



AREA 430

MARINE AGGREGATE EXTRACTION

Archaeological Assessment of Geophysical Data

Archaeological Monitoring Report

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Summary

Wessex Archaeology was commissioned by Marine Ecological Surveys Limited on behalf of CEMEX UK Marine Ltd and Lafarge Tarmac Marine Ltd to undertake an archaeological assessment of geophysical survey data as part of the heritage impact monitoring process implemented for aggregate extraction Area 430.

The overall aim of this report is to provide an archaeological review of the effects of dredging on known archaeological sites and previously identified geophysical anomalies that may be of potential archaeological interest; and to assess the areas for new sites of potential archaeological interest.

The assessment consisted of an archaeological interpretation of 23 geophysical anomalies identified by Marine Ecological Surveys Limited in sidescan sonar and multibeam bathymetry data acquired by GEOxyz in 2014. In addition to this, the results of the previous monitoring report undertaken by Wessex Archaeology in 2011 were assessed, and the 2006 desk-based assessment and 2007 reports on aircraft debris previously found from within Area 430 during dredging were also considered.

Thirteen geophysical anomalies identified by Marine Ecological Surveys Limited were interpreted as being natural in origin. Ten anomalies from the 2014 geophysical survey and three from the previous assessment have been identified as being of possible archaeological potential within the Study Area. Of these, six are located within the area expected to be impacted by dredging. These were all classified as anomalies of uncertain origin of possible archaeological interest and were not deemed to require exclusion zones.

No new mitigation strategies have been recommended for the area, though it is suggested that the present Managed Dredging Zone and Archaeological Exclusion Zones remain in place, and that any artefacts recovered during dredging activities continue to be reported through the *Marine Aggregate Industry Protocol for Reporting Finds of Archaeological Interest*.



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Acknowledgements

This assessment was commissioned by Marine Ecological Surveys Limited on behalf of CEMEX UK Marine Ltd and Lafarge Tarmac Marine Ltd. The data was provided by GEOxyz, and their assistance is acknowledged in this respect.

Abby Mynett carried out this assessment and compiled the report, with quality control provided by Dr Louise Tizzard. Ken Lymer prepared the illustrations and the project was managed for Wessex Archaeology by Dr Louise Tizzard.



Area 430

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1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology (WA) was commissioned by Marine Ecological Surveys Limited (MESL) on behalf of CEMEX UK Marine Ltd (CEMEX) and Lafarge Tarmac Marine Ltd (Lafarge) to undertake an archaeological assessment of geophysical survey data as part of the heritage impact monitoring process implemented for aggregate extraction Area 430.
- 1.1.2 Area 430 is licenced by CEMEX and Lafarge and is a large aggregate extraction area located approximately 25 km east of Southwold, Suffolk. As part of the Marine License conditions for the dredging area, geophysical monitoring surveys are reviewed for changes to the archaeological baseline. This report details the most recent archaeological monitoring investigation.
- 1.1.3 The assessment was to consist of an archaeological interpretation of 23 geophysical anomalies identified by MESL and previous results within the proposed licence boundary area and a 500 m buffer, referred to hereafter as the Study Area (**Figure 1**).
- 1.1.4 In addition to the geophysical coverage of the Study Area, anomalies identified in the three longer geophysical survey lines (known as 'northern extension lines') extending north-northeast from Area 430 were also assessed.
- 1.1.5 The assessment comprised a review of 23 geophysical anomalies provided by MESL using sidescan sonar and multibeam bathymetry data acquired by GEOxyz between 1st and 2nd of April 2014 and 10th and 11th of April 2014 (GEOxyz 2014). WA also reassessed the locations of features identified in the previous monitoring report undertaken in 2011 (WA 2011) and data covering the locations of existing Archaeological Exclusion Zones (AEZs) for Area 430 (WA 2007a; 2007b) (see **Figure 1**).

1.2 Previous work

- 1.2.1 In 2006 WA undertook a desk-based assessment (DBA), which included the archaeological assessment of geophysical survey data, in advance of the dredging licence renewal applications for Area 430 (WA 2006). This DBA included both the eastern area and a western area which, at the time, had not been dredged. The assessment included known and suspected archaeological sites, in addition to the sites identified during the interpretation of marine geophysical data.
- 1.2.2 Further work was undertaken by WA in 2007 in light of the recovery of numerous pieces of aircraft wreckage during dredging works. This resulted in a second DBA being undertaken, involving analysis of the wreckage discovered alongside existing geophysical data, and a new geophysical survey and associated report undertaken by WA (WA 2007a, 2007b).



