East Anglia ONE
Offshore Windfarm

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Archaeological Assessment of Geophysical Data

River Deben and Martlesham Creek Crossings
Ref: EA1-CON-F-IB-001453

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1.1 Introduction

1.1.1 Background

1. Wessex Archaeology (WA) were contracted by East Anglia ONE Limited (EAOL) to undertake an archaeological assessment of geophysical data acquired from two river crossing points (River Deben and Martlesham Creek) of the proposed East Anglia ONE onshore cable route. This was undertaken as part of continued assessments ahead of the proposed East Anglia ONE offshore windfarm development, and relates directly to the previous Desk-Based Assessment (DBA) and Heritage Statement (HS) produced for the onshore cable route and river crossings (WA 2014, WA 2015).

2. Specifically, this assessment was undertaken in advance of a proposed geotechnical sampling campaign, which is to involve the acquisition of boreholes and cone penetration tests (CPTs) from both river crossing sites. This archaeological assessment is intended to inform the positioning of these geotechnical sample locations to avoid impacting any river bed features of archaeological potential and to assess that the geotechnical data will sample appropriate sediments to assist in the geoarchaeological and palaeogeographic interpretation of the study areas.

3. The proposed East Anglia ONE onshore cable route extends approximately 37km from the offshore cable route landfall at Bawdsey Beach**,** Suffolk, to a proposed substation west of Bramford, Suffolk. Along this route it crosses two waterways; the Deben River and one of its tributaries, Martlesham Creek.

4. The Deben River crossing is situated across the lower reaches of the river east of Falkenham, between Falkenham Marshes and Ramsholt Marshes. The Martlesham Creek crossing is situated towards the western end of the creek, approximately 400m downriver of Martlesham Creek Boatyard.

5. The geophysical data assessed included sidescan sonar (SSS), marine magnetometer, multibeam echosounder (MBES) and sub-bottom profiler (SBP) data acquired by Aspect Land and Hydrographic Surveys Ltd. (ALHS) during August 2015.

6. For the purposes of this assessment, the study area boundaries for both crossing points are defined as being to the edges of the cable route red line boundary along the river, and to the high water mark across the river (**Figure 1**).

7. The geophysical data at both sites does not fully cover these defined study area boundaries (**Figure 1**). As such, there may be features present within the areas not covered by the geophysical data that, as a result, are not mentioned in this report. However, the areas not covered by geophysical data at both sites are within the intertidal zone, and as such any significant features are likely to be visible during low tide.

1.1.2 Aims and Objectives

8. The aim of the assessment was to undertake an archaeological assessment of the provided geophysical data at both river crossing points. This was to be achieved through the following objectives:

- To assess the geophysical data acquired by ALHS in order to identify whether any material of archaeological potential is located on the river bed at both river crossing points;
- To identify any evidence for palaeolandscape features of archaeological interest at both river crossing points;
- To compare the results with the previous DBA and HS, known archaeological sites and previous work undertaken in the region;
- To propose future mitigation for any identified material of archaeological interest, and inform the positioning of the proposed geotechnical samples.

1.2 Methodology

1.2.1 Data Sources

9. A number of data sources and additional information were utilised during this assessment. These included:

- Geophysical survey data acquired by ALHS in August 2015;

- Previous DBA and HS relating to the onshore cable route and river crossing points (WA 2014, WA 20145);
- Background information (e.g. boundary shapefiles, proposed geotechnical sampling locations) provided by EAOL;
- Background British Geological Survey (BGS) information and other previous work undertaken in the wider area (e.g. Sumbler 1996, EMU 2009, BGS 2015);
- Historic Environment Records (HER) relating to the study areas and immediate surroundings.

1.2.2 Geophysical Data – Technical Specifications

10. The geophysical survey data for both study areas were acquired by ALHS during August 2015, on board the survey vessel *Remote Sensor*. The data comprised SSS, MBES, marine magnetometer and SBP (pinger and boomer) data sets.

11. The SSS data were acquired by ALHS using an Edgetech 4125-P towfish operated at 400kHz and 30m range per channel. The data were digitally recorded using Edgetech Discover software and provided to WA as *.xtf* files.

12. The magnetometer data were acquired by ALHS using a Geometrics G-882 caesium vapour magnetometer. The data were digitally recorded using Geometrics MagLog software and provided to WA as both *.EDT* and *.XYZ* files.

13. The SBP data were acquired by ALHS using both a Knudsen Pinger chirp system and an Applied Acoustics AA200 surface towed boomer. The data from both systems were digitally recorded and provided to WA as *.sgy* files.

14. The MBES data were acquired by ALHS using an R2Sonic 2024 multibeam echo sounder system, with motion corrections supplied by a Kongsberg Seatex MRU 5 unit. The data were digitally recorded and provided to WA as 0.5m gridded *.XYZ* files.

15. All positions were recorded and expressed in British National Grid coordinates.

1.2.3 Geophysical Data – Data Quality

16. The geophysical data used for this report were assessed for quality and their suitability for archaeological purposes, and rated using the following criteria:

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.

Table 1: Criteria for assigning Data Quality Rating

17. Due to environmental variations between the two study areas (mainly water depth), the data quality differed between the two areas. At the River Deben study area, all data sets were rated as 'Good' using the above criteria, with very little noise visible within the data sets and small features generally clearly visible.

18. Some problems were experienced with the SSS and SBP data sets due to the shallow water depths within the study area, especially around the channel edges, although this did not detrimentally affect the data to a significant degree.

19. At the Martlesham Creek study area, there was much more of a variation between the data sets. The MBES data were again rated as 'Good' using the above criteria, with very little noise visible within the data.

20. The SSS and magnetometer data were rated as 'Average' using the above criteria. The magnetometer data were affected by very shallow water depths and the rapid bathymetric changes between the deep water channel and surrounding shallower areas, which resulted in a high magnitude background signal which makes the identification of smaller anomalies difficult. The sidescan sonar data were similarly affected by shallow water and rapid bathymetric changes, with some areas of data being blanked out and the full range not always being achieved. However, both systems were deemed suitable for archaeological assessment.

21. The SBP data were rated as 'Variable' using the above criteria. The water depths within the Martlesham Creek study area, with the exception of the deep water channel, were so shallow that much of the river bed pulse, and the upper section of the shallow geology, was within the direct acoustic wave. This results in large amounts of the data were uninterpretable from an archaeological perspective, due to interest in the upper sediment layers.

22. Both sub-bottom profiler data sets were assessed alongside each other during interpretation, but the boomer data were deemed to be of marginally better quality and more suitable for archaeological assessment, and so most interpretation was undertaken within this data set for both study areas, and supplemented by the chirp data.

1.2.4 Geophysical Data – Processing

23. The SSS data were processed by WA using Coda Geosurvey software. This allows 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.

24. A mosaic of the SSS data is produced during this process to assess the quality of the sonar towfish positioning. 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. During data processing, it was found that the offset information was included within the data files, and so no further layback adjustments were necessary.

25. 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.

26. 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. This software enables both the visualisation of individual lines of data and gridding of data to produce a magnetic anomaly map.

27. The data files were first despiked and then smoothed, to try and eliminate any data spikes that may have been present. 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 SSS data.

28. The SBP 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 sedimentary boundaries and shallow geological features that might be of archaeological interest.

