nearshore backscatter geophysical survey data and as such there is no associated magnetometer data available.

3.1.7 Wreck **70657** (UKHO 6058) is recorded to be the HMS *Ruthin Castle*. This was a British steam trawler ship built in 1916 and was sunk in 1917 by a mine laid by German Submarine UC-50 off the coast of Yorkshire. The vessel lies in quite shallow water in the nearshore area of the cable route and is recorded by diver's survey as being very broken up and abraded lying on the seabed. The surrounding seabed is covered in a substantial rocky reef with large boulders scattered across the area. In the backscatter geophysical dataset the wreck appears as a discreet large anomaly covered by sands and gravels. The skeleton of the vessel is subtly visible with some structure of the hull or stern area present and somewhat intact. The wreck is a dark diffuse reflector with a thin and bright shadow visible; it looks to be in a poor state of preservation as described in the UKHO database. This wreck is somewhat visible in the multibeam bathymetry data; however it is not distinguishable as a wreck. As the magnetometer fish could not be towed in this area of the cable route there is no evidence for a magnetic anomaly, however being as the HMS *Ruthin Castle* is recorded as being a steel construction it is expected that it would have caused a large magnetic anomaly to be present. The wreck has recorded dimensions of 18.5m x 6.2m x 0.9m. This wreck has been classified as A1 for its archaeological potential and is recorded as Live in the UKHO database (see **Wreck Sheet 1**).

3.1.8 45 anomalies have been identified as possible pieces of anthropogenic debris within the export cable corridor, and all of these have been assigned an A2 archaeological discrimination rating (see ***Appendix 1***). Significant pieces of debris are discussed below.

3.1.9 The largest object recorded is made up of two pieces of debris that look to have originally been one (**70730**). The geophysical dimensions recorded are 15.7m x 1.8m and a height of 0.9m. The main object piece is composed of a thin linear strip with interconnected central circular anomalies. The second debris piece is located directly next to this which looks to have been broken off. Both of these pieces of debris have large and bright shadows associated with them and they are isolated on the seabed. The remains are located on a very sandy area of the seabed and an associated large scour mark is visible to the east and west of the debris. There is no magnetic anomaly associated with this debris and as such it can be classified as non-ferrous material.

3.1.10 Debris piece **70671** is the second largest object recorded across the cable route and looks particularly anthropogenic. The debris has dimensions of 15.1m x 10.9m x 1m height. The debris also has a small magnetic anomaly associated with it measuring 13nT which suggests that it is, or at least contains, ferrous material. The debris appears to be broken up or partially buried on the sandy and even seabed. It appears in the sidescan data as a dark reflector with faint shadows, composed of two thin linear pieces, two irregular shaped anomalies and two smaller rounded anomalies. There is a large scour mark visible associated with this debris orientated north.

3.1.11 Debris **70791** is the smallest piece of debris identified in the cable route. The debris has dimensions of 1.2m x 0.8m with no measurable height dimensions due to the fact that this possible object was identified in the backscatter data georeferenced .tiff images. The debris is an irregular shaped diffuse dark reflector which is located on a fairly even area of the seabed. The interpretation of many of the targets identified in the backscatter data is tentative due to the fact that the data resolution is much poorer and as such identification and interpretation is very difficult, particularly without any associated magnetometer data.

3.1.12 Interestingly three pieces of debris lie within 40m of each other and may possibly be related or part of the same original object (**70695**, **70696** and **70697**). The debris all have similar characteristics and dimensions, being semi-circular shaped and solid, hard edged dark reflectors with bright shadows. The largest of the three possible objects has dimensions of 5.4m x 2.2m x 0.7m height. They are located on a sandy and even area of the seabed. No scouring is visible on the seabed and there are no magnetic anomalies associated with these possible objects, which indicates that they are made up of non-ferrous material.

3.1.13 There are 10 possible debris fields identified within the export cable corridor. Only one of these has an associated magnetic anomaly (**70673**), the remaining six areas are expected to be made up of non-ferrous material. Significant debris fields are discussed below.

3.1.14 The largest debris field (**70699**) is dispersed across the seabed covering an area of 37.6m x 6.9m and maximum height of 0.5m. The debris field is made up of three pieces of debris all of which are linear shaped, hard edged dark reflectors with small shadows. The largest piece of individual debris has dimensions of 4.9m x 0.8m and height of 0.3m. The surrounding seabed is very flat and even, and the debris field has not been identified in the multibeam bathymetry data.

3.1.15 The smallest debris field (**70732**) has dimensions of 7.2m x 5.4m x 1.5m height. The debris field has five possible objects within it; these are very distinct hard edged rounded dark reflectors with very bright shadows. The debris fields are grouped next to one another and have created a distinctive scour mark across the sandy seabed sediments.