- 1.2.3 The DBA established the presence of a number of geophysical anomalies of possible archaeological potential, and the designation of the eastern portion of Area 430 as a Managed Dredging Zone (MDZ) with AEZs placed around certain identified anomalies.
- 1.2.4 WA also undertook a monitoring report for Area 430 in 2011 (WA 2011). The report identified five geophysical anomalies of possible archaeological potential within the Study Area, two of which were located within the area expected to be impacted by dredging. None of the anomalies previously identified during the aircraft crash site survey were observed in the 2011 geophysical data. It was recommended that the MDZ and AEZs remain in place.

2 METHODOLOGY

2.1 Geophysical Survey

- 2.1.1 The geophysical survey was undertaken by GEOxyz between 1st and 2nd of April 2014 and 10th and 11th of April 2014 (GEOxyz 2014). The survey vessel used to collect the data was the *Geosurveyor XI*.
- 2.1.2 The survey was conducted using multibeam bathymetry and sidescan sonar geophysical survey equipment over an area that included the licence boundary area and a 500 m buffer zone. A line spacing of 80 m was planned for the survey, however the data recorded used a line spacing of 40 m for survey lines 1 – 30 and a double spacing of 80 m for lines 31 - 92. In addition to the geophysical coverage of the main area, three longer geophysical survey lines extending north-northeast from Area 430 were also surveyed.
- 2.1.3 Full coverage of the Study Area was achieved with the multibeam bathymetry system and at least 120% coverage was attained with the sidescan sonar equipment.
- 2.1.4 A Kongsberg EM3002 multibeam swathe bathymetric system was deployed which used a 2 x 256 beam swathe view setting. The data were collected using QINSy acquisition software and provided to WA as a 2m gridded .xyz file.
- 2.1.5 The sidescan sonar data was acquired using an Edgetech 4200 dual frequency system using both high and low frequency acquisition settings and a range of 95 m. The line spacing intervals of 40 m and 80 m provided sufficient coverage to match the 120 m specification. The data were digitally recorded and provided to WA as high and low frequency .xtf files.
- 2.1.6 For this survey all positions were recorded and expressed in WGS 1984, UTM Zone 31°N.

2.2 Data Processing Methodology

- 2.2.1 WA was commissioned to undertake an archaeological assessment of 23 anomalies initially interpreted as potential archaeology by MESL (**Table 1**). In order to do this WA were provided with images of each anomaly and the coordinates for the position of the sidescan sonar fish covering each targets location. In addition to the 23 identified anomalies, WA assessed the locations of anomalies identified in the 2011 monitoring report (WA 2011) and the locations of existing AEZs.



Image	Easting (UTM31N)	Nothing (UTM31N)	Heading	Fish Altitude (m)	Description / Comments
Corridor1-bisH	435758.63	5793750.11	6.2	17.55	Archaeological feature?
Corridor3H_1	438140.02	5793280.07	193.6	13.58	Archaeological feature?
Corridor3H_3	437948.23	5792285.67	184.7	14.38	Archaeological feature?
L_7H	438057.61	5791576.47	152.2	12.52	Archaeological feature?
L_7H_1	438522.37	5791175.6	149.7	12.54	Archaeological feature?
L_7H_2	438921.52	5790780.67	151	14.25	Archaeological feature?
L_8H	437858.99	5791701.18	293	10.7	Archaeological feature?
L_10H	438473.89	5791056.11	306.2	12.63	Archaeological feature?
L_15H	438701.22	5790591.59	119.9	14.42	Archaeological feature?
L_16H	438766.19	5790483	312.4	17.56	Archaeological feature?
L_23H	436583.79	5792003.82	155.9	13.59	Archaeological feature?
L_25bH	437020.64	5791522.95	151.5	12.35	Archaeological feature?
L_27H	438986.63	5789705.41	142	18.41	Archaeological feature?
L_29H_1	438865.86	5789701.8	123.4	17.95	Archaeological feature?
L_30H	436134.6	5792007.48	319.2	10.78	Archaeological feature?
L_33H	436205.41	5791810.09	106.4	14.56	Archaeological feature?
L_39H	437920.42	5789998.32	331.4	10.67	Archaeological feature?
L_39H_1	435933.27	5791716.43	329.2	12.43	Archaeological feature?
L_43H	437107.28	5790492.36	331.7	12.18	Trawl scars + Archaeological feature?
L_45H	437262.27	5790253.18	98.2	13.85	Dredge scars + Archaeological feature?
L_49H	435525.28	5791549.45	99.7	15.29	Archaeological feature?
L_73H_2	435053.22	5790698.42	113.6	16.46	Archaeological feature?
L_81H	437242.34	5788359.54	115.4	16.98	Archaeological feature?