29. The SBP data were interpreted with a two-way travel time along the z-axis. In order to convert from two-way travel time to depth, the velocity of the seismic waves was estimated to be 1,600ms^{-1}. This is a standard estimate for shallow, unconsolidated sediments.

30. Any small reflectors which appear to be buried material such as a wreck site covered by sediment were also recorded, the position and dimensions of any such objects noted in a gazetteer, and an image of each anomaly acquired. It should be noted that anomalies of this type are rare, as the sensors must pass directly over such an object in order to produce an anomaly.

31. The MBES data were analysed to identify any river bed structures that could be shipwrecks or other anthropogenic debris, and to provide a vertical reference for the SBP data. The data were gridded at 0.3m and analysed using IVS Fledermaus software, which enables 3-D visualisation of the acquired data and geo-picking of seabed anomalies.

1.2.5 Geophysical Data – Anomaly Grouping and Discrimination

32. The previous section describes the initial interpretation of all available geophysical data sets 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 data sets and apparently overstating the number of archaeological features in the study area.

33. To address this fact the anomalies were grouped together, allowing one ID number to be assigned to a single object for which there may be, for example, a HER record, a magnetic anomaly and multiple sidescan sonar anomalies.

34. Once all the geophysical anomalies and desk-based information have been grouped, a 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 river bed, these flags are ascribed as follows:

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

Table 2. Criteria Discriminating Relevance of Sea Bed Features to Proposed Project

35. All the sites that have been identified are presented in **Appendix I** and are discussed in this report. Recommendations have been made for mitigation measures should the sites be impacted by the proposed project.

36. 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.

37. Any sites which are located outside of the defined study area, either previously recorded in known databases (e.g. HER) or identified during this geophysical assessment, are deemed beyond the scope of the current assessment and are subsequently not included in this report.

1.3 Palaeogeographic Assessment

1.3.1 Geological Baseline

38. The study areas are located along the River Deben and one of its tributaries, within the Suffolk Coast and Heath Area of Outstanding Natural Beauty (AONB). The river flows approximately southeast from Debenham and drains into the southern North Sea at Felixstowe Ferry.

39. From a geological perspective, the study areas lie on the Mesozoic London Platform; an area of relatively high ground on the western edge of the North Sea Basin (Sumbler 1996).

40. According to BGS information, the basement geology differs between the two study areas. At Martlesham Creek, the underlying geology comprises the Upper Palaeocene Thanet Sand Formation and Lambeth Group (BGS 2015), which comprise fine, silty shallow marine sand and marsh/lacustrine/shallow lagoon clays, respectively (Sumbler 1996).

41. Further down the Deben River, towards the North Sea Basin, these are overlain by the Lower Eocene Thames Group/London Clay Formation (BGS 2015). This is a large, regional deposit within southern England and across the southern North Sea, comprising stiff silty marine clay, and forms the basement geology within the River Deben study area.

42. These formations are unconformably overlain at both study areas by Quaternary terrestrial and fluvial sediments, mainly tidal flat/marsh deposits, alluvium, and river terrace deposits (BGS 2015), which have the potential to date from a large period of time from the Pleistocene to the Present.

43. The Pleistocene history of the UK is dominated by repeated glacial/interglacial cycles and their associated effects, such as rises and falls in relative sea level, the presence of large ice sheets on the land, and the lasting physical erosive and depositional effects they have imprinted upon the landscape.

44. Although it has been interpreted that the study areas have only directly experienced one glaciation (during the Anglian Period – c. 488,000 – 423,000 BP), this event, and subsequent glacial/interglacial cycles, had an effect on the study areas.

45. The River Deben flows into the North Sea approximately 8km northeast of the River Stour and River Orwell estuary. Previous work undertaken off the coast of East Anglia has identified a large, underfilled palaeochannel still visible in bathymetric data extending eastwards from the Stour and Orwell estuary across the North Sea (Emu 2009).

46. This palaeochannel was created during a period of low relative sea level, when the area off the coast of East Anglia was exposed as a terrestrial environment, and is interpreted to be a multi-period feature originally dating from the Cromerian (c. 760,000 – 478,000 BP) and reactivated at subsequent sea level lowstands. It is also interpreted to be the original route of the Thames-Medway river system, which was gradually pushed further south to its present location, initially during the Anglian glaciation due to the advancing of the ice front (Emu 2009).

47. Situated just to the north of this old channel system the River Deben was likely a tributary to the old Thames – Medway river system, and has potentially been a relatively stable feature throughout the period of time from the Anglian deglaciation to the present. Previous work undertaken as part of the East Anglia ONE wind farm project has identified a buried palaeochannel extending offshore of the Deben Estuary that likely represents the offshore continuation of the river during periods of sea level lowstand.

48. As such, it is possible that fluvial and related deposits are present within both study areas spanning a period of time from the Cromerian to the present.

1.3.2 Archaeological Baseline

49. A detailed archaeological baseline has previously been provided in the DBA and HS associated with the East Anglia ONE onshore cable route. As such, only a brief summary shall be outlined here, and full potential including reference to specific monuments/findspots and their associated gazetteers are provided in WA (2014; 2015).

50. The potential relatively stable nature of the River Deben over a long period of time indicates it has a high archaeological potential. Riverine environments are rich in resources, and the study areas would have been attractive environments for different Hominin species, including Homo antecessor, Homo heidelbergensis, Homo neanderthalensis, and, eventually, modern humans (Homo sapiens). Similarly, it is likely that the area was uninhabitable during periods of ice advance (i.e. the Anglian glaciation), due to the interpreted proximity of the ice sheet to the study areas.

51. The earliest direct evidence for Hominin activity in the UK was identified at the Lower Palaeolithic sites of Happisburgh, on the Norfolk coast, and Pakefield, on the Suffolk coast, dating from c. 8000,000 and 700,000 BP respectively (Parfitt et al. 2005; 2010). These sites are both located within sediments of Cromerian age, suggesting they are potentially contemporary with the initial phase of the Thames – Medway river system, of which the River Deben was potentially a part.

52. Closer to the study area, the foreshore, cliffs and hinterland at Clacton-on Sea (Essex) comprises an important Middle Pleistocene site and is a designated geological Site of Special Scientific Interest (SSSI). Channel sediments from the area are also an important site for the Lower Palaeolithic Clactonian flint industry, and have yielded a rare wooden spear alongside lithic artefacts. The site dates from the Hoxnian interglacial period (c. 423,000 - 380,000 BP) (WA 2011), and the type site for the Hoxnian (the Hoxne Brick Pit) is located a relatively short distance inland outside of Diss, Suffolk.

53. The site identified within these channel deposits suggests occupation along the main Thames-Medway valley after the retreat of the Anglian ice sheet, and the discovery of the wooden spear suggests active hunting was taking place. The presence of these artefacts suggests similar activities may have been taking place within similar environments in the wider area at this time, such as around the River Deben.

54. The environment of the study area would have continued to be attractive for human communities as both a resource and a navigable communication route throughout history.

55. Although no Prehistoric artefacts have been identified from within the study areas, a number of sites and findspots are present within the wider region. Most Palaeolithic, Mesolithic and Neolithic evidence within the wider region is confined to individual findspots (WA 2015), despite the Neolithic being a period of time marked by the transition of human populations from nomadic hunter-gatherers to a more sedentary, farming lifestyle.

56. More evidence for Bronze Age settlement has been recorded in the wider region, such as a possible barrow cemetery in the vicinity of the Martlesham Creek study area, along with a series of possible Iron Age/Romano-British enclosures, field boundaries and trackways. Isolated find spots have been identified within the wider area dating from all Prehistoric periods (WA 2015).