3.1.16 **70653** is a large debris field that appears in the sidescan image as an oval profile and the outline of the debris field is hard edged and smooth with curvilinear sides. The debris field has dimensions of 12.2m x 11.4m and no measureable height. The centre of the debris field appears quite diffuse and looks to be made up of smaller pieces of debris or anomalies. This target is located on a sandy and even part of the seabed. The debris field has no associated magnetic anomaly suggesting it is non-ferrous material, and it was also not visible in the bathymetry data.

3.1.17 Debris field **70673** has a magnetic anomaly value of 52nT which indicates it is in part made up of ferrous material; this debris field was also identified in the sidescan and bathymetry data. The anomaly has dimensions of 29.3m x 19.8m x 2.1m height. The mound appears to be made up of uneven rubble material; it is visible as a rounded diffuse dark reflector with a very large and bright shadow. This mound-like feature is clearly visible in the bathymetry dataset. This debris is particularly significant because of its associated magnetic anomaly.

3.1.18 There are seven mounds identified across the Dogger Bank Teesside Export Cable Route Corridor (see ***Appendix 1***). All of these were identified in the multibeam bathymetry data and some of which are discussed in detail below.

3.1.19 The largest mound (**70759**) has dimensions of 98.0m x 56.0m x 1.4m height and this also has a magnetic anomaly value of 18nT associated. The mound is a large and irregular shape with an adjacent scour mark orientated northwest visible on the seabed.

3.1.20 The smallest mound (**70782**) has dimensions of 5.1m x 4.0m x 0.2m height. The mound is located in the nearshore area of the cable route and is quite isolated on a flat and even part of the seabed. This anomaly was not identified in the backscatter data.

3.1.21 Four rope and chain remains have been identified and flagged as an A2 archaeological potential rating (**70655**, **70719**, **70728** and **70825**). The longest of these is **70655**, which has dimensions of 63.5m x 0.9m with no measurable height. The remains appear as a diffuse dark reflector in the backscatter data which lies in an irregular and crimped pattern on a rough and uneven area of the seabed.

3.1.22 The second longest rope/chain anomaly (**70719**) is very discreet on a sandy and even area of the seabed. The curvilinear rope/chain has dimensions of 36.8m x 0.3m and a height of 0.1m, the object has quite a diffuse appearance. There is no magnetic anomaly associated with this target and as such it is unlikely to be composed of ferrous material.

3.1.23 There are two recorded seafloor disturbances (**70693** and **70801**). **70693** has geophysical dimensions of 5.6m x 3.8m with no measurable height. The disturbance is diamond shaped with a hollow centre and appears quite diffuse in the sidescan sonar data. There is a very faint scour mark across the sandy seabed associated with this feature.

3.1.24 The second recorded seafloor disturbance is **70801** was identified in the backscatter georeferenced *.tiff* files. The anomaly has dimensions of 26.6m x 4.4m, with no measurable height. This disturbance appears as a dark scour across the seabed. Unfortunately due to the data quality and resolution not much more can be inferred from this target.

3.1.25 There are 60 dark reflectors identified across the Dogger Bank Teesside Export Cable Route, these have all been classified as an A2 archaeological potential rating because of their unnatural characteristics until it can be proven that they are not of anthropogenic origin (see ***Appendix 1***). The most potentially significant of these dark reflectors are discussed below.

3.1.26 The smallest dark reflector anomaly (**70794**) has dimensions of 0.7m x 0.5m with no height measurement available due to the target being identified in the backscatter georeferenced *.tiffs*. The anomaly is very small and rounded in shape and located in a slight depression, there is also a potential associated faint scour mark on the seabed though this is somewhat faint and unclear.

3.1.27 Another small dark reflector (**70703**) has dimensions of 1.2m x 0.8m x 0.3m height. The possible object has an ‘S’ shaped appearance on the sidescan sonar image, made up of a hard edged anomaly with a small subtle shadow visible. There is a large scour mark present orientated north and south of the debris in the fine sandy sediments. No magnetic anomaly is associated with this possible debris indicating that it is composed of non-ferrous material.

3.1.28 The largest dark reflector (**70820**) has dimensions of 10.8m x 7.5m x 1m. The dark reflector is composed of a diffuse oval outline with a bright triangular shaped shadow in the centre of the anomaly. The possible object is isolated on a sandy area of the seabed.

3.1.29 There are 49 magnetic anomalies classified as an A2 archaeological discrimination (see ***Appendix 1***). A large number of the magnetic anomalies identified did not have a corresponding sidescan sonar or bathymetry target and were identified in areas categorised as sand, thin sands and gravels which indicates that even where there is little sediment cover there is the potential for buried material to be present. A very small number of magnetic anomalies were identified on patches of till which could be resultant of geological changes.