Table 1: Anomalies provided by MESL

- 2.2.2 The high frequency sidescan sonar data files were reviewed for this assessment. For each anomaly tagged by MESL the corresponding line of survey data was loaded into Coda and the position of the anomaly identified in the data.
- 2.2.3 Following the location of MESL's targets WA assessed the anomaly for its archaeological potential and created a database of anomalies within the Coda software. This was achieved by tagging the anomaly, recording their positions and dimensions and acquiring an image of each anomaly for future reference.
- 2.2.4 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. 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.
- 2.2.5 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.

- 2.2.6 The multibeam bathymetry data were gridded into a digital terrain map using IVS Fledermaus software using 2m cell-size (**Figure 2**). These data were examined at each of the anomalies locations.

2.3 Geophysical Data – Anomaly Grouping and Discrimination

- 2.3.1 The previous section describes the initial interpretation of all available geophysical data sets, which were conducted independently of each other. This can lead 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 area.
- 2.3.2 To address this fact, the anomalies are grouped together. This allows one ID number to be assigned to a single object for which there may be, for example, a bathymetric anomaly and a sidescan sonar anomaly.
- 2.3.3 Once all of the geophysical anomalies 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. These flags are ascribed as listed in **Table 2**.

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: Criterial discriminating relevance of feature to proposed scheme

- 2.3.4 Records of wrecks and obstructions within the Study Area and surroundings were obtained from the United Kingdom Hydrographic Office (UKHO) for the DBA (WA 2006) and were incorporated into this assessment.
- 2.3.5 All the archaeological sites that have been identified within the Study Area are presented in **Figure 3, Appendix I** and discussed below. Any previously identified anomalies have retained their identification number and newly observed anomalies have been given a new, unique number.
- 2.3.6 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.

2.4 Approach

- 2.4.1 Twenty-three anomalies identified by MESL were provided in an excel document with a brief description given a corresponding image (**Table 1**). The positions given in the table are taken from the position of the sidescan sonar towfish rather than the feature itself and so the corresponding survey line had to be replayed to a position close to that provided by MESL and then the images used to identify the anomaly. WA then tagged and recorded the anomaly as standard (see **Section 2.2.3**).



- 2.4.2 It should be noted that only those lines with anomalies reported on and provided to WA by MESL were assessed for this report. Anomalies identified from previous reports and any AEZs in place were also revisited to identify any changes in the archaeological record.
- 2.4.3 The multibeam bathymetry data were assessed only at the locations of anomalies identified in the sidescan sonar data.

3 RESULTS

3.1 Geophysical Assessment

- 3.1.1 The DBA undertaken in 2006 (WA 2006) listed a dead obstruction within the Study Area at 435437mE 5789730mN. However, no anomaly was observed in the 2014 data or in any previous interpretation.
- 3.1.2 All of the 23 anomalies identified by MESL provided to WA to interpret archaeologically were identified in the sidescan sonar data. Of these 13 were deemed not of anthropogenic origin and classified as natural features.
- 3.1.3 The remaining anomalies were grouped together and in total ten MESL targets were identified as being of possible archaeological potential within the Study Area, none of which corresponded with features identified in previous investigations. Five anomalies identified in previous surveys were revisited in the most recent dataset, one of these (**7004**) was identified in the 2014 data.
- 3.1.4 The archaeological assessment of geophysical data identified a total of 13 anomalies of possible archaeological potential. Of these 13 anomalies, six are within the area likely to be impacted by dredging and seven outside this area, and none of the anomalies are within the MDZ (see **Appendix 1, Figure 3**). Below is a summary of the number and types of features identified in the Study Area for Area 430. The anomalies have then been divided into their classifications and described accordingly.