57. No Saxon finds have previously been recorded within the study areas, although there is more evidence for Saxon activity within the immediate vicinity. Falkenham and Ramsholt, both close to the River Deben crossing, are mentioned in the Domesday Survey, as is the area just north of the Martlesham Creek crossing (then known as Kingston) (WA 2015). The nationally important Saxon cemetery at Sutton Hoo, with its famous boat burial, is also situated a little further up the Deben River, just east of Woodbridge.

58. Since the Saxon period, the area has remained relatively remote and beyond urban development. From the Medieval period to the present, the archaeological potential of the study areas is likely to relate to farming and land reclamation (especially around the River Deben crossing), local navigation/fishing use of the river, and riverside structures such as jetties and river walls. Some such features of unknown date (described in **Section 1.4**) have previously been identified within the Martlesham Creek study area.

1.3.3 Palaeogeographic Assessment Results – River Deben

59. The basal geological unit at the River Deben study area is the Eocene London Clay Formation (**Section 1.3.1**). This unit is too old to be of archaeological potential, although its upper surface may have been a land surface upon which archaeological artefacts could have been deposited.

60. The River Deben crossing is currently located in a relatively low-lying area of marshes and reclaimed land, and there is the potential for terrestrial deposits dating from prehistory to the modern period to be present within the study area (BGS 2015).

61. A sequence of interpreted Quaternary deposits were identified within the SBP data, confined to the western half of the River Deben study area. The extents of these deposits are illustrated in **Figure 2**.

62. This sequence comprises three separate cut and fill deposits. The lower fill is relatively acoustically unstructured, and is cut significantly by the second fill. The middle fill is more acoustically chaotic, and is the most extensive of the three fills. The upper fill is acoustically layered, cuts into the middle fill, and is the least extensive (**Figure 3**).

63. These different phases of cut and fill are generally restricted to the current river channel (although the lower fill appears to extend further), and may record the movement of the main channel over time. As such, the upper fill may represent the modern river sediments, whilst the middle and lower fills may be significantly older and have the potential to contain both in-situ and derived archaeological artefacts and preserved palaeoenvironmental material.

64. No shallow geological units of possible archaeological or palaeoenvironmental potential were identified in the eastern half of the study area, although, considering the nature of the surrounding area, some thin, localised deposits may be present.

1.3.4 Palaeogeographic Assessment Results – Martlesham Creek

65. The basal geological units at the Martlesham Creek study area are the Palaeocene Thanet Sand Formation and Lambeth Group (**Section 1.3.1**). These units are too old to be of archaeological potential, although their upper surfaces may have been a land surface upon which archaeological artefacts could have been deposited.

66. The Martlesham Creek crossing is located in a relatively low-lying area of marshes and reclaimed land, and there is the potential for deposits dating from prehistory to the modern periods to be present within the study area (BGS 2015). The creek itself is tidal, and the study area is only completely inundated at high tide. As such, much of the study area is exposed at low tide.

67. No deposits of archaeological potential were identified during the SBP assessment. This could either be due to no deposits being present within the study area, or due to the relatively poor data quality attained due to the very shallow water depths present within the study area. A representative example of the acquired SBP data is provided in **Figure 4**.

68. Due to this uncertainty a definitive palaeogeographic assessment of the study area is not possible at this time, and it should be noted that deposits of archaeological and palaeoenvironmental interest may be located within the study area. Any assessment of the palaeogeographic potential will need to be ascertained through the assessment of the geotechnical data.

1.4 River Bed Features Assessment

1.4.1 River Bed Features Results – River Deben

69. A total of nine features of possible archaeological potential were identified within the River Deben Crossing study area. Full descriptions of all identified anomalies are provided in **Appendix I**, and their distribution is illustrated in **Figure 5**.

70. Of the nine identified anomalies, eight are clustered around the low water line on the east bank of the river. The largest and most distinct of these is **7006**, a rounded dark reflector measuring approximately 2.2m x 1.8m x 0.5m with a distinct scour downriver, identified within both the SSS and MBES data (**Figure 6**). This is interpreted as a possible piece of debris, which is possibly non-ferrous in nature as no associated magnetic anomaly was identified.

71. Another possible piece of debris, **7008**, was identified approximately 67m NNW of **7006**. This feature is less well defined, measuring 2.2m x 1.0m x 0.2m, although is irregular and in form and also visible within the MBES data (**Figure 6**). As with 7006, it is likely to be non-ferrous in nature.

72. Anomalies **7003**, **7004** and **7007** are less distinct, and are all dark reflectors with shadows but without associated magnetic anomalies, and have been tentatively identified within the MBES data (**Figure 6**). They are all of less certain origin, and could be pieces of non-ferrous debris or natural features.

73. Anomalies **7001**, **7002** and **7005** are all solely magnetic in nature without any associated SSS or MBES contacts. These possibly represent buried pieces of ferrous debris. Anomaly **7001** is particularly large (369nT) and was identified on a number of survey lines, and so potentially represents a significant piece of debris.

74. One anomaly, **7000**, is located towards the western bank of the river. This is a relatively poorly defined dark reflector with shadow, but with a distinct scour and small, associated linear anomaly. This has been interpreted as another piece of debris, and is likely to be non-ferrous due to the lack of an associated magnetic anomaly.

75. It appears unusual that both identified visible SSS and magnetic anomalies are both clustered within one area, and yet no correlation was observed between the SSS and magnetic anomalies. However, the positioning provided within the data appears to be accurate, and so the magnetic and SSS anomalies are recorded as separate features in this assessment.

1.4.2 River Bed Features Results – Martlesham Creek

76. A total of seven geophysical anomalies of possible archaeological potential were identified within the Martlesham Creek Crossing study area, along with the locations of three Historic Records. Full descriptions of all identified anomalies are provided in Appendix I, and their distribution is illustrated in **Figure 7**.

77. Five of the identified anomalies are clustered in the north-west corner of the study area. The most distinct of these is **7009**, which is an irregular dark reflector with an acoustic shadow measuring approximately 1.8m x 1.0m x 0.2m identified in the

SSS data (**Figure 8**). This has been interpreted as a possible piece of debris, which is possibly non-ferrous in nature as no associated magnetic anomaly was identified.

78. Anomalies **7010** and **7012** are less distinct, and are dark reflectors with shadows but without associated magnetic anomalies (**Figure 8**). They are all of less certain origin, and could be pieces of non-ferrous debris or natural features. It is possible that they relate to historic records identified within the vicinity (**7016** and **7017**, described below), but this is uncertain.

79. Anomalies **7011** and **7013** are also located within the northwest area of the study area. These are large magnetic anomalies (591nT and 225nT respectively) that have not been associated with any SSS or MBES contacts. They possibly represent large pieces of buried ferrous debris, although it is possible that they represent rapid bathymetric changes over the deep water channel. Anomaly **7011** possibly relates to Historic Record **7017**, but this is uncertain.

80. The remaining two anomalies within the study area, **7014** and **7015**, are also large magnetic anomalies (934nT and 674nT respectively). They could also represent large pieces of buried ferrous debris, or could be the result of rapid bathymetric changes.