3.1.30 The largest magnetic anomaly besides debris field **70673** is **70778**, which has a recorded value of 35nT and is visible as a medium sized irregular shaped dipole anomaly in its magnetic profile. The anomaly is present over two survey lines but is not associated with any seabed features and as such may represent buried ferrous debris.

3.1.31 There are five magnetic anomalies with a magnetic value of 5nT which is the smallest anomaly value that was taken forward past assessment stage. These and the remaining magnetic anomalies could potentially be buried ferrous debris and as such are classified as A2 anomalies until proven otherwise.

3.2 Palaeogeographic Assessment

3.2.1 The proposed Dogger Bank Teesside Export Cable route extends from the western boundary of the Dogger Bank Round 3 Zone to landfall at Redcar; a distance of approximately 156km. Despite this, relatively few palaeogeographic features of possible archaeological potential have been identified along the proposed route. The locations of the identified features are illustrated in ***Figure 13***, and the individual features described in ***Appendix 1*** and outlined below.

3.2.2 The Quaternary sedimentary sequence along the proposed Cable Route is generally relatively thin. Close to the landfall, a thin layer of Holocene marine sediments directly overlie the Jurassic bedrock (Cameron *et al*. 1992). Further offshore, a blanket deposit of Weichselian till (Bolders Bank Formation) is present between the bedrock and overlying superficial sand. Older, pre-Weichselian sediments become visible within the sequence as the route approaches Dogger Bank (Cameron *et al*. 1992).

3.2.3 These sediments are not considered of interest from an archaeological perspective, though a few features have been identified cutting into the bedrock and till that are of possible archaeological potential.

3.2.4 The features of highest archaeological potential (**75451** and **75452**) have been identified close to the landfall at Redcar, and are small, NNE-SSW trending channel features cut directly into the bedrock (***Figure 14***). These are distinct features with a single phase of fill, and are possibly the original offshore courses of waterways during periods of relatively lower sea level. It is most likely that they originally related to Skelton Beck, which flows into the North Sea a little further along the coast at Saltburn-by-the-Sea.

3.2.5 These channels have the potential to contain both *in-situ* and derived archaeological and palaeoenvironmental material and as such are deemed to be of relatively high archaeological potential.

3.2.6 A number of cut and fill features (**75450**, **75453**, **75454**, **75455**, **75456**, **75457**, **75458** and **75459**) have been identified along the proposed route which are generally too small or indistinct to be classified as channels. Feature **75455** is an exception and is a large feature which crosses the entire proposed route, and is characterised by a well-defined base and a single phase of acoustically transparent fill.

3.2.7 The fill is interpreted as being recent Holocene sand, and so is not considered of archaeological potential. However, the feature itself is interpreted as being a possible glacial scour, which would have created a significant landscape feature during periods of lower sea level. Because of this, the base of the feature may contain both *in-situ* and derived archaeological material, although this is uncertain.

3.2.8 Features **75457**, **75458** and **75459**, located towards the edge of the Dogger Bank Zone, have been identified on a number of survey lines but are very poorly defined. They are characterised by an acoustically chaotic fill, though they seem to differ little from the background geology. These are potentially fluvial features belonging to Phase Ia identified from within Tranche B, though due to their poorly defined nature this is uncertain.

3.2.9 Also present along the proposed route are a number of isolated cut and fill features than were only identified on one survey line (see ***Appendix 1*** for full list and ***Figure 14*** for locations). These are generally shallow and laterally limited, and could either be the remnants of channel systems that have subsequently been removed by erosion, or individual hollows in the bedrock/till that have subsequently been infilled.

4 DISCUSSION AND RECOMMENDATIONS

4.1.1 A total of 217 seabed features of possible archaeological potential, including 39 previously recorded wrecks and obstructions not observed within the geophysical data, have been identified along the proposed export cable route.

4.1.2 Of these, only one wreck (**70657**) has been definitively identified, and as such is considered to be of the highest archaeological potential. It is recommended that a 100m exclusion zone be implemented around this wreck for the duration of any work associated with the proposed development scheme.

4.1.3 No further work is recommended for the remaining seabed anomalies at this time, though further investigation may be required on a site by site basis should the proposed scheme directly impact upon these features.

4.1.4 A relatively small number of palaeogeographic features of possible archaeological potential have been identified along the proposed export cable route. Of these, only **75451** and **75452** are interpreted as being of particularly high archaeological potential. No further work is recommend at this time in relation to these features, though it is recommended that any samples obtained from these or any of the other identified features be made available for geoarchaeological assessment so the interpretation and associated archaeological potential can be refined.

5 REFERENCES

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