Archaeological Discrimination	Quantity	Interpretation
A1	0	Anthropogenic origin of archaeological interest
A2	13	Uncertain origin of possible archaeological interest
A3	0	Historic record of possible archaeological interest with no corresponding geophysical anomaly
Total	13	

Table 3: Anomalies of archaeological potential within the Study Area

Anomaly Classification	Number of Anomalies
Debris	10
Bright reflector	2
Dark reflector	1
Total	13

Table 4: Types of anomaly identified

- 3.1.5 Anomaly **7001** is a bright reflector and was only identified in the 2011 survey data, this may have since been covered by sediments. It is visible as a distinct bright reflector measuring approximately 5.3 m x 3.6 m, and could possibly represent a piece of debris composed of material that absorbs acoustic waves, such as saturated wood.



- 3.1.6 Five pieces of debris have been identified within the active dredging zone; debris **7000** again was only identified in the previous 2011 survey data, visible as an elongate dark reflector with a shadow and possible scour measuring approximately 8.8 m x 2.4 m x 0.5 m. This debris may now be covered by sands and sediment.
- 3.1.7 Four previously unidentified anomalies interpreted as debris have been interpreted in the 2014 data (**7008, 7009, 7010, and 7011**). The largest of these is **7009** which has dimensions of 6.8 m x 1.0 m x 1.1 m and is visible as a hard edged curvilinear dark reflector with a bright shadow. This is located on sand waves and has a distinctive scour mark coming from it orientated to the north and measuring 9.3 m length (**Figure 4**).
- 3.1.8 **7008** is visible as a distinct hard edged but thin dark reflector with a bright shadow (**Figure 4**). The debris has dimensions of 6.7 m x 3.0 m x 0.8 m and looks anomalous to the surrounding seabed and is interpreted as possible debris. This is located within sand waves with scouring present orientated to the north and measuring 15.5 m length.
- 3.1.9 Seven anomalies (**7002, 7003, 7004, 7005, 7006, 7008 and 7012**) were identified outside of the Active Dredge Zone but within the Study Area and these consist of five anomalies interpreted as debris, one bright reflector and one dark reflector.
- 3.1.10 **7004** has been identified in both the 2011 and 2014 geophysical datasets. This is visible as a small dark reflector interpreted to be either a boulder or partially buried debris (**Figure 4**). The feature has dimensions of 0.8 m x 0.3 m x 0.6 m and is surrounded by a possible small area of seafloor disturbance. The anomaly has some scouring visible in the most recent dataset, orientated north and measuring 11.2 m length.
- 3.1.11 Debris **7012** is visible as medium sized feature with a set of uniform long, thick and dark reflectors, some with shadows and some without (**Figure 4**). In the sidescan sonar data this has a rectangular profile shape and dimensions of 16.5 m x 6.0 m x 0.7 m. Based on the nature of the anomaly this debris could possibly represent a small wreck. This feature has not previously been interpreted and further investigation would be required to understand the nature of the feature.
- 3.1.12 As with the 2011 survey data no anomalies were identified in the 2014 geophysical data within the three current AEZs and MDZ which were put into effect after the aircraft crash site survey reports (WA 2007a and 2007b). It is possible that a changing sediment distribution has taken place potentially covering the anomalies.

4 MITIGATION

4.1 Mitigation Strategies

- 4.1.1 With regards to mitigation of archaeology, the marine planning authority, working with the relevant regulator and advisors, takes account of the desirability of sustaining and enhancing the significance of heritage assets and adopts a general presumption in favour of the conservation of designated heritage assets within an appropriate setting (HM Government 2011; DCALG 2012).
- 4.1.2 Thirteen of the 23 geophysical anomalies identified by MESL were interpreted as being natural in origin and omitted from this report.
- 4.1.3 In total 13 anomalies from the 2014 geophysical survey and previous investigations have been identified as being of possible archaeological potential within the Study Area, six of these are located within the area expected to be impacted by dredging. These were all



classified as A2 anomalies of uncertain origin of possible archaeological interest and were deemed not to require exclusion zones, though their positions should be noted, particularly the features identified within the licence area.

- 4.1.4 Three AEZs and a MDZ are in place within the Study Area. Similarly to the results of the 2011 monitoring report no new anomalies were identified within these areas in the 2014 geophysical datasets.
- 4.1.5 No new mitigation strategies have been recommended for the area, though it is recommended that the present MDZ and AEZs remain in place, and that any artefacts recovered during dredging activities continue to be reported through the *Marine Aggregate Industry Protocol for Reporting Finds of Archaeological Interest* (BMAPA and EH 2005).