81. Three historic records, **7016**, **7017** and **7018**, have also been identified within the study area during production of the DBA and HS (WA 2014, WA 2015). Record **7016** (Historic Environment Record (HER) number MSF20726, previous WA ID 109) is located in the northwest corner of the study area and comprises a series of linear alignments of wooden posts associated with the northern bank of the river. The recorded location is outside of the study area, but the associated polyline shapefile extends within the study area and so this record has been included in this assessment.

82. Record **7017** (HER number MSF20727, previous WA ID 110) is also situated in the northwest corner of the study area and comprises a series of wooden posts both in and to the south of the deep water channel at its currently position (as shown by the multibeam bathymetry data). Record **7018** (HER number MSF20725, previous WA ID 112) is located in the south of the study area and comprises parallel rows of posts extending into the creek from the surrounding reed beds.

83. The features listed in the historic records have not been dated, although it is thought that **7016** relates directly to the northern river wall, and that **7018** could be an old river wall or dock. The extents of these features are illustrated by the HER as polylines and polygons, although the true extents are uncertain. As such, features associated with these records may extend beyond the recorded boundaries and need to be taken into account regarding geotechnical borehole acquisition.

1.5 Discussion, Conclusions and Recommendations

1.5.1 River Deben

84. A sequence of shallow geological deposits of possible archaeological and palaeoenvironmental potential were identified within the western half of the study area. Within the mapped limits of these deposits, two boreholes (**OWB-4** and **OWB-8**) are currently planned (**Figure 2**), of which borehole **OWB-4** would sample the full sequence of deposits and is therefore of particular archaeological interest.

85. A such, it is recommended that continuous U100 sampling is undertaken through the upper 5m of soft Holocene deposits between the level of the river bed and the stiff underlying bedrock at location **OWB-4**. It is also recommended that, where practicable, sampling and recording of any peat or organic deposits, or sediments containing archaeological material such as pottery or flint tools, be undertaken from the other proposed sampling locations.

86. Three of the planned borehole locations are located outside of the mapped limits of the deposits. In order to fully understand and map the deposits from an archaeological perspective, it is recommended that, if possible, locations **OWB-5** (borehole) and **OWC-5** (CPT) (**Figure 2**) be switched, so that three boreholes sample the deposits of possible archaeological potential, thereby maximising the understanding of the shallow geology and the archaeological potential.

87. A number of features have also been located on the river bed. Of these, anomaly **7006**, the largest piece of identified debris, is located approximately 2m away from the proposed location of CPT **OWC-7**. It is recommended that this CPT is moved 10m away from **7006** to avoid directly impacting the anomaly.

88. Similarly, the proposed location for borehole **OWB-7** is situated close to magnetic anomalies **7001** (approx. 15m) and **7002** (approx. 9m). As no river bed anomalies have been identified at these locations, there do not appear to be any obstructions

to borehole sampling at the current proposed positions. However, the geotechnical contractor should be aware that there may be buried ferrous debris in the vicinity.

89. Although records of historic and archaeological interest are present in the vicinity of the River Deben crossing, no known historic records are present within the study area (WA 2014, WA 2015).

1.5.2 Martlesham Creek

90. No shallow geological deposits of archaeological interest were identified within the study area. However, it is unclear as to whether this was due to a lack of such deposits or a result of the data quality. Due to this uncertainty, it is recommended that continuous U100 sampling is undertaken through the upper 4m of soft Holocene deposits between the level of the river bed and the stiff underlying bedrock at location **OWB-2** (**Figure 1**).

91. The MBES data indicate that this location has the potential to sample the most complete series of Holocene deposits, which should aid in determining whether any deposits of archaeological potential are located within the study area. It is also recommended that, where practicable, sampling and recording of any peat or organic deposits, or sediments containing archaeological material such as pottery or flint tools, be undertaken from the other proposed sampling locations.

92. A number of geophysical anomalies of archaeological potential were identified, mostly confined to the northwestern corner of the study area. Additionally, the locations of three historic records are also present within the study area.

93. The proposed borehole **OWB-1** is situated within the polygon of record **7017**, and approximately 4m from the recorded position (**Figure 7**). It is recommended that this borehole be relocated to avoid this historic record – a location approximately 25m east would situate the borehole outside of the Historic Record polygon and at a suitable distance from other identified anomalies, whilst keeping it within the deep water channel if necessary.

94. The remaining proposed geotechnical locations are clear of any identified geophysical anomalies of archaeological potential or historic records.

1.6 References

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2 Appendix I

2.1 Sea Bed Features of Archaeological Potential

WA_ ID	Classification	Easting	Northing	Archaeological Discrimination	L (m)	W (m)	H (m)	Mag Amp (nT)	Notes	Crossing
7000	Debris	630834	239690	A2	0.6	0.3	0.1	-	Small dark reflector with small shadow, and possible short linear feature extending from it. Located within a distinct scour feature, also identified within the bathymetry data. No associated magnetic anomaly. Possible piece of non-ferrous debris.	River Deben
7001	Magnetic	630993	239713	A2	-	-	-	369	Large, distinct magnetic dipole identified on a number of survey lines. No associated sidescan sonar or multibeam bathymetry contact. Possible large piece of buried ferrous debris.	River Deben
7002	Magnetic	630975	239712	A2	-	-	-	15	Relatively small but distinct magnetic anomaly, without an associated sidescan sonar or multibeam bathymetry contact. Possible piece of buried ferrous debris.	River Deben
7003	Dark Reflector	630982	239738	A2	0.8	0.3	0.1	-	Small, poorly defined, irregular dark reflector with small shadow but without an associated magnetic anomaly. Tentatively identified within the multibeam bathymetry data. Could be natural or non-ferrous debris.	River Deben
7004	Dark Reflector	630979	239746	A2	0.8	0.3	0.2	-	Small, poorly defined, irregular dark reflector with small shadow but without an associated magnetic anomaly. Tentatively identified within the multibeam bathymetry data. Could be natural or non-ferrous debris.	River Deben
7005	Magnetic	630963	239768	A2	-	-	-	24	Relatively small but distinct magnetic anomaly, without an associated sidescan sonar or multibeam bathymetry contact. Identified on more than one survey line. Possible piece of buried ferrous debris.	River Deben