5 REFERENCES

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APPENDIX I: ANOMALIES OF POSSIBLE ARCHAEOLOGICAL POTENTIAL

WA ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Description	Sources	Area
7000	Debris	436247	5792323	A2	8.8	2.4	0.5	Elongate dark reflector with shadow and small possible scour. Located in an area of mega ripples and possibly represents a piece of partially buried debris. Not identified in the most recent survey, may have since been covered by sediment	7000	Inside Active Dredge Zone
7001	Bright Reflector	435957	5790625	A2	5.3	3.6	0	Distinct bright reflector in an area of mega ripples with possible small associated scour. Possible piece of debris. Not identified in the most recent survey, may have since been covered by sediment	7001	Inside Active Dredge Zone
7002	Debris	438946	5790408	A2	44.1	14.1	0	Area of dark reflectors, possibly debris though located in a depression next to a large sand wave so could be an accumulation of coarse sediment. Not identified in the most recent survey, may have since been covered by sediment. Close to another anomaly 7006 but not part of same feature	7002	Outside Active Dredge Zone
7003	Debris	436136	5789375	A2	12.9	5.8	0	Two short, parallel linear dark reflectors. Possibly partially buried debris, or could represent a localised deep section of a dredging scar. Not identified in the most recent survey, may have since been covered by sediment	7003	Outside Active Dredge Zone



WA ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Description	Sources	Area
7004	Dark Reflector	438222	5788841	A2	0.8	0.3	0.6	Small dark reflector with shadow and a possible small surrounding area of seafloor disturbance. Could be a boulder or a small piece of partially buried debris. 2014 data indicates a very thin right angled feature with a scour orientated N and measuring 11.2m. Identified in both surveys	7004	Outside Active Dredge Zone
7005	Debris	437955	5791658	A2	3.8	2.7	1.2	V shaped and thin hard edged dark reflector with a bright shadow located in sand waves and its full extent possibly hidden. Possible small amount of scouring to the N measuring 11.7m. Possibly debris	L7H; L8H	Outside Active Dredge Zone
7006	Debris	438948	5790423	A2	6.4	0.6	0.5	Hard edged and thin linear dark reflector with a bright shadow located perpendicular to the sand waves. Distinct and anthropogenic looking anomaly, possibly debris. Not covered by the multibeam data	L16H	Outside Active Dredge Zone
7007	Bright reflector	438740	5789742	A2	10.2	1.3	0	Long and tapered bright reflector anomaly, could possibly be a piece of debris composed of material that absorbs acoustic waves such as wood	L29H	Outside Active Dredge Zone
7008	Debris	436157	5791946	A2	6.7	3	0.8	Distinct hard edged but thin dark reflector with a bright shadow. Anomalous to the surrounding seabed and located within sand waves, scouring is present to the north measuring 15.5m. Possible debris	L30H	Inside Active Dredge Zone



WA ID	Classification	Easting	Northing	Archaeological Discrimination	Length (m)	Width (m)	Height (m)	Description	Sources	Area
7009	Debris	436116	5791925	A2	6.8	1	1.1	Possible debris, medium sized hard edged curvilinear dark reflector with a bright shadow and located on sand waves, feature has a distinctive scour mark coming from it orientated N and measuring 9.3m	L33H	Inside Active Dredge Zone
7010	Debris	437177	5790400	A2	5.3	3.4	0.4	Possible debris, made up of two thin and long parallel hard edged dark reflectors with a short shadow located in sand waves, discreet anomaly that is anomalous to the surrounding seabed.	L43H; L45H	Inside Active Dredge Zone
7011	Debris	434979	5790716	A2	5.2	3.7	1	Thin but distinctive possible debris, with a diffuse outer edge and a bright curvilinear shadow, located on a sandy and even area of the seabed, isolated and anomalous	L73H	Inside Active Dredge Zone
7012	Debris	437190	5788496	A2	16.5	6	0.7	Possibly debris or small wreck? Not identified in previous surveys and not recorded by the UKHO. Made up of a thick but diffuse set of aligned/rectangular long and dark reflectors, some with shadows and some without, looks highly anomalous and distinct on a sandy and sand wave rich area of the seabed	L81H	Outside Active Dredge Zone

1. Co-ordinates are in WGS84 UTM31N
2. Positional accuracy estimated ± 15 m