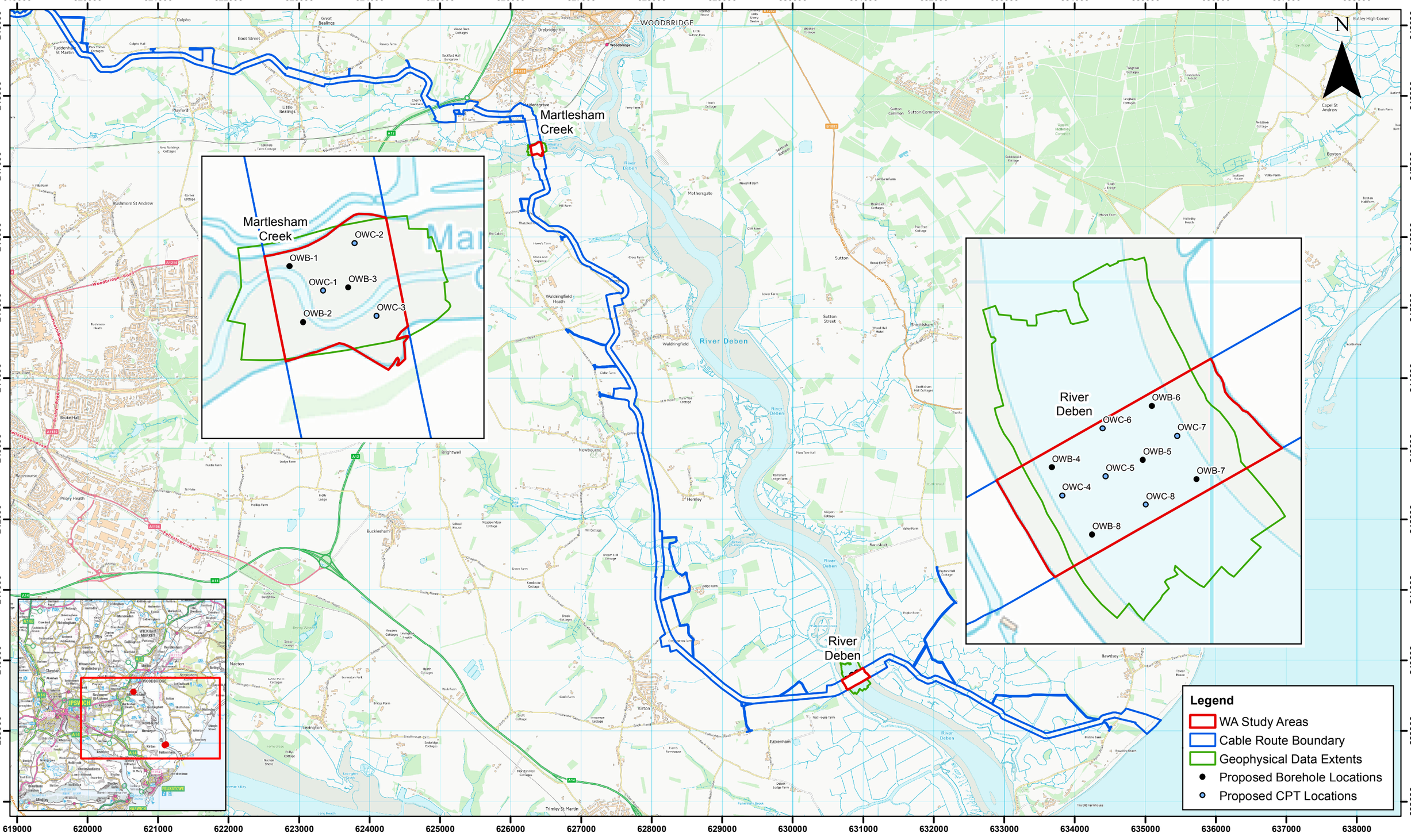
WA_ ID	Classification	Easting	Northing	Archaeological Discrimination	L (m)	W (m)	H (m)	Mag Amp (nT)	Notes	Crossing
7006	Debris	630954	239782	A2	2.2	1.8	0.5	-	Large, distinct dark reflector with distinct shadow and associated scour, identified within the sidescan sonar and multibeam bathymetry data sets. No associated magnetic anomaly. Possible piece of non-ferrous debris.	River Deben
7007	Dark Reflector	630945	239801	A2	3.5	2.8	0.1	-	Very poorly defined, rounded dark reflector with small shadow and possible small scour, although this is unclear. Tentatively identified within the multibeam bathymetry data. No associated magnetic anomaly. Possible non-ferrous debris, although could be a natural feature.	River Deben
7008	Debris	630927	239844	A2	2.2	1.0	0.2	-	Elongate, irregular dark reflector with small shadow, also tentatively identified within the multibeam bathymetry data. No associated magnetic anomaly. Possible piece of non-ferrous debris.	River Deben
7009	Debris	626285	247254	A2	1.8	1.0	0.2	-	Relatively poorly defined, irregular dark reflector with shadow but no associated magnetic anomaly. Possible piece of non-ferrous debris.	Martlesham Creek
7010	Dark Reflector	626293	247288	A2	1.1	0.7	0.1	-	Poorly defined dark reflector with shadow but no associated magnetic anomaly. Could be non-ferrous debris or a natural feature.	Martlesham Creek
7011	Magnetic	626317	247273	A2	-	-	-	591	Large, distinct magnetic anomaly identified on more than one survey lines, although without an associated sidescan sonar or multibeam bathymetry contact. Possibly associated with previously recorded post structures (**7017**), although this is uncertain. Possible large piece of buried ferrous debris.	Martlesham Creek
7012	Dark Reflector	626335	247285	A2	1.1	0.4	0.2	-	Elongate dark reflector with distinct shadow, but without an associated magnetic anomaly. Could be a piece of non-ferrous debris or a natural feature.	Martlesham Creek
7013	Magnetic	626342	247262	A2	-	-	-	225	Large, distinct magnetic anomaly, although only identified on one survey line and without an associated sidescan sonar or multibeam bathymetry contact. Possible large piece of buried ferrous debris.	Martlesham Creek

WA_ ID	Classification	Easting	Northing	Archaeological Discrimination	L (m)	W (m)	H (m)	Mag Amp (nT)	Notes	Crossing
7014	Magnetic	626356	247210	A2	-	-	-	934	Very large, distinct magnetic anomaly identified on more than one survey line, although without an associated sidescan sonar or multibeam bathymetry contact. Possible large piece of buried ferrous debris.	Martlesham Creek
7015	Magnetic	626435	247237	A2	-	-	-	674	Large, distinct magnetic dipole although only identified on one survey line and without an associated sidescan sonar or multibeam bathymetry contact. Possible large piece of buried ferrous debris.	Martlesham Creek
7016	Historic Record	626206	247306	A3	-	-	-	-	Location of HER record number MSF20726 (WA_ID 109 in WA 2015). Described as "*Post lines associated with river wall - two phases visible running parallel with each other and in line with existing wall to corner. From corner up to 5 rows visible all running parallel. Beyond this 2-3 lines visible*". The site is undated. Not identified within the geophysical data, although if they are small, partially buried features then they would be difficult to detect, although some of the identified anomalies may be related. Position given is the centre of a polyline - it is unclear as to whether the polyline encompasses the entire site, or whether some features exist beyond its boundaries. The HER record position lies outside of the current study area, but the associated polyline continues within the study area.	Martlesham Creek
7017	Historic Record	626309	247275	A3	-	-	-	-	Location of HER record number MSF20727 (WA_ID 110 in WA 2015). Described as "*Three posts approx. 20m apart, visible at low tide level. Further 3 posts visible in channel*". The site is undated, and the nature and origins are unknown. Not identified within the geophysical data (although a magnetic anomaly, **7011**, may be associated), although if they are small, partially buried features then they would be difficult to detect. Position given is the centre of a polygon - it is unclear as to whether the polygon encompasses the entire site, or whether some features exist beyond its boundaries.	Martlesham Creek

WA_ ID	Classification	Easting	Northing	Archaeological Discrimination	L (m)	W (m)	H (m)	Mag Amp (nT)	Notes	Crossing
7018	Historic Record	626390	247177	A3	-	-	-	-	Location of HER record number MSF20725 (WA_ID 112 in WA 2015). Described as "*Double row of close set posts running out from reed beds. Possibly remains of old river wall or old dock*". The site is undated. Not identified within the geophysical data, although if they are small, partially buried features then they would be difficult to detect. The whole site was also not entirely covered by geophysical data. Position given is the centre of a polygon - it is unclear as to whether the polygon encompasses the entire site, or whether some features exist beyond its boundaries.	Martlesham Creek

Notes

1. Co-ordinates are in British National Grid
2. Positional accuracy estimated ±10m



Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF
Checked: LT
Verified: LT

1:50,000 Scale @ A3

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East Anglia Offshore Wind

Study Area Locations

Drg No	74549_DMRC_01
Rev	A
Date	07/09/15
Figure	1

Datum: OSGB36 Projection: OSNG

Shapefile Ref:

630600 630800 631000 631200 631400

240000

239800

239600

N

River
Deben

OWB-6

OWC-6

OWC-7

OWB-5

OWB-4

OWC-5

OWB-7

OWC-4

OWC-8

OWB-8

Legend

- WA Study Area
- Cable Route Boundary
- Geophysical Data Extents
- Proposed Borehole Locations
- Proposed CPT Locations
- Data Example Location (Figure 3)
- Upper Fill
- Middle Fill
- Lower Fill

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment	
				Created: KL/KJF
A	07/10/15	KL	First Issue.	Checked: LT
				Verified: LT

1:2,500
Scale @ A3

0 37.5 75 150 m

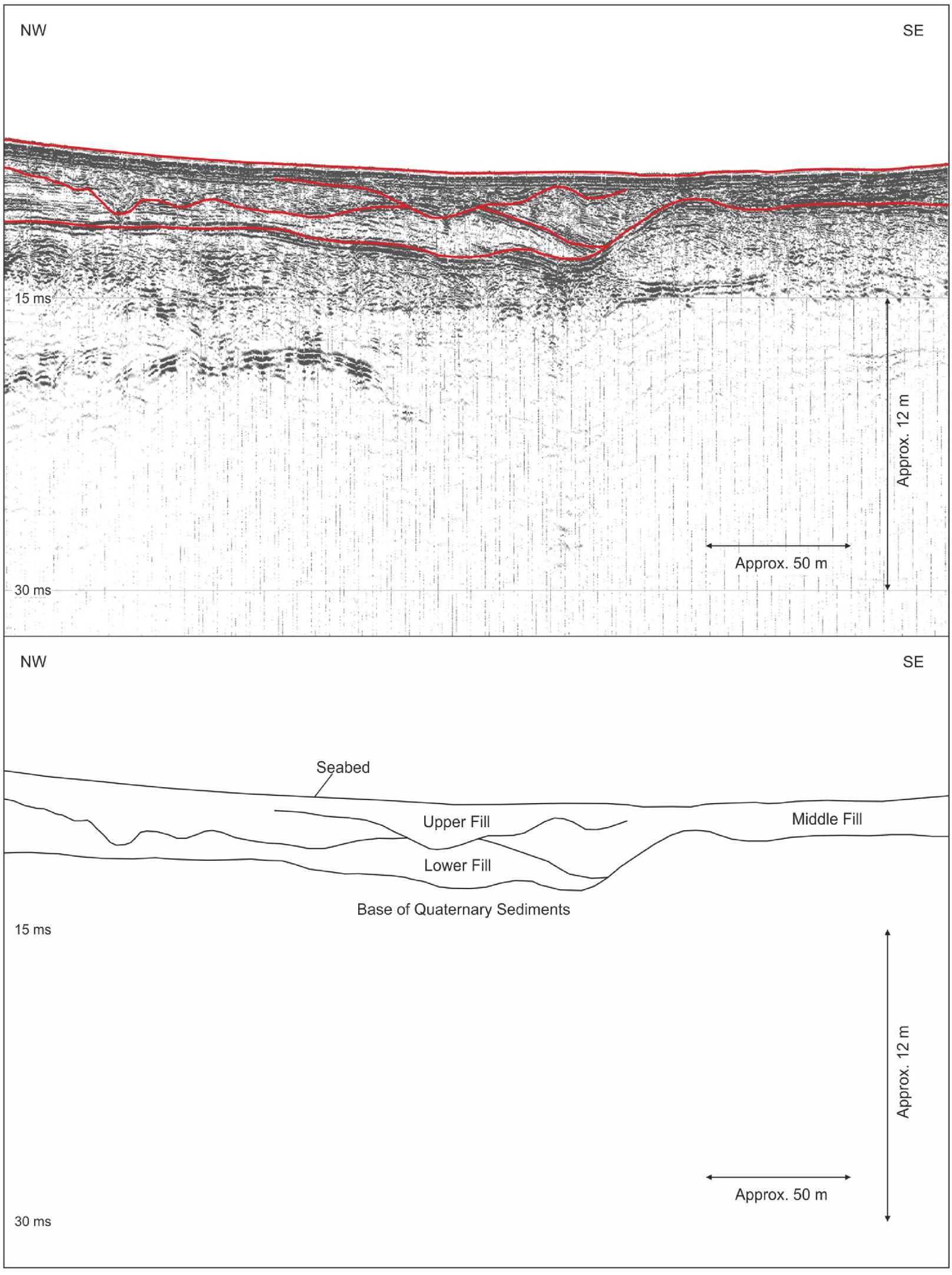
East Anglia Offshore Wind

River Deben Crossing – Palaeogeographic Assessment

Drg No	74549_DMRC_02
Rev	A
Date	07/09/15
Figure	2

Datum: OSGB36
Projection: OSNG

Shapefile Ref:



East Anglia Offshore Wind

River Deben Crossing – Sub-bottom Profiler Data Example

Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF

Checked: LT

Verified: LT

NTS @ A3

Figure	Date	Rev	Dwg No.	
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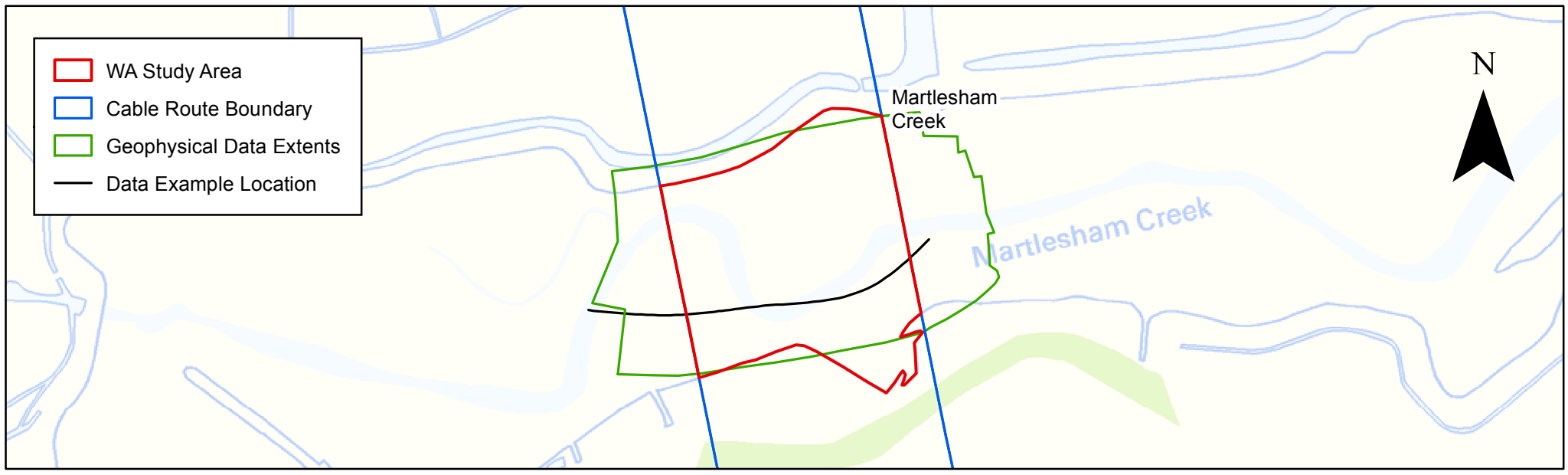

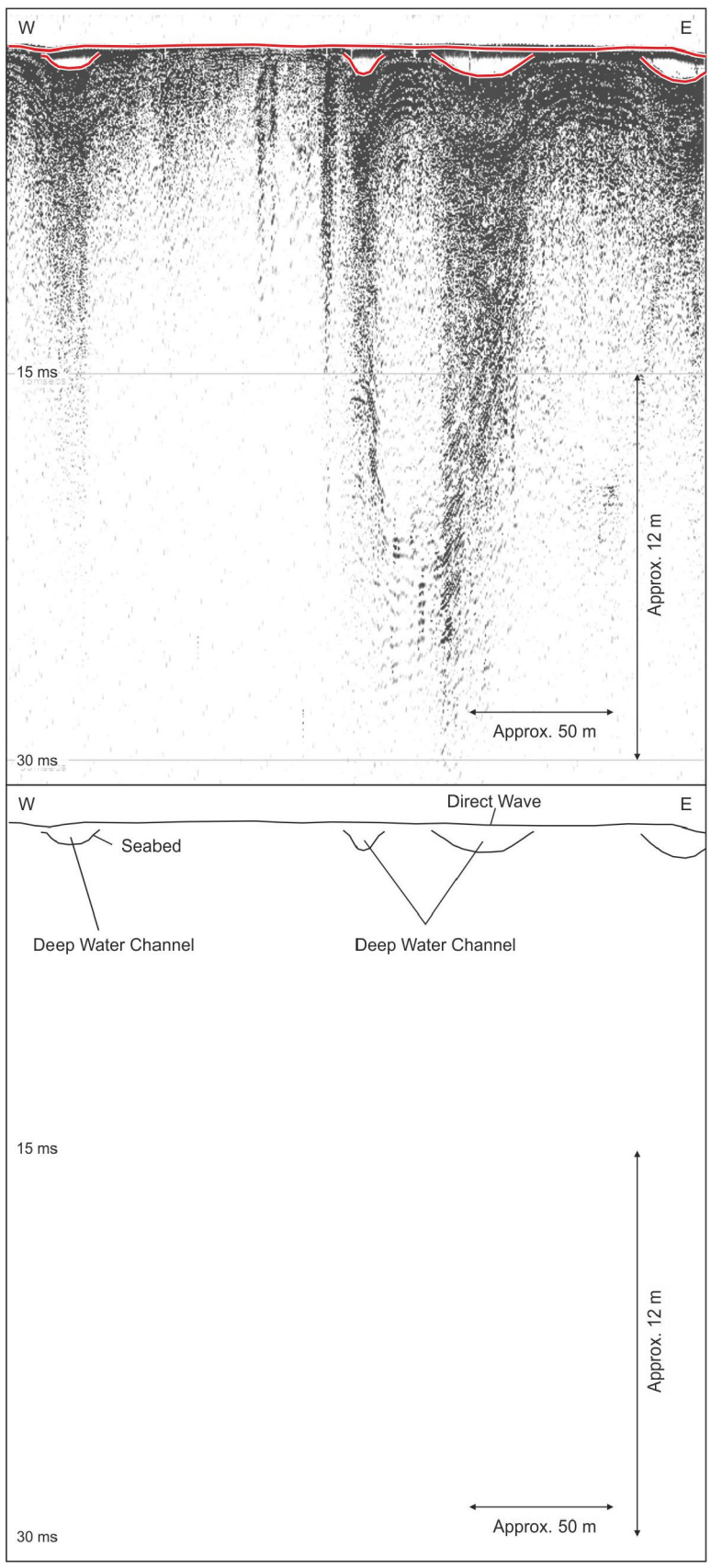

East Anglia Offshore Wind

Martlesham Creek Crossing – Sub-bottom Profiler Data Example

Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF
Checked: LT
Verified: LT

1:4,000 Scale @ A3

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Figure	Date	Rev	Dwg No.	
4	07/10/15	A	7459_04	Datum: OSGB36 Projection: OSNG

630600 630800 631000 631200 631400

240000

239800

239600

N

River
Deben

7008
7007
7006
7005
7004
7003
7002
7001
7000

Legend

- WA Study Area
- Cable Route Boundary
- Geophysical Data Extents
- A2 – Uncertain origin of possible archaeological interest

Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF
Checked: LT
Verified: LT

1:2,500
Scale @ A3

0 37.5 75 150 m

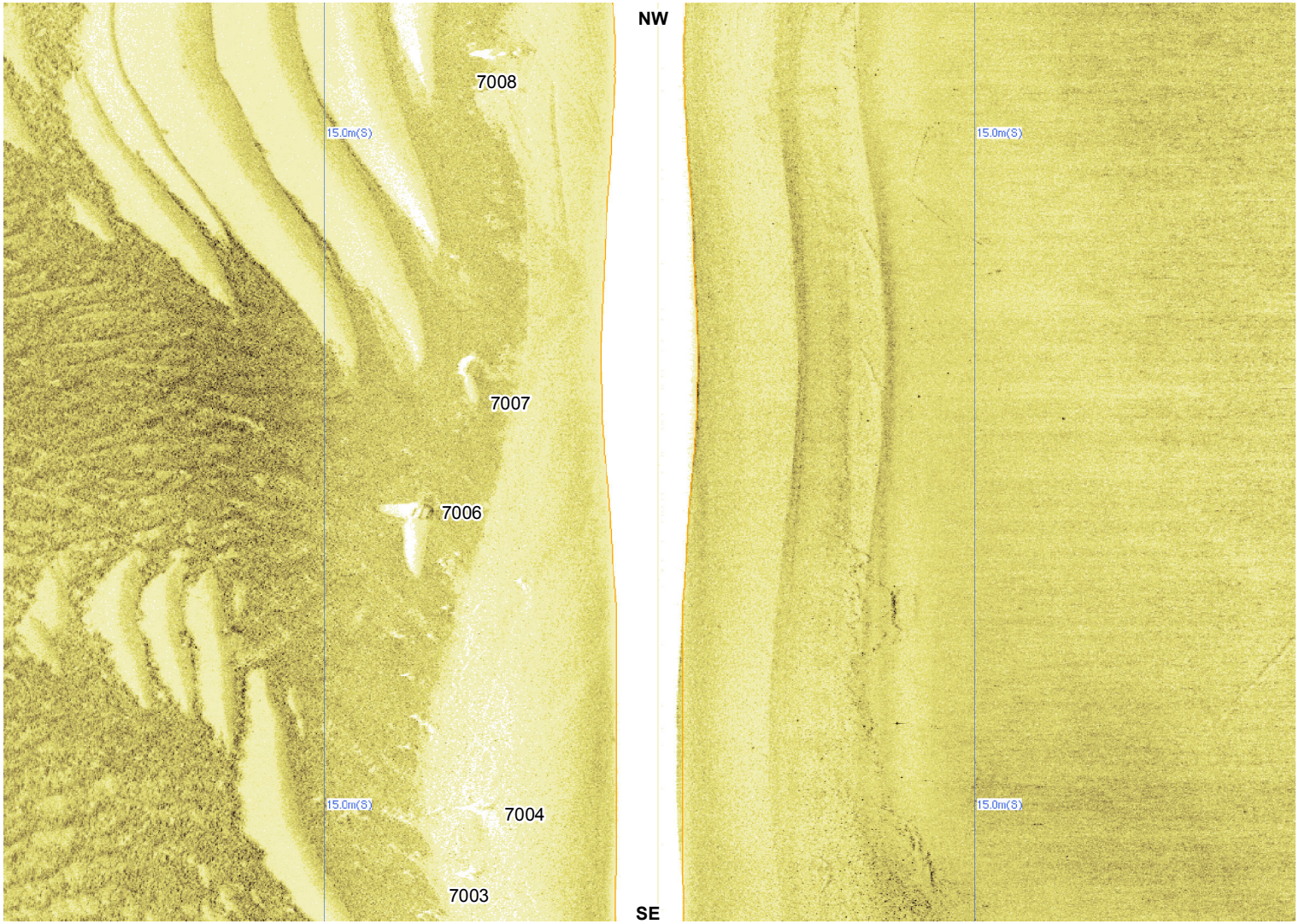
East Anglia Offshore Wind

River Deben Crossing – River Bed Features of Archaeological Potential

Drg No	74549_DMRC_05
Rev	A
Date	07/09/15
Figure	5

Datum: OSGB36
Projection: OSNG

Shapefile Ref:



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Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF
Checked: LT
Verified: LT

NTS @ A4

East Anglia Offshore Wind

River Deben Crossing –
Sidescan Sonar Data Example

Drg No	74549_DMRC_06
Rev	A
Date	07/10/15
Figure	6

Datum: N/A
Projection: N/A

Shapefile Ref:

626200 626400 626600

247400

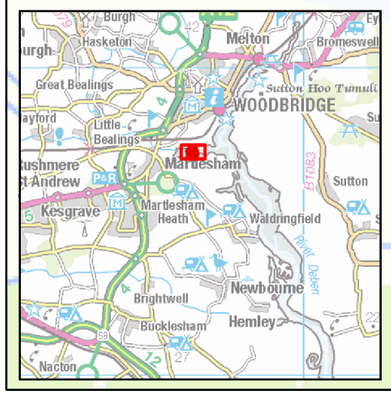
247200

N

Martlesham Creek

7016
7010
7012
7017
7011
7013
7009
7015
7014
7018

Martlesham Creek



Legend

- WA Study Area
- Cable Route Boundary
- Geophysical Data Extents
- HER Monument Record Extents[1]
- A2 – Uncertain origin of possible archaeological interest
- A3 – Historic record with no corresponding geophysical anomaly

Notes:
1. Based on data derived from Suffolk Historic Environment Record.

626200 626400 626600

SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

Created: KL/KJF
Checked: LT
Verified: LT

1:2,000
Scale @ A3

0 30 60 120 m

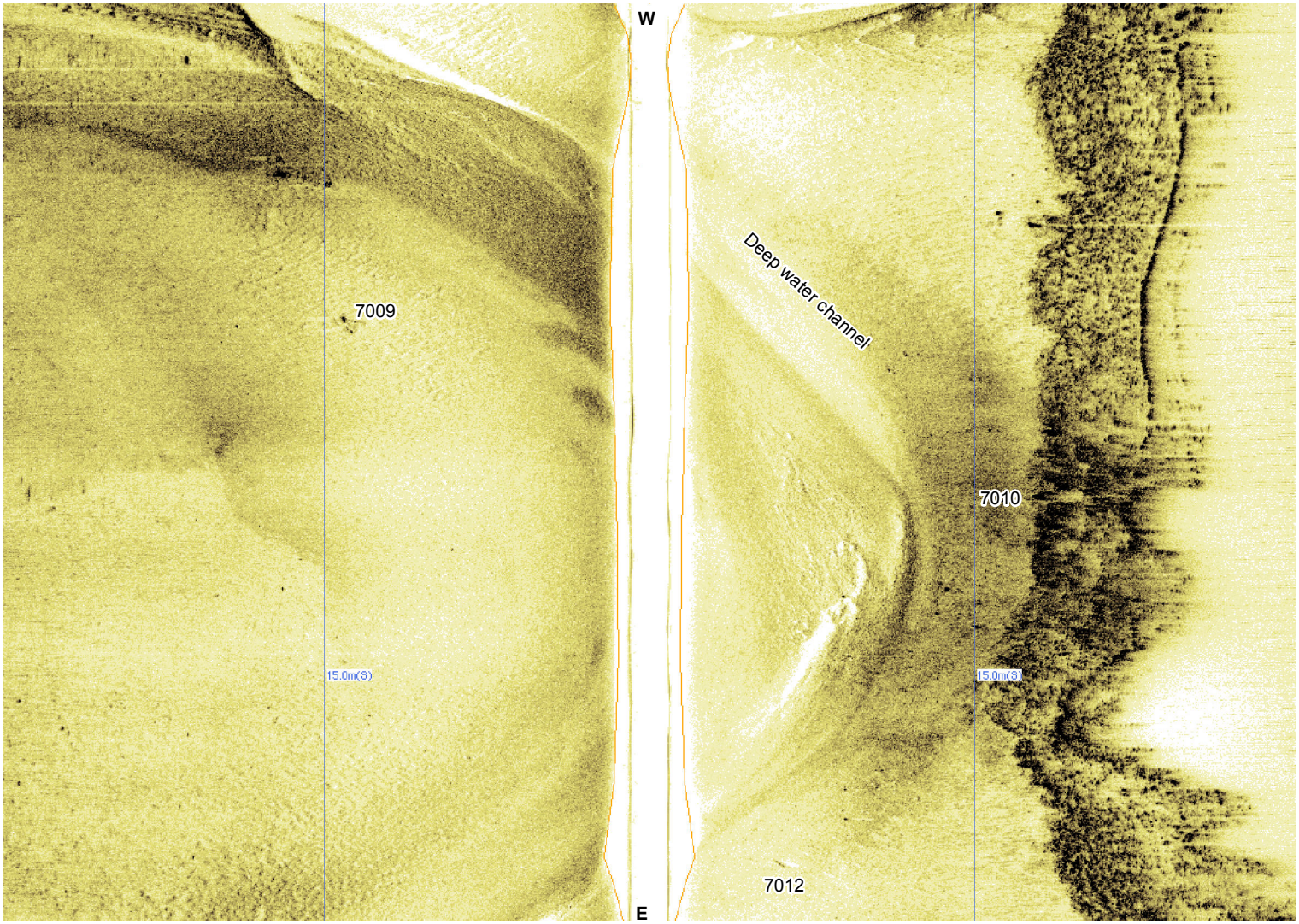
East Anglia Offshore Wind

Martlesham Creek Crossing – River Bed Features of Archaeological Potential

Drg No	74549_DMRC_07
Rev	A
Date	07/09/15
Figure	7

Datum: OSGB36 Projection: OSNG

Shapefile Ref:



SCOTTISHPOWER RENEWABLES

Rev	Date	By	Comment
A	07/10/15	KL	First Issue.

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Verified: LT

NTS @ A4

East Anglia Offshore Wind

Martlesham Creek Crossing – Sidescan Sonar Data Example

Drg No	74549_DMRC_08
Rev	A
Date	07/10/15
Figure	8

Datum: N/A
Projection: N/A

Shapefile Ref: