# ASSESSMENT OF EFFECTS <br> ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix S: Sub-bottom Profiling

January 2003

# ASSESSMENT OF EFFECTS ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

 in respect of the proposed development of
## London Gateway

## Appendix S: Sub-bottom Profiling

Prepared by Stuart Leather Consultant

Approved by Antony Firth Head of Coastal and Marine Projects

## Draft and Confidential

# ASSESSMENT OF EFFECTS ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

 in respect of the proposed development of
## London Gateway

## Appendix S: Sub-bottom Profiling

Version: 1.0
Referenc

## CONTENTS

Contents ..... i
Acknowledgements. ..... ii

1. Introduction ..... 1
2. Background ..... 1
3. Aim and Objectives ..... 2
4. Methodology ..... 2
5. Results ..... 3
6. Discussion ..... 4
7. Conclusion ..... 6

# ASSESSMENT OF EFFECTS ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix S: Sub-bottom Profiling

## ACKNOWLEDGEMENTS

Wessex Archaeology gratefully acknowledges the assistance of Richard Cooke and Angela Proctor of Emu Ltd., Nick Shepherd of Oxford Archaeology, Claire Dickinson of Faber Maunsell and Gill Andrews. Wessex Archaeology would also like to thank Martin Bates and Richard Bates for their assistance.

Bathymetric data was provided by Port of London Authority. Wessex Archaeology gratefully acknowledges the assistance of John Pinder (Port Hydrographer).

Stuart Leather prepared this report, with the assistance of Martin Bates. Antony Firth managed the project.

# ASSESSMENT OF EFFECTS <br> ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix S: Sub-bottom Profiling

Version: 1.0 Reference:49575 Date: 13 January 2003

## 1. INTRODUCTION

1.1. Wessex Archaeology was commissioned by Faber Maunsell to undertake sub-bottom profiling in connection with the London Gateway project at Shellhaven, Essex. The area of study extended from Hole Haven Creek to the southern end of Lower Hope (see Drawing J.1.02.0476.01).
1.2. The works were undertaken to enhance the palaeo-geographic mapping and deposit model. The enhanced deposit model, reflecting both the results of the sub-bottom profiling and investigations on land, is presented elsewhere.
1.3. The sub-bottom profiling was undertaken by Emu Ltd., comprising data acquisition and geological interpretation. Their report is appended to this document.

## 2. BACKGROUND

2.1. Palaeo-geographic mapping indicates that deposits corresponding to terraces on land fall within the horizontal and vertical extents of proposed dredging. However, the corresponding terraces are reported to be relatively late in the Lower Palaeolithic and Middle Palaeolithic, which are not currently regarded as being rich in archaeological material. Some earlier channels have been identified that may be of greater archaeological potential, apparently lying below proposed dredging depths.
2.2. Palaeo-geographic mapping also confirms the presence of peat deposits within the horizontal and vertical extents of proposed dredging. The presence of peat deposits suggests potential for the survival in situ of archaeological material, and both the peat and associated alluvium contain palaeo-environmental and dating evidence of archaeological importance.
2.3. The model of sea-level change developed in the course of palaeogeographic mapping suggests that the Study Area may have comprised extensive terrestrial and intertidal areas until the later Mesolithic and possibly into the Neolithic, but thereafter the Study Area would have become predominantly marine in character.
2.4. In general terms, the area is underlain by Tertiary London Clay and then by Quaternary gravel deposits in terrace formations. The latest deposit associated with terrace formation is the Shepperton Member laid down in the Late Devensian, at the base of the current channel of the Thames. In the course of sea-level rise, further deposits have been laid down on the margins of the channel, including the peaty and other alluvial deposits referred to above. As the environment developed from riverine to estuarine and fully marine conditions, so further deposition and reworking in the channel is likely to have occurred.
2.5. The sub-bottom profiling was intended to clarify the presence and relationship between these deposits in the channel area in order to extend the dryside deposit model.

## 3. AIM AND OBJECTIVES

3.1. The aim of the sub-bottom profiling was to inform the assessment of effects on the cultural heritage of the London Gateway proposals.
3.2. The objectives of the sub-bottom profiling were to facilitate the extension of the dryside deposit model by:

- identifying geological units within and on the margins of the channel;
- clarifying the form of geological units and the relationships between them;
- commenting on their archaeological interpretation.


## 4. METHODOLOGY

4.1. The methodology applied in acquiring survey data and in geological interpretation are detailed in the appended report by Emu Ltd. The methodology included a seismic source trial to optimise the penetration and resolution that could be achieved.
4.2. The area surveyed encompasses the channel immediately off London Gateway, plus areas up and down-stream to provide sufficient context to correlate results with the regional geology.
4.3. Wessex Archaeology attended fieldwork and contributed to the geological interpretation. A meeting was held between Emu Ltd., Wessex Archaeology, Martin Bates and Richard Bates on 18 December 2002 to discuss interpretation, and a further meeting was held with Martin Bates on 10 January 2003 to discuss the results and their archaeological implications.
4.4. Heights derived from the sub-bottom profiling data are being incorporated in the deposit model.

## 5. RESULTS

5.1. As detailed in the appended report by Emu Ltd., five lines and 21 crosslines were surveyed using a surface tow boomer profiler. The trackplot is reproduced on drawing J.1.02.0476.01.
5.2. Seven units were distinguished. It should be noted that these are units that are distinct from each other seismically, i.e. in terms of their acoustic properties. Their geological attribution is by inference.
5.3. All the data was interpreted. Lines and crosslines representing the area surveyed and showing notable features were selected for presentation (J.l.02.0476.03-04). Depths to units, and isopachs of selected units relative to OD, are presented in J.1.02.0476.05-08.
5.4. Generally the data were very good. However, the survey coverage was limited by water depth restricting navigability, and also by acoustic masking in inshore areas.
5.5. $\quad$ The source of acoustic masking is debatable. While the cause is likely to be shallow biogenic gas, it is not clear whether this gas has originated in the course of decay of modern sediments, or whether it originates from older organic sediments and has migrated upwards. If of older origin, acoustic masking may indicate the presence of peaty horizons (see Appendix L). However, if the gas is of recent origin it is simply an inconvenience to the application of seismic methods. To further complicate the matter, shallow gas of both origins could be present in the area surveyed. On balance, shallow gas in inshore areas seems more likely to be of modern origin, whereas shallow gas in the channel may indicate the presence of older organic deposits.
5.6. The seven units identified in the geological interpretation are summarised below:

| Unit 1 | The basal unit underlying the whole area, interpreted as the basal <br> London Clay. |
| :--- | :--- |


| Unit 2 | Overlying Unit 1 throughout the majority of the site, It has been <br> interpreted as comprising sand and gravels and is associated with <br> terrace formations. |
| :--- | :--- |
| Unit 3 | Occurs in discrete areas. Interpreted as sedimentary in nature, most <br> probably channel infill. Probably fine sand and clays due to its low <br> seismic reflectivity. |
| Unit 4 | This unit has been interpreted as sand. It represents the oldest layer of <br> a sequence of Units prograding from the south of the area. |
| Unit 5 | This represents a later unit in the sequence of prograding layers from <br> the south. It has been interpreted as comprising sand and gravels. |
| Unit 6 | This has been interpreted as sand and gravels. It overlies Unit 2 and has <br> similar seismic characteristics. It also overlies Unit 3 uncomformably in <br> certain locations. |
| Unit 7 | This unit has been interpreted as predominantly sand and forms the <br> majority of the seabed from chainage 6700m to the east of the area. It <br> is, therefore, thought to be the result of modern sediment deposition or <br> reworking. |

5.7. It is worth noting that the data obtained are capable of further interpretation and review as additional evidence (e.g. borehole logs, palaeo-environmental assessment and dating) becomes available, and as interpretations of the regional geology develop.
6. DISCUSSION
6.1. The evidence suggests that at least two phases of erosion are present into the top of the London Clay surface (Unit 1). The height of the surface of the London Clay in Route 2 shows a change from approximately -15 m O.D. at +5900 m to -25 m O.D. at +6700 m with a sharp break at +6650 m . This difference of up to 10 m suggests that the higher surface was cut in an earlier episode to cutting of the lower surface, and that a phase of general downcutting along the profile of the Thames occurred between these two episodes.
6.2. Gravels of Unit 2 are present above the erosion surface of Unit 1. The surface elevation of these gravels reflects the form of the underlying erosion surface, i.e. there are marked changes in the height of the top surface of Unit 2. This suggests that at least in Route 2, Unit 2 comprises two gravel bodies of differing ages. However, the relationship between the overlying gravel bodies is less clear in Line 11 where a single gravel body associated with the younger, lower gravel unit in Route 2 may be present.
6.3. The implications of the evidence obtained from the study of Units 1 and 2 is that the notion of a single gravel body (i.e. the Shepperton Member) existing beneath the area surveyed is erroneous. A complex history of gravel deposition and erosion is apparent from the subbottom profiling data. While it is not possible to assign ages to these events it is likely that the deposits span large parts of the last cold
stage (Devensian) and may extend into the penultimate cold stage (i.e. before the lpswichian warm stage).
6.4. It should be noted that a number of the gravel units that have been mapped in the Middle Thames disappear below the floodplain downstream of East London because of the downstream dip on the gravel bodies within the Thames. Consequently, units identified in the Middle Thames have not previously been readily apparent to geologists in the region. As a result, there is scope in the area surveyed to identify different gravel units that can be associated with units previously mapped upstream.
6.5. The sub-bottom profiling has produced no evidence from within Unit 2 of fine-grained sediments. Consequently the potential for recovering in situ stratified archaeology and palaeoenvironmental material from Unit 2 appears to be low. However, the possible presence of preDevensian gravels suggests that the potential for derived Palaeolithic artefacts may be higher than thought previously.
6.6. The interpretation of the seismic units overlying Unit 2, and their possible importance, is difficult to determine at present. The evidence clearly shows that fine grained clays exist in places (Unit 3) and that locally these either fill channel-like features cut into or superimposed on the surface of Unit 2, or are present as discontinuous sheets of material across the surface. The fine-grained nature of these sediments suggests that any archaeological remains associated with these deposits may have suffered only minimal post-depositional movement. Although this suggests that the archaeological potential may be relatively high, it is unclear whether Unit 3 is Holocene (i.e. Late Upper Palaeolithic/Mesolithic) or Pleistocene (i.e. Middle Palaeolithic) in date (see discussion of Unit 5, below).
6.7. Similar sediments, although at higher elevations, are noted within the (Holocene) wedge of sediments both to the north and south of the channel. For example, Unit 4 resting in places on the surface of Unit 2 and/or on the surface of Unit 3, consists of sand units that are comparable to deposits noted within the area to the south of the Thames beneath Cooling and Shorne Marsh.
6.8. Unit 5 appears to be of major importance. This unit is considered to consist of sand and gravel and forms an extensive deposit along parts of Route 2 and as a wedge of material thinning to the north in Line 19. The surface of Unit 5 outcrops between -10 and $-13 m$ O.D. at elevations similar to those considered typical of the top of the Shepperton Member and is likely to have been considered to be the upper part of the Shepperton Member by the BGS. If the attribution of this deposit to the Pleistocene is correct, the implication is that the
sediments of Units 3 and 4 are also of Pleistocene date. Attribution of these fine-grained deposits to a Late Pleistocene (Middle Palaeolithic) warm stage is plausible. The notion that such sediments are of relatively low archaeological potential because Britain is suspected not to have been inhabited at this time is currently under review. However, if Unit 5 is Pleistocene in date then it suggests that very little Holocene sediment exists within the channel. It would follow that the Late Upper Palaeolithic/Mesolithic potential of the channel (as compared to floodplain deposits) is low, which accords with the model of sea-level change set out in Appendix L.
6.9. An alternative explanation is that Unit 5 (and indeed all overlying units) are of relatively recent date and reflect marine gravel deposition on the base of the modern channel. If so, then the fined grained deposits of Unit 3 are likely to be late Devensian/early Holocene in date, potentially containing in situ material of Late Upper Palaeolithic/early Mesolithic date.
6.10. Deposits exist at the south end of Line 11 (Units 6 and 7) that occur at levels equivalent to the Holocene sediments of the Shorne/Cooling Marshes. These appear to be the only deposits clearly identified that may correlate with the dry side deposits. Their archaeological potential is considered to be high.

## 7. CONCLUSION

7.1. By way of conclusion, the following key points should be noted:

- The BGS mapping indicating a simple sequence consisting of the Shepperton Member with overlying Tilbury Member is incorrect.
- At least two phases of gravel aggradation appear to be present beneath the area surveyed.
- Evidence exists for the presence of finer grained sediments infilling channel-like features.
- It remains unclear whether significant thicknesses of Holocene deposits occur within the channel. The presence of thick Holocene deposits on the channel sides is confirmed, but their internal structure is unclear, partly due to acoustic masking by shallow gas.
- Two alternative models can be constructed to account for Units 3-5. Interpretation of Unit 5 as of Pleistocene date indicates that the channel like feature associated with Unit 3 is of Late Pleistocene (Middle Palaeolithic) age. Alternatively if Unit 5 is of Holocene date then the channel-like feature is of late Devensian/early Holocene (Late Upper Palaeolithic/early Mesolithic) date.
- Irrespective of the dating of the deposits, this set of sediments represents a situation in which archaeological material, if present, may be in situ or minimally modified. Furthermore fine-grained sediments of this type are likely to contain palaeo-environmental material for landscape reconstruction.
- This evidence collaborates the information obtained from the dry side areas suggesting that the interpretation of the subsurface stratigraphy as well as the inferred archaeological and palaeoenvironmental potential is complex.


# Shell Haven 

Archaeological Geophysical Survey

## For

## Wessex Archaeology

Report No. 02/J/1/02/0476/0336
January 2003

Job No. J/1/02/0476

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire, SO32 2EJ
Tel: +44 (0) 1489860050
Fax: +44 (0) 148986005
mail@emulimited.com
www.emulimited.com

# Shell Haven Archaeological Geophysical Survey 

For<br>\section*{Wessex Archaeology}

Report No. 02/J/1/02/0476/0336
Job No. J/1/02/0476
January 2003

Emu Ltd
Head Office
1 Mill Court
The Sawmills
Durley
Southampton
Hampshire, SO32 2EJ
Tel: +44 (0) 1489860050
Fax: +44 (0) 1489860051
mail@emulimited.com
www.emulimited.com

## EXECUTIVE SUMMARY

Emu Ltd was commissioned by Wessex Archaeology to undertake seismic, sidescan sonar and magnetometer surveys of the approaches to the proposed port development at Shell Haven, on the north bank of the Thames. The survey was commissioned to give information to assist in determining the likely impact on the archaeology of the area during construction and dredging for the port development.

The project consisted of two tasks:

- to determine the location and nature of features on the seabed that may be of archaeological importance such as wrecks, in the approaches to Shell Haven. These were located using a sidescan sonar and magnetometer towed from the survey vessel contemporaneously, along 4 parallel lines extending from Shell Haven, eastwards along the centre of the existing shipping channel to a point approximately 32 km to the east.
- To conduct a high resolution seismic survey of the Thames in the vicinity of the proposed port development to determine the sub-seabed geology which can be tied in to data collected on land to give a comprehensive view of the archaeological importance of the area.

This report covers the seismic survey only.
The survey was conducted between $18^{\text {th }}$ to $22^{\text {nd }}$ November 2002, using the vessel 'Saint David of London'.

A series of trials were undertaken across the site with three different seismic energy sources (boomer, pinger and chirp profilers) to determine which source would give the optimum data for this site. It was determined that a boomer system gave the best results and this was used for the survey.

The data show that underlying the whole of the site is a seismic unit which is likely to be London Clay, overlain by a series of terrace gravels. Two paleochannels have been determined which cut in to the terrace gravels and are infilled with predominantly clay. To the east of the survey area a sequence of prograding sedimentary horizons have been identified along with several periods of erosion. To the west of the area the terrace gravels are intermittently overlain by a unit likely to comprise sand and gravel.

| CONTENTS |  | Page |
| :---: | :---: | :---: |
| 1.0 | INTRODUCTION AND OBJECTIVES | 1 |
| 1.1 | Introduction | 1 |
| 1.2 | Scope of Work | 1 |
| 2.0 | METHODOLOGY | 2 |
| 2.1 | Horizontal Positioning | 2 |
| 2.2 | Single-channel Seismic Survey | 3 |
| 3.0 | RESULTS | 4 |
| 3.1 | Data Quality | 4 |
| 3.2 | Data Interpretation | 4 |
| 3.2.1 | Seismic Source Trials | 4 |
| 3.2.2 | Seismic Data Interpretation | 4 |
| 3.2.3 | Seismic Data Interpreted Sequence of Events | 7 |
| 4.0 | CONCLUSIONS | 9 |
| 5.0 | AUDIT INFORMATION | 10 |
| APPENDIX A | Daily Logs |  |
| APPENDIX B | Drawings |  |

## LIST OF FIGURES

Figure 1.1 Location Plan

## LIST OF TABLES

Table 2.1 Summary of Horizontal Positioning System
Table 2.2 Summary of Seismic Survey Methodology

## LIST OF DRAWINGS

Drawing No J.1.02.0476.01
Drawing No J.1.02.0476.02
Drawing No J.1.02.0476.03
Drawing No J.1.02.0476.04
Drawing No J.1.02.0476.05
Drawing No J.1.02.0476.06
Drawing No J.1.02.0476.07
Drawing No J.1.02.0476.08

Trackplot (Boomer Position)
Interpolated Bathymetric Contours
Seismic Profile of Centre Line (Route 2)
Seismic Profiles of Cross-Lines (Lines 11, 14 and 19)
Depth to Seismic Unit 1
Depth to Seismic Units 2 and 3
Depth to Seismic Unit 5 + Isopachs of Seismic Unit 6
Isopach of Seismic Unit 7

### 1.0 INTRODUCTION AND OBJECTIVES

### 1.1 Introduction

This report describes the high resolution marine seismic survey undertaken on the River Thames, in the vicinity of the planned port development at Shell Haven, on the north bank. The survey was commissioned to give information to assist in determining the likely impact on the archaeology of the area during construction and dredging for the port development.

This survey was part of a larger project that also included a sidescan sonar and magnetometer survey along the approaches to Shell Haven, designed to provide information on the location and nature of objects on the seabed such as wrecks, which may be of archaeological importance.

The seismic survey was undertaken between $18^{\text {th }}$ and $22^{\text {nd }}$ November 2002. The location of the survey area is shown in Figure 1.1.

Previous geophysical and geotechnical surveys, commissioned by P\&O to give information primarily to aid planning of engineering aspects of the proposed port development, have indicated that the site is underlain by a sequence of unconsolidated sediments over rock.

The seismic survey was commissioned to give detailed information regarding the unconsolidated sediments.

### 1.2 Scope of Work

The scope of work for this element of the project was to collect high resolution seismic data particularly of the sedimentary sequences that other data sets indicate overlie the solid geology in this area.

### 2.0 METHODOLOGY

This section includes a brief factual description of the methods used to achieve the project objectives. More detailed descriptions of specific survey techniques and procedures are contained within Emu Ltd Method Statement, numbers 8 and 9 (a component part of the Company's QA Manual - details of which can be inspected on request).

### 2.1 Horizontal Positioning

## POSITIONING

| Requirement | Application |
| :---: | :---: |
| - To provide navigation information to on board sensors with an accuracy of $3-5 \mathrm{~m}$. | A Leica MX412 DGPS Navigation System was used. This receives corrections from a network of differential beacons located around the British coast, and uses the data to correct positions in real time. <br> This enables the location of seabed information collected by on board sensors to be determined with a high degree of accuracy. |
| Data Collection |  |
| $\begin{array}{ll}\text { Equipment Used: } & \begin{array}{l}\text { Leica MX412 Navigation DGPS } \\ \text { Trimble HYDROPro navigation software } .\end{array}\end{array}$ |  |
| Vessel: Saint David of London |  |
| Methodology: |  |
| The survey was undertaken in accordance with the standard Emu Environmental Survey Methods and Procedures Numbers 8 and 9 (details are contained within the Company QA Manual and can be inspected on request). |  |
| The DGPS receiver was configured to receive corrections from North Foreland. The transformation from WGS84 to OSGB36 undertaken during the survey used the following Cartesian transformation parameters: |  |
| $\delta \mathrm{X}$ +369.50 <br> $\delta \mathrm{Y}$ -112.50 <br> $\delta \mathrm{Z}$ +434.50 |  |
| The vessel position was continuously updated and logged at regular intervals using Trimble HYDROPro navigation software. |  |
| Outputs |  |
| - Drawing No. J.1.02.0476.01 | Trackplot (Boomer position) |

Table 2.1 Summary of Horizontal Positioning System

### 2.2 Single-channel Seismic Survey

## SINGLE-CHANNEL SEISMIC SURVEY

$\left.\begin{array}{|l|l|}\hline \text { Requirement } & \text { Application } \\ \hline \begin{array}{l}\text { To determine the structure of the sub } \\ \text { seabed geology, particularly fine detail } \\ \text { within the sediments above rockhead. }\end{array} & \begin{array}{l}\text { Surface tow boomer profilers typically provide } \\ \text { seismic images in the top 50 metres of the seabed } \\ \text { (although they can often penetrate much deeper), } \\ \text { with the actual depth of penetration being dependent } \\ \text { upon the nature of the seabed sediments. The } \\ \text { boomer system emits a high frequency (1-5kHz), low } \\ \text { energy pulse. On meeting a boundary separating } \\ \text { material of different density some of the sonar } \\ \text { energy is reflected back to the receiver thus } \\ \text { providing an indication of the depth at which the } \\ \text { signal was reflected. The remaining energy then } \\ \text { penetrates subsequent layers and the same process } \\ \text { continues until all of the sonar energy is dissipated. } \\ \text { Sharp changes in the reflector profile at any point in }\end{array} \\ \text { a record may indicate the presence of a sub-surface } \\ \text { obstruction or abrupt change in the geology. }\end{array}\right\}$

Vessel: Saint David of London
Methodology: The survey was undertaken in accordance with the standard Emu Ltd Survey Methods and Procedures Numbers 8 and 9 (details are contained within the Company QA Manual and can be inspected on request).

The survey grid used for this survey consisted of 5 lines approximately parallel to the river channel and 21 crosslines perpendicular to the axis of the river channel. At the start of the survey trials were undertaken with a Geochirp system, Geoacoustics pinger system and the boomer system described above, to determine the most appropriate source. Throughout the survey the seismic source was towed at a distance of approximately 40 m from the stern of the vessel.

Comments: At the start of the survey numerous towing arrangements, operating frequencies and power output configurations were tried to determine the optimum arrangement for the survey. As conditions varied parameters were adjusted and these changes were recorded in relevant survey logs.

## Outputs

- Thermal paper seismic records
- Digital seismic records
- Drawing Nos. J.1.02.0476.01-8

Table 2.2 Summary of Seismic Survey Methodology

### 3.0 RESULTS

### 3.1 Data Quality

Throughout the survey vessel positioning was of a high quality with an estimated horizontal accuracy of 2.0 to 4.0 m . Navigation checks were carried out at a known location at Gravesend pier on each survey day, these co-ordinates were noted in the Daily Log (Appendix A).

The quality of seismic data obtained during the survey was generally good, with penetrations in excess of 10-15 metres achieved over the majority of the site. This was reduced in areas of acoustic masking (caused by the presence of biogenic gas) where seismic penetration was completely prohibited in places. This was particularly the case towards the west of the site and in data collected along the one survey line across Blyth Sands to the south of the site.

The depth to which meaningful seismic data was obtained was also reduced in shallow areas such as the Blyth Sands by the presence of a seabed multiple across the records at twice the water depth. This effectively prevented seismic data from deeper depths being interpretable.

However, across the rest of the site seismic data quality was of a high standard.

### 3.2 Data Interpretation

### 3.2.1 Seismic Source Trials

At the start of the survey several survey lines were run across an area of known geological conditions with each of three seismic systems. These were:

Geoacoustics pinger system
Geochirp system
Applied Acoustics Boomer system
The pinger system gave high resolution data of the top $1-2 \mathrm{~m}$ of the seabed but beyond that penetration was restricted. Data collected with the Geochirp system was of a lower resolution than the pinger system and penetration was similar. By setting the filters on the boomer system to the higher frequencies $(1500-3000 \mathrm{kHz})$ the data collected was of only slightly less resolution than the pinger and geochirp system but good penetration was achieved. Therefore, this system was used for the survey.

### 3.2.2 Seismic Data Interpretation

The following drawings should be viewed with this section of the report:

Drawing No J.1.02.0476.01
Drawing No J.1.02.0476.02
Drawing No J.1.02.0476.03
Drawing No J.1.02.0476.04
Drawing No J.1.02.0476.05
Drawing No J.1.02.0476.06
Drawing No J.1.02.0476.07
Drawing No J.1.02.0476.08

Trackplot (Boomer Position)
Interpolated Bathymetric Contours
Seismic Profile of Centre Line (Route 2)
Seismic Profiles of Cross-Lines (Lines 11, 14 and 19)
Depth to Seismic Unit 1
Depth to Seismic Units 2 and 3
Depth to Seismic Unit 5 + Isopachs of Seismic Unit 6
Isopach of Seismic Unit 7

Throughout the site many seismic units have been identified. The interpretation described below has not attempted to put the seismic units in to an archaeological context as this is beyond the remit of Emu Ltd's input in to the project.

## Seismic Unit 1

Underlying the whole of the site is a unit, which generally has low levels of seismic reflectivity. Where internal reflectors are identified these are parallel to sub parallel and generally dipping to the southeast. The upper surface of this unit is not marked by a strong, distinct reflector but by a gradual increase in seismic reflectivity. This indicates that there is not a sharp change in density between the two units.

The upper surface of Seismic Unit 1 is between 2 and 22 m below the river bed and generally shallows towards the west.

Other sources of geological information for this area and comparison with other seismic data collected by Emu Ltd in the Thames area indicate that this unit is likely to be London Clay.

## Seismic Unit 2

Overlying Unit 1, throughout the majority of the site, is a unit exhibiting significant levels of seismic reflectivity and little sedimentary structure. This unit is likely to be composed of predominantly sand and gravel and is between 2 and 6 m thick throughout the majority of the site but can reach up to 14 m thick in places.

To the east of the site, the top of the unit is up to 11 m below seabed ( -20 m O.D.) and becomes closer to the surface with distance towards the west. Between chainage 4540 m and 6050 m this unit outcrops at the seabed. Further to the west the unit is exposed intermittently at the river bed and is overlain by up to 8 m of sediments in places.

To the east the surface of this unit is marked by a strong reflector as there is a strong contrast with the unconformably overlying seismic unit (Unit 6) which has a lower level of seismic reflectivity and pronounced sedimentary structures. To the west of the region where it is at outcrop at the seabed Unit 2 is overlain by a unit with similar levels of seismic reflectivity and more sedimentary structure (Unit 6). Due to a lack of sedimentary structures in Unit 2 it cannot be determined whether this interface is unconformable or not.

Unit 2 is also occasionally exposed at the seabed on both the north and south sides of the river where overlain by more recent sediments towards the centre of the channel.

At two locations a paleochannel feature can be determined and traced between adjacent survey lines. The channels cut in to Unit 2 and trend approximately NNW-SSE. Both features are filled with a seismic unit which is fine grained and exhibits little sedimentary structure, likely to be predominantly clay (Unit 3).

The eastern most paleochannel is centred on a line running from approximately 300 m west of the west side of the entrance to Hole Haven to a point approximately 700m to the west of Egypt Bay. This paleochannel is up to 400 m wide and 8 m deep, being deepest towards the west.

The second paleochannel, located approximately 3500 m further west is up to 200 m wide and 4 m deep.

The seismic character of this unit together with other geological information obtained in this area suggest that Unit 2 is likely to be part of a sequence of terrace gravels. Drawings J.1.02.0476.03 and

06 show that the level of the upper surface of this unit varies quite significantly across the site, suggesting that the unit represents several terraces.

## Seismic Unit 3

The predominant seismic characteristics for this unit are that it has low seismic reflectivity and little identifiable sedimentary structure suggesting that this unit is fine grained and likely to be predominantly clay. The unit lies unconformably above Unit 2 on an erosional surface and is present in the vicinity of the two paleochannels described above, predominantly as channel infill. These features can be clearly seen in Drawing No. J.1.02.0476.03.

In the area of the eastern paleochannel the unit is present as paleochannel fill only beneath the middle of the present river channel and its lateral extents are predominantly bounded by the edges of the paleochannel with an upper horizontal erosional surface. At the base of this channel infill is an area of high seismic reflectivity, approximately 3 m thick and 120 m wide which consists predominantly of gravel. Further to the north this unit is not bound by channel edges and extends to within 0.5 m of the river bed over an area approximately 650 m wide and is up to 4.5 m thick. It unconformably overlies Unit 2 and the upper surface dips shallowly to the west below more recent sediments (Unit 5) which conformably overlie it. To the west and north its relationship with other units cannot be determined due to acoustic masking and edge of survey extents, respectively.

In the vicinity of the western paleochannel it is present as channel fill only.
To the south of the centre of the current river channel the nature of this unit cannot be determined, again because of the presence of biogenic gas causing acoustic masking.

## Seismic Unit 4

On the south side of the river a sequence of seismic units can be identified in the eastern most crosslines (19, 20 and 21), which unconformably overlie Units 2 and 3 and pinch out towards the north. To the south they increase in thickness but cannot be determined at the southern most extremes of the lines due to biogenic masking. These units exhibit sedimentary structures in the form of subparallel seismic reflectors which dip to the north suggesting that this is a prograding sequence with sediment movement from south to north over an erosional surface, which marks the top of Units 2 and 3.

The oldest/deepest of these units has been labelled Unit 4. This Unit is up to 3.5 m thick and can be identified over a distance of approximately 200 m in a south-north direction. It has moderate levels of seismic reflectivity and contains parallel to sub-parallel reflectors that dip towards the north. It lies unconformably above Unit2 and Unit 3 (where present) and below Unit 5. The interface with Unit 5 is indistinct and is marked by a gradual transition to a unit which has a higher level of seismic reflectivity and has less distinct sedimentary structures. To the west this unit pinches out as Unit 5 directly overlies Unit 3 on crossline 18.

Unit 4 is likely to represent a prograding sequence of predominantly sand.

## Seismic Unit 5

This unit is another in the prograding sequence identified in the southeast of the site and overlies Unit 4 as described above. Where Unit 4 pinches out to the north it lies unconformably above Units 2 and
3. The thickness of this unit ranges from 0 towards the north where it pinches out to over 5 m towards the south of the survey area.

As it has a reasonably high level of seismic reflectivity and limited sedimentary structures evident it is likely to be a coarse grained lithology probably containing sand and gravel.

To the north this unit extends beyond survey line Route 2, and to the east it is still evident beyond crossline 21 although at this point it does not extend as far north as Route 2. On Route 2 it pinches out between crosslines 20 and 21 and appears to be conformably overlain by Unit 7, suggesting a continuation in approximate predominant direction of sediment movement but a change in grain size.

To the west Unit 7 decreases in thickness to the point where Unit 5 forms the river bed between chainage 6050 m and 6700 m . At chainage 6050 m Unit 5 pinches out as Unit 2 reaches the river bed.

## Seismic Unit 6

This unit has relatively high levels of seismic reflectivity and exhibits little sedimentary structure, suggesting that this unit consists of predominantly sand and gravel. It occurs as the river bed material intermittently to the west of the site. At nearly all locations it overlies Unit 2 and has a reasonably similar seismic character. It also overlies Unit 3 where it is present and at these locations the boundary between the two units is a distinct unconformable surface likely to have been an erosional plane.

Where present this unit occurs as highs in the river bed profile and its lateral extents are truncated by troughs in the river bed profile, which cut through in to Unit 2 below.

## Seismic Unit 7

From chainage 6700 m to the east this Unit forms the riverbed and generally increases in thickness to the east to reach a maximum depth of approximately 10.5 m at the eastern extents of the survey area. In the east, this unit conformably overlies Unit 5 where present, otherwise it unconformably overlies Unit 2. In the west it occurs on the banks to the south and overlies Units 6 where present, otherwise Unit 2.

The seismic character of this unit consists of low to medium seismic reflectivity with distinct parallel to sub-parallel reflectors. These internal reflectors are sub-horizontal over most of the survey area and dip down-slope (northwards) on the banks to the south of the river. To the north this unit tends to be absent.

This unit is likely to be predominantly sand.

### 3.2.3 Seismic Data Interpreted Sequence of Events

In this section an attempt is made to draw all the information described in the section above, in to a likely sequence of events.

Units 1 and 2 are the only units which can be identified throughout the majority of the site. Above this the site can be divided in to two broad regions; East and West Regions, which can be divided by the area at which Unit 2 reaches the river bed.

A possible sequence of events is as follows:
Unit 1 was deposited in a low energy environment and lithified. As the top of this unit is gradational with that above it is likely that the upper part of Unit 1 has been weathered or this part has not lithified to the same extent.

Unit 2 is likely to be a series of terrace gravels that were deposited above Unit 1, throughout the site. As the height of Unit 2 relative to Ordnance Datum varies significantly across the site, this Unit probably represents a series of terrace gravels. As the upper surface of this Unit is unconformable with those above it is likely that there was a period of erosion prior to deposition of the younger sequences identified from data collected during this survey.

Two paleochannel features have been identified cutting in to Unit 2, which have been infilled with Unit 3 which is likely to be predominantly clay. At all locations where identified the upper surface of Unit 3 indicates a period of erosion following it's deposition. The paleochannel to the east has an area of coarse material at the base which may indicate a period of high energy deposition subsequent to erosion of the paleochannel and prior to the deposition of Unit 3 identified in these data.

In the eastern region Units 4 and 5 are located to the southeastern part of the site. These are likely to represent a prograding sequence which can be divided in to two units (4 and 5) with predominant direction of sediment movement from south to north. Unit 4 is limited in its extents and was overlain by a conformable sequence of more coarse sediments (Unit 5).

In the western region the geology is more simple. Unit 2 is overlain by another unit of sand and gravel (Unit 6) which has been eroded in places to expose Unit 2 at the river bed.

To the east Unit 5 was overlain by up to 10.5 m of parallel bedded sand (Unit 7) which thins to the west, occurring only on the banks on the south side of the river.

### 4.0 CONCLUSIONS

A good quality and comprehensive set of seismic data was collected for this project. The detail obtained was high but would require further analysis to derive a comprehensive understanding of the geological processes involved in this area during the depositional period the sediment sequences identified. This report gives an overview of the main components of the seismic information obtained.

Towards the banks of the river and to the west of the site, seismic penetration has been restricted by the presence of biogenic gas. In the rest of the site the data show that the whole area is likely to be underlain by London Clay with several sequences of sediment deposition above. Throughout the site the London Clay is overlain by a seismic unit, likely to be terrace gravels in the top of which two NNW-SSE trending paleochannels have been observed.

In the eastern part of the site several more seismic units have been identified including a prograding sequence in the southeast of the area. In the western part of the site the geology is more simple as localised areas of another seismic unit likely to contain sand and gravel have been identified overlying the terrace gravels. On the banks on the south side of the river Unit 7, consisting predominantly of recent sand deposits, can be seen at the river bed.

## 5.0 <br> AUDIT INFORMATION

| Title: Shell Haven Archaeological Geophysical Survey |  |  |  |  |
| :--- | :--- | :--- | :---: | :---: |
| Report No $:$ | $02 / \mathrm{J} / 1 / 02 / 0476 / 0336$ |  |  |  |
| Job No $\quad:$ | $\mathrm{J} / 1 / 02 / 0476$ |  |  |  |
| Client Contact $:$ | Stuart Leather |  |  |  |
| Project Manager | Angela Proctor |  |  |  |
| Main Report written by | Richard Cooke |  |  |  |
| Report checked by | Angela Proctor |  |  |  |
| Report authorised by | Simon Shaw |  |  |  |
|  |  |  |  |  |

## APPENDIX A

Daily Logs

## APPENDIX B

DRAWINGS




West











# ASSESSMENT OF EFFECTS <br> ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix Q: Enhanced Wreck Site Identification

March 2003

## Draft and Confidential

# ASSESSMENT OF EFFECTS ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

 in respect of the proposed development of
## London Gateway

## Appendix Q: Enhanced Wreck Site Identification

## Draft and Confidential

# ASSESSMENT OF EFFECTS ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix Q: Enhanced Wreck Site Identification

Version: 1.3
Reference:49575 Date: 7 March 2003

## CONTENTS

Contents ..... i
Acknowledgements. ..... ii

1. Background ..... 1
1.1. Introduction ..... 1
1.2. Review of Existing Data ..... 1
1.3. 2002 Sidescan and Magnetometer Survey ..... 2
2. Aims and Objectives ..... 2
3. Methodology .....  2
3.1. Review of PLA database and Existing Sidescan Data ..... 2
3.2. 2002 Sidescan and Magnetometer Survey ..... 3
Aquisition ..... 3
Processing ..... 4
Interpretation ..... 4
4. Results ..... 5
5. Discussion ..... 6
6. Conclusion ..... 8
Appendix I: Resulting List of Sites ..... 9
Appendix II: PLA Data Relating to the Survey Area ..... 16
Appendix III: 2001 Sidescan Anomalies from the Survey Area ..... 29
Appendix IV: 2002 Sidescan and Magnetometer Anomalies ..... 32

# ASSESSMENT OF EFFECTS <br> ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix Q: Enhanced Wreck Site Identification

Version: 1.3
Reference:49575 Date: 7 March 2003

## ACKNOWLEDGEMENTS

Wessex Archaeology gratefully acknowledges the assistance of Richard Cooke and Angela Proctor of Emu Ltd., Nick Shepherd of Oxford Archaeology, Claire Dickinson of Faber Maunsell and Gill Andrews.

Wessex Archaeology gratefully acknowledges the assistance of John Pinder (Port Hydrographer, Port of London Authority).

Stuart Leather prepared this report. The illustrations are by Rob Goller. Antony Firth managed the project for Wessex Archaeology.

# ASSESSMENT OF EFFECTS <br> ARCHAEOLOGICAL HERITAGE: INTERTIDAL AND MARINE 

in respect of the proposed development of

## London Gateway

## Appendix Q: Enhanced Wreck Site Identification

Version: 1.3
Reference:49575 Date: 7 March 2003

## 1. BACKGROUND

### 1.1. Introduction

1.1.1. Further investigations were proposed to enhance the Environmental Assessment of London Gateway, to include Task 5: Enhanced Wreck Site Identification.
1.1.2. Task 5 comprised two elements, a review of existing sidescan survey, and additional sidescan and magnetometer survey. For the purposes of Task 5, the Survey Area comprised the Limit of Deviation (LOD) and an area of proposed dredging extending 2.77 km eastwards along the channel from the Sea Reach No. 1 navigation buoy (Figure 1). The potential for archaeological material in proposed Dredging Areas beyond this Survey Area is not addressed in this report.
1.1.3. Wessex Archaeology was instructed to undertake Task 5 by Faber Maunsell in October 2002.

### 1.2. Review of Existing Data

1.2.1. The existing sidescan data was collected on 29-30 March 2001 by Emu Ltd in the course of geotechnical investigations (see Emu Environment Ltd., June 2001). Although the sidescan data was acquired, no processing occurred until the present study.
1.2.2. In addition to the sidescan data, Wessex Archaeology was provided with a copy of a database of seabed features maintained by the PLA.
1.2.3. Both the existing sidescan data and the PLA data extend beyond the area addressed in the review. Accordingly, both datasets were filtered to include only those sites within the Survey Area.

### 1.3. 2002 Sidescan and Magnetometer Survey

1.3.1. The additional sidescan and magnetometer survey was carried out between 14th - 18th November 2002. Emu Ltd. were contracted to undertake the survey under the supervision of Wessex Archaeology.

## 2. AIMS AND OBJECTIVES

2.1. The aim of the work was to enhance the assessment of the effects on the cultural heritage of the London Gateway proposals.
2.2. The objectives of the survey were:

- to review wreck data held by the PLA;
- to identify anomalies recorded by the 2001 sidescan survey;
- to acquire new, higher resolution, sidescan data and magnetometer data;
- to correlate the results of the above work with the earlier results of deskbased assessment.


## 3. METHODOLOGY

### 3.1. Review of PLA database and Existing Sidescan Data

3.1.1. The PLA data, comprising a revision dated 2002, was supplied via Halcrow. Until the present study, WA had been aware of the PLA data only through extracts in Halcrow reports. Data is exchanged between PLA and UKHO, which was a principal source for WA's earlier deskbased assessment. Consequently, the main expectation was not that 'new' sites might be identified from the PLA data, but that further information could be added to records of wrecks and anomalies already known to the LG project. Data from the PLA and from Wessex Archaeology's earlier desk-based assessment that fall within the Survey Area are shown on Figure 2.
3.1.2. As noted above, the existing sidescan data was collected on 29-30 March 2001 by Emu Ltd.in the course of geotechnical investigations (see Emu Environment Ltd., June 2001). The survey was undertaken from the vessel Wessex Explorer and the equipment comprised a EG\&G 272 side scan sonar fish with a EG\&G 260 thermal recorder interfaced to a Triton Elics digital acquisition and processing system operated at 100 KHz and a range setting of 150 m per channel. Navigation data was supplied through a Leica MX420 Differential Global Positioning System (DGPS) receiver integrated with Trimble Hydro pro survey software. Two survey lines were run giving total coverage of the proposed dredge channel (see Fig. 3). Overlap was obtained in the central 100 m corridor.
3.1.3. The existing sidescan data was processed by Wessex Archaeology and Emu Ltd.on 23-28 October at WA's offices. The data was analysed in Delphmap software, using different gain settings to optimise target recognition. Anomalies were observed, their co-ordinates obtained, and images captured as non-georeferenced .tif files.
3.1.4. Anomalies within the Survey Area were reviewed in conjunction with the results of WA's earlier desk-based studies and the PLA data between 28 October and 8 November. The three datasets were mapped using MapInfo, which also enabled access to background mapping, charts and scheme details. The review was essentially geographical, in that records that coincided when mapped were assumed to relate to a single wreck/anomaly.

### 3.2. 2002 Sidescan and Magnetometer Survey

## Aquisition

3.2.1. The 2002 survey was carried out by Emu Ltd. on behalf of Wessex Archaeology from the survey vessel Avanti between 14th - 18th November 2002. A member of Wessex Archaeology staff was on board the vessel throughout the survey.
3.2.2. The sidescan sonar equipment comprised a EG\&G 272 side scan sonar fish with a EG\&G 260 thermal recorder interfaced to a Triton Elics digital acquisition and processing system. The survey was generally undertaken at 500 KHz and a range setting of 75 m per channel.
3.2.3. A Geometrics G881 caesium magnetometer was interfaced into the navigation computer where the magnetic field strength was recorded. Magnetometers record data corresponding to an area directly below the towfish. The area of detection depends on the density of ferrous material in the anomaly and its proximity to the sensor, as the field strength is proportional to the distance from the source.
3.2.4. Navigation data was supplied through a Leica MX420 Differential Global Positioning System (DGPS) receiver integrated with Trimble HydroPro survey and navigation software.
3.2.5. Four survey lines were run at a spacing of 100 m in the main channel, with the sidescan sonar and the magnetometer operating concurrently. Total coverage of proposed Dredging Areas within the Survey Area was achieved by the sidescan sonar, with overlap in the central 100m corridor (see Fig. 4).
3.2.6. In the area adjacent to the proposed jetty construction, lines were run at a spacing of 100 m . However, the magnetometer was not used in this area in order to facilitate the movements of the survey vessel.
3.2.7. In the area proposed for the channel turning circle, lines were run at a spacing of 150 m . The sidescan sonar and magnetometer were run concurrently. The sidescan sonar was operated at 100 kHz to allow for the increased line spacing.

## Processing

3.2.8. The sidescan sonar data was processed in Triton Elics' Isis and Delphmap software using different gain settings to optimise target recognition. Anomalies were observed, their co-ordinates obtained, and images captured as non-geo-referenced tif files. Anomalies of high archaeological potential, or areas showing scatters of material, were recorded as geo-referenced .tif files.
3.2.9. The magnetometer data was processed to give an $x, y, z$ file comprising NGRs ( $x, y$ ) and magnetic field strength (z). The difference between consecutive values for magnetic field strengths was calculated to minimise the effect of the diurnal variation in the ambient magnetic field. If left unfiltered, such variation would mask local rapid changes in the data indicating magnetic anomalies. The data were plotted with the values represented by graded colour bands to show changes in the magnetic field.

## Interpretation

3.2.10. Anomalies from the 2002 sidescan and magnetometer data were incorporated into a Geographical Information System (GIS) where they were compared, in terms of their character and proximity, to sites arising from the desk-based assessment (DBA), from the PLA database, and from the 2001 sidescan survey. The GIS also enabled all the datasets to be reviewed in conjunction with background mapping, charts and scheme data. This layering is illustrated in Figure 5. As a result it was possible to identify correspondences between DBA/PLA sites and anomalies, new sites, and sites recorded in the DBA/PLA sites with no corresponding features on the seabed.
3.2.11. The consolidated list of sites arising from this process was then assessed in terms of their possible archaeological interest. Sites were rated according to their proximity to recorded sites, size and shape, correspondence between 2001 and 2002 sidescan data, and correspondence with magnetic anomalies.
3.2.12. Ratings were ascribed as follows:

| High | Ascribed when several datasets coincide with the site description in the PLA or DBA suggesting an archaeological origin or sidescan data warrants definite further investigation. Examples are shown in Figure 7. |
| :---: | :---: |
| Medium | A sidescan sonar target with a possible archaeological origin or a weak sidescan target with a magnetometer deflection in close proximity. An example is shown in Figure 8 (top). |
| Low | Comprised an ephemeral or small sidescan sonar target with no corroborating data. An example is shown in Figure 8 (bottom) |
| 0 | Target unlikely to be of archaeological origin. |

3.2.13. It should be emphasised that the identification of a site on the basis of sidescan, magnetometer or previous hydrographic survey does not imply that the site is necessarily of archaeological interest. Many of the sites so identified may prove to be of modern origin, or to be - for example - geological exposures, features attributable to sediment movement, or scars from fishing gear. Some of the sites are, however, clearly of archaeological interest. The form, size and/or extent of anomalies need not enable easy discrimination; a single small but prominent anomaly may comprise all that is present, or it 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 dredging or fishing, for example. The application of a rating system is, therefore, a means of prioritising sites to inform mitigatory investigations.

## 4. RESULTS

4.1. A total of 453 sites fall within the Survey Area. The resulting list is set out in Appendix I of this report. The list includes the rating ascribed to the possible archaeological interest of the site, and cross-refers to the data sources. The distribution of resulting sites in shown in Figure 6. The sites have been rated as follows:

| Rating | Total |
| :--- | :---: |
| High | 25 |
| Medium | 112 |
| Low | 306 |
| 0 | 10 |
|  | $\mathbf{4 5 3}$ |

4.2. Information about 62 of the sites in the Survey Area arises from Wessex Archaeology's previous desk-based assessment. The gazetteer arising from the desk- based assessment is set out in Appendix B of The (London Gateway Port) Harbour Empowerment Order 2002: Assessment of Effects Cultural Heritage in Respect of the Proposed

Development of London Gateway Port Development (CD/HEO/15.1/FINAL).
4.3. Information about 70 of the sites in the Survey Area arises from the PLA database. Relevant sites from the PLA database are set out in Appendix II of this report. PLA and DBA sites falling within the Survey Area are shown on Figure 2.
4.4. Ninety-seven sites in the Survey Area are represented by anomalies in the 2001 sidescan data. Sites from the 2001 sidescan survey falling within the Survey Area are set out in Appendix III of this report (see Fig. $3)$.
4.5. Altogether, 335 anomalies were identified from the 2002 sidescan and magnetometer survey, as set out in Appendix III of this report (see Fig. 4).

## 5. DISCUSSION

5.1. The quality of the 2002 sidescan data was good, enhancing and expanding data from the 2001 survey. A far greater number of anomalies were observed, indicating the value of the higher resolution survey. Issues arising in respect of the data and their archaeological implications are raised in the following paragraphs.
5.2. Anomalies were identified from the 2002 data that were not identified from the 2001 data, but which are corroborated by the PLA data. An example is WA 5026, which corresponds to a PLA record of the remains of a wartime submarine defence (see Fig. 9). Figure 9 also shows clearly the presence of bedforms indicating movement of the seabed. Such movement could cause sites to be periodically covered and uncovered, and explain why some sites appear in the 2001 sidescan data but not the 2002 sidescan data. Further
5.3. Although the proposed Dredging Areas received comprehensive cover, some areas within the Limit of Deviation fell outside the coverage of both the 2001 and 2002 surveys. One site where this was the case is that of the London (5029). The desk-based assessment described the wreck of the London as a 64 gun ship dating to 1665. The PLA database describes the site as the Cannon Wreck but contains very little information. As the site fell outside the cover of the 2001 and 2002 surveys, an sidescan image of the wreck was acquired by the PLA on behalf of Wessex Archaeology. The image clearly shows a large anomaly, proud of the seabed at the reported location of the London (Figure 10).
5.4. The Dovenby $(5010 ; 5012)$ was a barque that sank in 1919 with a cargo of guano from South America. The ship broke in two after a collision and sank in the channel. The accident is well documented in the records of the PLA and UKHO. The ship is represented on the current Admiralty Chart as two distinct areas. Both areas have been swept to confirm the navigable depth of the channel. The sidescan survey undertaken in 2001 clearly shows the two areas of wreckage with the more distinctive 'ship-shape' to the north (Figure 11). The 2002 sidescan and magnetometer survey shows the two sites highlighted in 2001 but in considerably greater detail; individual features and elements of structure are apparent. Also shown is an area containing wreckage (7369) between the two sites that also has a very high magnetometer deflection. This additional area of debris is not apparent in the 2001 sidescan data, or in the PLA or desk-based assessment information.
5.5. The information provided in the DBA and the PLA describes the wreck of the King (5019) as an historic wreck. A cannon was recovered from the site in 1962 and dated to 1636. The PLA suggest that the true name of the vessel is not the King but no other information is given. The existence of a substantial anomaly at the reported location of the King was confirmed by the 2001 sidescan data (see Fig. 12, top). However, the character and extent of the site are more readily apparent in the 2002 sidescan data. There are two apparently discrete areas of wreckage linked by scour and sediment plumes. One area appears quite broken; the other contains a substantial (c. 30m) section of coherent structure likely to be either the base of the hull, or a side. This section is associated with a further area of relatively coherent structure. It is assumed at resent that these areas of structure all have their origin in a single vessel, but it is possible that the remains of more than one vessel is present.
5.6. Far less prominent are the remains of the 'iron bar' wreck (5020) recorded in both the desk-based assessment and the PLA database. The vessel was located in 1978 and is reported to be wooden and carrying a cargo of iron bars. The wreck was 'swept clear', though the officer in charge of dredging 'stated that it could not be guaranteed that all remains of this old vessel had been cleared' (PLA 686). Both the 2001 and 2002 sidescan data show anomalies in the vicinity, confirming that some remains of this vessel appear to have survived (see Fig. 13).
5.7. A similar case is presented by the 'ancient wreck' (5185) identified by the desk-based assessment butreported to have been salvaged. Both the 2001 and 2002 sidescan surveys indicate anomalies in the vicinity that may suggest that some remains of the vessel may survive (see Fig. 14). It is worth noting that without corroboration from the desk-based
assessment, these anomalies are likely to have been rated as of 'low' archaeological interest. It follows that sites currently rated as 'low' or 'medium' may yet prove to be of archaeological interest.
5.8. In addition to 'maritime' anomalies comprising wreck or other shiprelated debris, sidescan also has potential to identify anomalies of possible prehistoric interest. Figure 15 shows the two ends of a long linear anomaly (7509; 7510) that is interpreted as a geological exposure, possibly of a horizon of dense clay or even peat. Given the depth and location of this horizon on the southern side of the channel opposite Shell Haven, it is possible that the anomaly represents a layer that is of palaeo-environmental interest laid down in the Holocene.
5.9. It is worth noting that not all sites identified from the desk-based assessment or PLA data are confirmed by the sidescan surveys. In particular, there is not trace of one of the aircraft (5041) recorded in the desk-based assessment and in the PLA database. Some material may have been removed or otherwise lost as a result of previous clearance or dredging. Other examples may have been covered by mobile sediment at the time of the survey. Further, there remains the possibility that some material of archaeological interest is not susceptible to detection using the methods employed, even if present on the surface of the seabed.

## 6. CONCLUSION

6.1. This study has correlated several datasets and acquired new data that have enhanced the identification of sites of archaeological interest within the Survey Area. A total of 453 sites fall within the Survey Area. The presence, extent and character of some sites of archaeological interest has been confirmed, including the London (5029), Dovenby (5010; 5012), and King (5019). Anomalies have also been confirmed at the reported locations of the 'iron bar' wreck (5020) and 'ancient wreck' (5185). Anomalies and other data indicative of the presence of further sites of archaeological interest have also been detailed, though it should be emphasised that the identification of a site on the basis of sidescan, magnetometer or previous hydrographic survey does not imply that the site is necessarily of archaeological interest The further possibility of the presence of archaeological material not identified in the present study - due to burial, sediment movement or insusceptibility to the techniques employed - has also been raised.
6.2. This study considerably enhances knowledge of the archaeological potential of the Yantlet channel and will facilitate implementation of the Archaeological Mitigation Framework.

## APPENDIX I: RESULTING LIST OF SITES

| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 5007 | 601499180605 | 17 | 88 |  | M |
| 5009 | 600884180646 | 109 |  |  | L |
| 5010 | 597736180652 | 717 | 40 | 415;289 | H |
| 5012 | 597665180831 | 716 |  | 518 | H |
| 5012 | 597754180693 | 716 | 91 | 288 | H |
| 5014 | 598667181061 |  |  |  | L |
| 5019 | 589852180959 | 706 | 98 | 314;369;524 | H |
| 5020 | 589083181079 | 686 | 99 | 318 | H |
| 5021 | 576822181181 | 596 | 124 | 448 | M |
| 5023 | 577362181478 | 604 | 125 |  | M |
| 5024 | 576189181024 |  |  |  | M |
| 5025 | 596152180470 | 713 |  |  | M |
| 5026 | 596150180553 | 712 |  | 297 | H |
| 5027 | 578476181182 | 593 |  |  | M |
| 5028 | 587819181066 | 681 |  | 239 | H |
| 5029 | 590283180961 | 707 |  |  | H |
| 5030 | 575635180980 | 599 |  |  | L |
| 5033 | 573812181448 |  |  |  | L |
| 5035 | 571750180110 | 583 | 3 | 209 | L |
| 5038 | 593097180321 | 766 |  |  | M |
| 5039 | 593447180339 |  |  | 299 | L |
| 5040 | 593369180270 |  |  | 388 | H |
| 5041 | 601412180241 | 18 |  |  | M |
| 5044 | 582981181166 |  |  |  | L |
| 5045 | 598663180827 | 728 |  |  | M |
| 5046 | 599115181000 | 729 | 90 | 513 | M |
| 5049 | 579633181363 | 699 |  |  | L |
| 5050 | 580547181526 | 698 |  | 337 | H |
| 5051 | 576540181289 | 592 | 123 | 221 | M |
| 5148 | 574719181033 | 581 |  | 218 | M |
| 5149 | 573144180797 | 582 |  |  | L |
| 5150 | 578381181137 | 591 |  |  | L |
| 5178 | 578025181472 | 598 |  |  | L |
| 5180 | 578477181209 |  |  |  | L |
| 5181 | 576291181061 | 602 |  |  | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 5183 | 581186181135 | 614 |  |  | L |
| 5185 | 572660180610 |  | 117;116 | 214 | L |
| 5185 | 572660180610 |  | 117;116 | 214 | L |
| 5186 | 587661181138 |  |  |  | L |
| 5189 | 578915181045 |  |  |  | M |
| 5190 | 580330181058 | 610 |  |  | L |
| 5191 | 581282181060 | 615 |  |  | L |
| 5193 | 596637180433 | 791 |  |  | L |
| 5195 | 596181180348 | 794 |  |  | M |
| 5196 | 591675180150 |  |  |  | M |
| 5197 | 592690180148 | 785 |  |  | M |
| 5198 | 595125180237 |  |  |  | L |
| 5201 | 596189180245 |  |  |  | M |
| 5202 | 596092180236 |  |  |  | L |
| 5203 | 595997180215 |  |  |  | L |
| 5204 | 593856180124 | 793 |  |  | L |
| 5208 | 595902180197 | 742 |  |  | L |
| 5213 | 594405180111 |  |  |  | L |
| 5220 | 593516180031 |  |  |  | L |
| 5221 | 593863180042 |  |  |  | L |
| 5222 | 593921180041 |  |  |  | L |
| 5223 | 593849180034 |  |  |  | L |
| 5229 | 584391181079 | 637 |  | 452 | L |
| 5230 | 591475180321 |  |  |  | L |
| 5534 | 587024181471 |  |  |  | L |
| 5588 | 585582180984 |  |  |  | L |
| 5860 | 591901180197 |  |  |  | L |
| 6595 | 602777180075 | 26 | 87 |  | M |
| 6596 | 572700181400 |  |  |  | L |
| 7101 | 572446180464 |  | 1 | 212 | 0 |
| 7102 | 572012180333 |  | 2 |  | L |
| 7103 | 573522180791 |  | 4 |  | L |
| 7104 | 573789180756 |  | 5 |  | L |
| 7105 | 575378181180 |  | 6 |  | L |
| 7106 | 575678181253 |  | 7 | 275 | M |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7106 | 575362181085 |  | 7 | 275;219 | M |
| 7107 | 578329181436 |  | 8;18 | 274 | M |
| 7107 | 575685181195 |  |  | 8 | L |
| 7108 | 575629181199 |  | 9 |  | L |
| 7109 | 572684180705 |  | 10 | 211 | M |
| 7110 | 576162181178 |  | 10 |  | L |
| 7111 | 576162181178 |  | 10 |  | L |
| 7112 | 576415181094 |  | 11 |  | L |
| 7113 | 577195181257 |  | 12 | 449 | M |
| 7114 | 577269181137 |  | 13 |  | L |
| 7115 | 577467181179 |  | 14 |  | L |
| 7116 | 577715181152 |  | 15 |  | L |
| 7117 | 577946181157 |  | 16 |  | L |
| 7118 | 578191181315 |  | 17 |  | L |
| 7120 | 578507181275 |  | 19 |  | L |
| 7121 | 578851181208 |  | 20 |  | M |
| 7122 | 579904181340 |  | 21 |  | L |
| 7123 | 580773181115 |  | 22 |  | L |
| 7124 | 581794181315 |  | 23 | 233 | M |
| 7124 | 581622181124 |  | 23 |  | L |
| 7125 | 571663181029 |  | 120 |  | L |
| 7126 | 590049180740 |  | 25 | 311 | M |
| 7127 | 590496180623 |  | 26 |  | L |
| 7128 | 591643180302 |  | 27 | 475 | H |
| 7129 | 592330180242 | 803 | 28 |  | L |
| 7130 | 592717180262 |  | 29 |  | L |
| 7133 | 593481180196 |  | 32 |  | L |
| 7134 | 595667180382 |  | 33 |  | L |
| 7135 | 596375180407 |  | 34 |  | L |
| 7136 | 596526180601 |  | 35 | 294;408 | 0 |
| 7137 | 597062180537 |  | 36 |  | L |
| 7138 | 597353180569 |  | 37 |  | L |
| 7139 | 597499180555 |  | 38 |  | L |
| 7140 | 597597180634 |  | 39 | 414 | H |
| 7141 | 597993180541 |  | 41 |  | L |
| 7142 | 598054180646 |  | 42 |  | L |
| 7143 | 598537180534 |  | 43 |  | M |
| 7144 | 598799180526 |  | 44 |  | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7145 | 598984180673 |  | 45 |  | L |
| 7146 | 599174180685 |  | 46 |  | L |
| 7147 | 599415180698 |  | 47 |  | L |
| 7148 | 599644180749 |  | 48 |  | L |
| 7149 | 599754180817 |  | 49 |  | L |
| 7150 | 599749180779 |  | 50 | 489;430;431 | 0 |
| 7151 | 600164180740 |  | 51 |  | L |
| 7152 | 600165180725 |  | 52 |  | L |
| 7153 | 600208180552 |  | 53 |  | L |
| 7154 | 600742180370 |  | 54 |  | L |
| 7155 | 600780180383 |  | 55 |  | L |
| 7156 | 601041180427 |  | 56 |  | L |
| 7157 | 601863180075 |  | 57 |  | L |
| 7158 | 602345179870 |  | 58 | 494 | L |
| 7159 | 599762180915 |  | 89 |  | L |
| 7160 | 594338180555 |  | 92 |  | L |
| 7163 | 592769180315 |  | 94 |  | L |
| 7164 | 590723180670 |  | 95 |  | L |
| 7165 | 590706180812 |  | 96 |  | L |
| 7166 | 589999180923 |  | 97 |  | L |
| 7167 | 588588181134 |  | 100 | 320 | L |
| 7169 | 587213181317 |  | 102 |  | M |
| 7170 | 585046181464 |  | 103 |  | L |
| 7171 | 581812181343 |  | 24;104 | 265;260;261 | L |
| 7172 | 584883181501 |  | 105 |  | L |
| 7173 | 584403181485 |  | 106 |  | L |
| 7174 | 583605181347 |  | 107 | 257 | M |
| 7175 | 583369181346 |  | 108 | 258 | L |
| 7176 | 583199181396 |  | 109 | 259 | M |
| 7177 | 581371181594 |  | 110 |  | L |
| 7178 | 577506181508 |  | 111 |  | L |
| 7179 | 575957181390 |  | 112 |  | L |
| 7180 | 573754180838 |  | 113 |  | L |
| 7181 | 573658180866 |  | 114 | 279 | L |
| 7182 | 573600181040 |  | 115 | 208 | L |
| 7183 | 573254181431 |  | 121 |  | L |
| 7184 | 572482181249 |  | 122 |  | L |
| 7213 | 573468181054 | 588 |  | 206;207 | M |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7214 | 576338181071 | 595 |  |  | L |
| 7215 | 576872181151 | 606 |  |  | L |
| 7216 | 581257181310 | 613 |  |  | M |
| 7216 | 581257181310 | 613 |  |  | M |
| 7217 | 581708181310 | 619 |  | 232 | M |
| 7218 | 581865181436 | 702 |  |  | L |
| 7219 | 582981181166 | 694 |  |  | L |
| 7220 | 584113181411 | 802 |  | 329 | M |
| 7221 | 584650181414 | 697 |  |  | L |
| 7222 | 585125181485 | 652 |  |  | L |
| 7223 | 589443181077 | 797 |  |  | L |
| 7224 | 591581180310 | 806 |  |  | L |
| 7225 | 596650180455 | 753 |  |  | L |
| 7226 | 597431180476 | 792 |  |  | L |
| 7227 | 601470180240 | 136 |  |  | L |
| 7301 | 574021181434 |  |  | 200 | L |
| 7302 | 573216181262 |  |  | 201 | M |
| 7303 | 572240180923 |  |  | 202 | L |
| 7304 | 572231180940 |  |  | 203 | L |
| 7305 | 572743181055 |  |  | 204 | L |
| 7306 | 573671181138 |  |  | 205 | L |
| 7307 | 572034180327 |  |  | 210 | L |
| 7308 | 572251180428 |  |  | 213 | L |
| 7309 | 572936180662 |  |  | 215 | L |
| 7310 | 573735180796 |  |  | 216 | L |
| 7311 | 574550180988 |  |  | 217 | M |
| 7313 | 575297181084 |  |  | 220 | L |
| 7314 | 577469181315 |  |  | 222 | M |
| 7315 | 577534181321 |  |  | 223 | L |
| 7316 | 577566181293 |  |  | 224 | L |
| 7317 | 577742181313 |  |  | 225 | M |
| 7318 | 578190181344 |  |  | 226 | L |
| 7319 | 579530181285 |  |  | 227 | L |
| 7320 | 579929181288 |  |  | 228 | M |
| 7321 | 580102181319 |  |  | 229 | L |
| 7322 | 580737181279 |  |  | 230 | M |
| 7323 | 582161181308 |  |  | 231 | L |
| 7324 | 581784181310 |  |  | 234 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7326 | 585806181262 |  |  | 236 | M |
| 7327 | 586244181202 |  |  | 237 | L |
| 7328 | 586169181170 |  |  | 238 | L |
| 7329 | 588015181025 |  |  | 240 | M |
| 7330 | 588496180971 |  |  | 241 | L |
| 7331 | 588617180915 |  |  | 242 | L |
| 7332 | 589187180822 |  |  | 243 | L |
| 7333 | 589546180763 |  |  | 244 | M |
| 7334 | 589737180736 |  |  | 245 | L |
| 7335 | 590051180745 |  |  | 246 | 0 |
| 7336 | 589370180926 |  |  | 247 | L |
| 7337 | 589071180981 |  |  | 248 | L |
| 7338 | 588880181026 |  |  | 249 | L |
| 7339 | 588592181070 |  |  | 250 | L |
| 7340 | 588195181097 |  |  | 251 | L |
| 7341 | 587986181183 |  |  | 252 | L |
| 7342 | 586895181239 |  |  | 253 | L |
| 7343 | 586913181276 |  |  | 254 | L |
| 7344 | 585044181319 |  |  | 235;255 | L |
| 7345 | 584291181387 |  |  | 256 | H |
| 7346 | 582380181355 |  |  | 262 | L |
| 7347 | 581971181412 |  |  | 263 | L |
| 7348 | 581883181363 |  |  | 264 | L |
| 7349 | 580540181387 |  |  | 266 | 0 |
| 7350 | 580374181410 |  |  | 267 | M |
| 7351 | 579969181366 |  |  | 268 | M |
| 7352 | 579975181417 |  |  | 269 | L |
| 7353 | 578740181383 |  |  | 270 | L |
| 7354 | 576324181387 |  |  | 271 | L |
| 7355 | 576203181341 |  |  | 272 | M |
| 7356 | 576013181309 |  |  | 273 | L |
| 7357 | 575484181260 |  |  | 276 | M |
| 7358 | 574651181052 |  |  | 277 | L |
| 7359 | 573928180973 |  |  | 278 | M |
| 7360 | 573424180861 |  |  | 280 | M |
| 7361 | 600541180735 |  |  | 281 | L |
| 7362 | 600215180861 |  |  | 282 | L |
| 7363 | 600148180816 |  |  | 283 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7364 | 600045180860 |  |  | 284 | L |
| 7365 | 599939180918 |  |  | 285 | L |
| 7366 | 599841180837 |  |  | 286 | L |
| 7367 | 598090180745 |  |  | 287 | L |
| 7368 | 597717180720 |  |  | 290 | H |
| 7369 | 597659180705 |  |  | 291 | H |
| 7370 | 597552180678 |  |  | 292 | H |
| 7371 | 597521180725 |  |  | 293 | H |
| 7373 | 596351180563 |  |  | 295 | L |
| 7374 | 596321180584 |  |  | 296 | L |
| 7375 | 593694180366 |  |  | 298 | H |
| 7376 | 592927180367 |  |  | 300 | L |
| 7377 | 597950180738 |  |  | 301 | L |
| 7378 | 591690180397 |  |  | 302 | L |
| 7379 | 592810180311 |  |  | 303 | L |
| 7380 | 592638180414 |  |  | 304 | L |
| 7381 | 592395180469 |  |  | 305 | M |
| 7382 | 591987180444 |  |  | 306 | L |
| 7383 | 591829180487 |  |  | 307 | L |
| 7384 | 591117180576 |  |  | 308 | L |
| 7385 | 590540180660 |  |  | 309 | L |
| 7386 | 590385180709 |  |  | 310 | L |
| 7387 | 589993180933 |  |  | 312 | L |
| 7388 | 590011180883 |  |  | 313 | L |
| 7389 | 589690180964 |  |  | 315 | L |
| 7390 | 589521180960 |  |  | 316 | L |
| 7391 | 589164181092 |  |  | 317 | L |
| 7392 | 588930181070 |  |  | 319 | H |
| 7394 | 588548181188 |  | 101 | 321 | M |
| 7395 | 586553181427 |  |  | 322 | M |
| 7396 | 586417181418 |  |  | 323 | L |
| 7397 | 585667181433 |  |  | 324 | L |
| 7398 | 585486181446 |  |  | 325 | L |
| 7399 | 585339181488 |  |  | 326 | L |
| 7400 | 585136181496 |  |  | 327 | L |
| 7401 | 584886181482 |  |  | 328 | M |
| 7403 | 584120181497 |  |  | 330 | M |
| 7404 | 583617181470 |  |  | 331 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7405 | 583384181445 |  |  | 332 | M |
| 7406 | 582174181506 |  |  | 333 | M |
| 7407 | 582039181461 |  |  | 334 | L |
| 7408 | 581045181471 |  |  | 335 | M |
| 7409 | 580981181516 |  |  | 336 | L |
| 7410 | 580230181513 |  |  | 338 | H |
| 7411 | 579943181477 |  |  | 339 | L |
| 7412 | 579731181532 |  |  | 340 | L |
| 7413 | 579761181469 |  |  | 341 | L |
| 7414 | 579327181526 |  |  | 342 | L |
| 7415 | 579027181532 |  |  | 343 | L |
| 7416 | 578356181532 |  |  | 344 | L |
| 7417 | 578198181551 |  |  | 345 | L |
| 7418 | 578201181529 |  |  | 346 | L |
| 7419 | 577334181502 |  |  | 347 | L |
| 7420 | 576335181460 |  |  | 348 | L |
| 7421 | 576173181463 |  |  | 349 | H |
| 7422 | 575336181359 |  |  | 350 | L |
| 7423 | 575666181360 |  |  | 351 | M |
| 7424 | 574533181205 |  |  | 352 | M |
| 7425 | 572986180845 |  |  | 353 | M |
| 7426 | 571796180514 |  |  | 354 | L |
| 7427 | 589758180693 |  |  | 355 | M |
| 7428 | 589870180720 |  |  | 356 | L |
| 7429 | 590071180718 |  |  | 357 | L |
| 7430 | 590103180688 |  |  | 358 | 0 |
| 7431 | 590189180682 |  |  | 359 | L |
| 7432 | 590214180662 |  |  | 360 | L |
| 7433 | 590232180660 |  |  | 361 | L |
| 7434 | 590296180662 |  |  | 362 | L |
| 7435 | 590471180614 |  |  | 363 | M |
| 7436 | 590195180824 |  |  | 364 | L |
| 7437 | 590067180740 |  |  | 365 | L |
| 7438 | 590040180855 |  |  | 366 | L |
| 7439 | 589961180859 |  |  | 367 | L |
| 7440 | 589908180835 |  |  | 368 | L |
| 7441 | 589705180956 |  |  | 370 | L |
| 7442 | 589684180956 |  |  | 371 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7443 | 589136181081 |  |  | 372 | L |
| 7444 | 589255180972 |  |  | 373 | L |
| 7445 | 589735180917 |  |  | 374 | L |
| 7446 | 590086180742 |  |  | 375 | L |
| 7447 | 590468180640 |  |  | 376 | L |
| 7448 | 590942180513 |  |  | 377 | M |
| 7449 | 591128180504 |  |  | 378 | L |
| 7450 | 591200180481 |  |  | 379 | L |
| 7451 | 591486180423 |  |  | 380 | M |
| 7452 | 591650180453 |  |  | 381 | M |
| 7453 | 592303180281 |  |  | 382 | M |
| 7454 | 592536180255 |  |  | 383 | L |
| 7455 | 592743180307 |  |  | 384 | L |
| 7456 | 592783180294 |  |  | 385 | L |
| 7457 | 592812180303 |  | 31 | 386 | 0 |
| 7458 | 592861180288 |  |  | 387 | L |
| 7460 | 593342180296 |  |  | 389 | L |
| 7461 | 593363180239 |  |  | 390 | L |
| 7462 | 595004180391 |  |  | 391 | L |
| 7463 | 595012180430 |  |  | 392 | L |
| 7464 | 595092180421 |  |  | 393 | L |
| 7465 | 595930180504 |  |  | 394 | L |
| 7466 | 595981180490 |  |  | 395 | L |
| 7467 | 595932180496 |  |  | 396 | L |
| 7468 | 595972180461 |  |  | 397 | L |
| 7469 | 595976180473 |  |  | 398 | L |
| 7470 | 595969180436 |  |  | 399 | L |
| 7471 | 596027180458 |  |  | 400 | L |
| 7472 | 596044180483 |  |  | 401 | L |
| 7473 | 596067180494 |  |  | 402 | L |
| 7474 | 596137180552 |  |  | 403 | L |
| 7475 | 596135180474 |  |  | 404 | M |
| 7476 | 596187180463 |  |  | 405 | M |
| 7477 | 596219180475 |  |  | 406 | M |
| 7478 | 596374180532 |  |  | 407 | L |
| 7480 | 596680180502 |  |  | 409 | L |
| 7481 | 596683180540 |  |  | 410 | L |
| 7482 | 596728180527 |  |  | 411 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7483 | 596854180575 |  |  | 412 | H |
| 7484 | 596961180585 |  |  | 413 | L |
| 7485 | 598744180717 |  |  | 416 | M |
| 7486 | 598787180753 |  |  | 417 | L |
| 7487 | 598960180768 |  |  | 418 | L |
| 7488 | 598942180725 |  |  | 419 | L |
| 7489 | 599062180740 |  |  | 420 | L |
| 7490 | 599157180780 |  |  | 421 | L |
| 7491 | 599163180731 |  |  | 422 | L |
| 7492 | 599196180798 |  |  | 423 | L |
| 7493 | 599210180743 |  |  | 424 | L |
| 7494 | 599226180798 |  |  | 425 | M |
| 7495 | 599326180747 |  |  | 426 | L |
| 7496 | 599486180782 |  |  | 427 | M |
| 7497 | 599560180840 |  |  | 428 | L |
| 7498 | 599860180767 |  |  | 429 | L |
| 7500 | 599969180809 |  |  | 432 | M |
| 7501 | 600047180752 |  |  | 433 | M |
| 7502 | 600160180787 |  |  | 434 | M |
| 7503 | 600186180755 |  |  | 435 | M |
| 7504 | 600180180717 |  |  | 436 | L |
| 7505 | 600233180708 |  |  | 437 | M |
| 7506 | 600333180702 |  |  | 438 | L |
| 7507 | 571630179923 |  |  | 439 | L |
| 7508 | 572422180447 |  |  | 440 | L |
| 7509 | 572515180391 |  |  | 441 | H |
| 7510 | 573226180547 |  |  | 442 | H |
| 7511 | 573066180568 |  |  | 443 | L |
| 7512 | 573060180591 |  |  | 444 | L |
| 7513 | 573540180709 |  |  | 445 | L |
| 7514 | 573523180689 |  |  | 446 | L |
| 7515 | 576358181092 |  |  | 447 | L |
| 7517 | 577757181178 |  |  | 450 | L |
| 7518 | 577776181154 |  |  | 451 | L |
| 7519 | 578722181189 |  |  | 453 | M |
| 7520 | 579027181192 |  |  | 454 | M |
| 7521 | 580117181177 |  |  | 455 | L |
| 7522 | 580375181219 |  |  | 456 | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7523 | 581533181207 |  |  | 457 | M |
| 7524 | 581608181199 |  |  | 458 | M |
| 7525 | 582710181173 |  |  | 459 | M |
| 7526 | 582771181215 |  |  | 460 | M |
| 7527 | 582909181166 |  |  | 461 | M |
| 7528 | 583354181210 |  |  | 462 | M |
| 7529 | 585280181143 |  |  | 463 | M |
| 7530 | 587822180911 |  |  | 464 | L |
| 7531 | 588644180814 |  |  | 465 | H |
| 7532 | 589061180750 |  |  | 466 | M |
| 7533 | 589202180762 |  |  | 467 | M |
| 7534 | 589476180728 |  |  | 468 | L |
| 7535 | 589440180657 |  |  | 469 | L |
| 7536 | 589604180691 |  |  | 470 | L |
| 7537 | 589594180613 |  |  | 471 | L |
| 7538 | 590442180500 |  |  | 472 | L |
| 7539 | 590837180414 |  |  | 473 | L |
| 7540 | 591525180329 |  |  | 474 | M |
| 7541 | 591824180271 |  |  | 476 | L |
| 7542 | 592311180241 |  |  | 477 | L |
| 7543 | 592865180151 |  | 30 | 478 | L |
| 7544 | 596161180376 |  |  | 479 | M |
| 7545 | 596356180409 |  |  | 480 | L |
| 7546 | 596371180440 |  |  | 481 | M |
| 7547 | 596410180433 |  |  | 482 | M |
| 7548 | 596800180590 |  |  | 483 | M |
| 7549 | 598955180664 |  |  | 484 | M |
| 7550 | 599333180727 |  |  | 485 | L |
| 7551 | 599298180641 |  |  | 486 | L |
| 7552 | 599343180657 |  |  | 487 | M |
| 7553 | 599456180673 |  |  | 488 | M |
| 7554 | 600185180637 |  |  | 490 | L |
| 7555 | 602051180040 |  |  | 491 | L |
| 7556 | 602130180005 |  |  | 492 | L |
| 7557 | 602152180005 |  |  | 493 | L |
| 7558 | 602139180050 |  |  | 495 | L |
| 7559 | 597065180683 |  |  | 496 | L |
| 7560 | 597363180726 |  |  | 497 | M |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7561 | 597965180752 |  |  | 498 | M |
| 7562 | 598061180736 |  |  | 499 | M |
| 7563 | 599689180894 |  |  | 500 | L |
| 7564 | 600281180799 |  |  | 501 | L |
| 7565 | 600518180730 |  |  | 502 | M |
| 7566 | 601341180412 |  |  | 503 | L |
| 7567 | 602172180232 |  |  | 504 | M |
| 7568 | 601714180451 |  |  | 505 | L |
| 7569 | 600630180824 |  |  | 506 | M |
| 7570 | 600135180997 |  |  | 507 | L |
| 7571 | 600134180958 |  |  | 508 | L |
| 7572 | 599979180958 |  |  | 509 | L |
| 7573 | 599697181032 |  |  | 510 | M |
| 7574 | 599542181019 |  |  | 511 | M |
| 7575 | 599461181016 |  |  | 512 | L |
| 7576 | 598847180984 |  |  | 514 | L |
| 7577 | 598407180866 |  |  | 515 | L |
| 7578 | 598169180853 |  |  | 516 | M |
| 7579 | 597917180873 |  |  | 517 | M |
| 7581 | 597314180809 |  |  | 519 | M |
| 7582 | 593416180530 |  | 93 | 520 | 0 |
| 7583 | 592515180466 |  |  | 521 | L |
| 7584 | 590689180813 |  |  | 522 | L |
| 7585 | 589980180930 |  |  | 523 | L |
| 7586 | 596569180526 |  |  | 525 | 0 |
| 7587 | 595736181490 |  |  | 526 | M |
| 7588 | 595299181506 |  |  | 527 | M |
| 7589 | 595282181458 |  |  | 528 | M |
| 7590 | 571900181033 |  |  | 529 | 0 |
| 7591 | 571097180577 |  |  | 530 | L |
| 7592 | 571094180598 |  |  | 531 | M |
| 7593 | 571544180558 |  |  | 532 | L |
| 7594 | 571832180522 |  |  | 533 | L |
| 7595 | 571710180525 |  |  | 534 | L |
| 7596 | 573046180352 | 587 |  |  | L |
| 7597 | 573565180507 | 584 |  |  | L |
| 7598 | 572470181498 | 589 |  |  | L |
| 7599 | 572873181416 | 585 |  |  | L |


| WA | NGR | PLA | 2001target | 2002 target | Rating |
| :---: | :--- | :---: | :---: | :---: | :---: |
| 7600 | 573174181347 | 586 |  |  | L |
| 7601 | 585205181594 | 703 |  |  | L |
| 7602 | 593889180076 | 795 |  |  | L |

## APPENDIX II: PLA DATA RELATING TO THE SURVEY AREA

| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5009 | 109 | Located by PLA in 1967. Original report of further details not available, this info. taken from PLA Wreck sheet. Retained for record purposes. |
| 5010 | 717 | This is the south part of the Dovenby last swept by Maplin, close sounded by Chartwell during the 1990 main survey.Remains charted as swept <br> 12.2. See 343-11, north part of wreck. <br> Posn 597733mE 180633 mN . <br> Re-examined 4 December 96 Posn 597734 mE 180659 mN least depth 12.8 scour 18.4 bed 13 to 15 m . This search found less water than on the previous examination but still deeper than the swept depth. Wreckage covers and area $75 \times 65 \mathrm{mtrs} \mathrm{E} / \mathrm{W}, \mathrm{N} / \mathrm{S}$, full extent of the scour not determined. See drawing 113-343-019. <br> H.O. Chart as 12.2 m swept in new fixed position. <br> Wreck Book 3/281 Rpt 5/79,E8/90, 46/96, <br> ***SEE PREVIOUS RECORD FOR ADDITIONAL HISTORICAL INFORMATION*** |
| 5012 | 716 | North part of the Dovenby sunk in 1919. Last swept by Maplin in 1981. Close E/S search during 1990 main survey gave least depth 12.0 m . Remains charted at 11.7 m . Posn 597653 mE 180799 mN <br> Following a visit to the Guildhall Library, Lloyds Register of 1897/8 was being inspected in respect of the HAWKSDALE PLA 209/1, when it was found that her owners/managers were also that of the Dovenby. Lloyds Register lists as follows: <br> Off. No 99313 Code L. MHDK Steel Barque 1653 T Gross 1547 T Net Port of Reg. Liverpool Built 1891 by W Pickersgill of Sunderland Dimensions L 256' B 38.1' D 22' Raised quarter deck Focstle. Bar keel 9.5" Owner P Iredale \& Porter of Mersey Chambers, Old Church Yard, Liverpool. Re-examination 15 October 96 Posn 597642 mE 180809 mN least depth 12.1 scour 17.0 bed 14 to 15 m -wreckage $50 \times 10 \mathrm{mtrs}$ NNW/SSE direction, wreckage fragmented in a well defined scour. <br> H.O. Chart as 11.7 swept wk in new position. <br> Wreck Book 3/280 \& 3/311 Rpt 4/79, 1/81,E7/90, 43/96, |
| 5014 | 720 | Comments in 1979,"Difficult to sweep in a small scour hole, about same level as surrounding sea bed." In 1990 close E/S search deepest water within 10 metres of previous position is 13.5 , general depth 13 m . Considered to have covered, charted as foul - hatch symbol. Wreck Book 3/292 Rpt 16/79,E1 1/90 |
| 5019 | 706 | * This is not the real name. Wreckage identified on charts as "K". <br> Apparently located by E.S. in 1962. A cannon dated 1636 was salvaged from this wreck. Close sounded 15 Feb 1999, least depth in position 589844 mE 180955 mN - to be swept. <br> Wreck book 4/405 <br> Rpts. HS/1/79,E1/90,8/99, <br> 8/99, 23/99, 28/99: Close sounding confirmed former position - see 113-343-024 <br> An awkward sweep made on both flood and ebb before satisfactorily concluded. <br> HO: chart as 10.4 m swept wreck |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5020 | 686 | From past records recorded as an unknown wooden vessel containing a cargo of iron bars. <br> Wreck apparently first located durign periodic survey on Jan.' 78 , and then swept clear 11.2 , bed 12.0 scour $12.4 \mathrm{E} / \mathrm{S} 11.6 \mathrm{~m}$ on 10 th May '78. <br> Posn 589068 mE 181085 mN , examined from Havengore 10 Sept 85 , Rept:- The remains of this wreckage shown on Admiralty chart 1185 as \#, and by PLA as foul on previous 342. Close sounded within radius of 50 mtrs of the above posn. revealed no signs of wreckage. However as the report from the Salvage Officer in charge of the dredging stated that it could not be guarenteed that all remains of this old vessel had been cleared, plus the fact that some signs of debris were evident on the E. Record on subsequent channel surveys 'PLA 125' immediately after the salvage ops. It is recommended that the '\#' remains. <br> No least depth, scour or bed level info. reported. <br> H.O. Agreed. <br> Rpt. HL4/78, 5/85, |
| 5021 | 596 | Charted \# examined as part of 341 main survey October 1998 position examined 576820 mE 181183 mN . <br> Originally located 1971 and allocated Admiralty Wreck No 0033A obstruction 9.1m. Rept. HS $6 / 80$ position 576820 mE 181174 mN least depth 9.7 m a small obstruction not considered dangerous. H.O. Chart as \#. Re-examined 12 Jan 88 least depth 9.8 m position 576817 mE 181184 mN . Rpt HL2/88. <br> Oct 98: An isolated object standing 0.3 m above the bed with some minor scour to the NW. Position located 576823 mE 181181 mN least depth 9.8 bed 10.1 m . <br> Drawing 113-341-073 <br> H.O. Chart as \# symbol in new position. <br> Rpt. HS6/80, HL2/88,56/1998, |
| 5023 | 604 | An unknown obstruction located 45 mtr south of the north channel edge of LCOW Canvey in 1980, least depth 13.8 bed 14.5 m 577368 mE <br> 181485 mN a small obstruction not considered dangerous. Echo record shows a whispy spike standing above the bed. Report dated 21 Nov. 80. <br> H.O Chart as \#. <br> 11 January 88, after extensive search, not found. <br> H.O. Delete from chart. <br> Rpt.: HS7/80, HS3/88, <br> Admiralty wreck card 0028A circa 1971 REMAINS OF MINEFIELD OFF HOLEHAVEN, previous foul confirmed still to exist, 19 August 1971. <br> Information retained for record purposes. |
| 5024 | 597 | Examined as part of 341 main svy, position shown on chart as 576183 mE 181032 mN . <br> A small obs with perhaps a shallow scour sitting 0.3 m proud of the bed in position 576190 mE 181024 mN . Least depth 9.1 bed 9.6 m . <br> Drawing 113-341-072 <br> H.O. Chart as \# in new position. <br> Subsequently found earlier reports:- Aircraft lost 26/12/69, located 4/5/78 while looking for Mid Blyth Buoy, Divers positively identified, part salvaved, some pieces fell off during lifting operations.Least depth 9.6 m Report HS 12/1980. Re-examined 11 Jan 88 when least depth found at 8.7 m . This obstruction is now 0.9 m shallower than when last sounded! Position 576186 mE 181032 mN . <br> Rpt.HS12/80, HS4/88, 55/1998, |
| 5025 | 713 | Originally located by Maplin, a very small obstruction considered to be part remains of boom. H.O. Chart as \#. <br> Rpt. HSR5/81 |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5026 | 712 | This obstruction was located during the normal channel surveys. It has awaited a divers inspection since 1981. An attempt was made by divers but not located. However they did bring to surface what may have been part of the wartime submarine defence hardware, which was located in the vicinity. Posn 596150 mE 180555 mN . <br> Re-examination 4 December 96 confirms the existence and nature of previous findings. Although marginally deeper this search, there is not sufficient evidence to warrant increasing the charted depth, it is recommended to remain at 10.8 m . Additionally Shivering Sand tides not available. Posn 596152 mE 180552 mN least 10.8 scour 12.5 bed 12.1 m . <br> H.O. Agreed- leave charted as 10.8 m in new position. <br> (Oct. 98 Original obstruction report located in old file. Originally found by sidescan, but only located after extremely close sounding.) <br> Re-examined prior to publishing 343 in 1999. Leasty depth 10.8 remains but found in position 3 mors west on a line run E/W. Posn 596149 mE 180552 mN . <br> Rpt. Ob.HSR4/81, 45/96, 7/99, |
| 5027 | 593 | South side of the fairway off NTGB Jetty Canvey, obs is situated 20 mtrs south of the south channel edge, echo shows a spike protruding out of the bed on the cant edge. <br> Original report dated 9 Dec 82, when position given as 578472 181185, least depth 12.1 acour 13.5 bed 13.3 m but current ISO Survey Instructions give position as 578471 mE 181183 mN , hence has there been an updated search in the interim of which the record is missing? <br> Following above comments missing report subsequently found which shows 2 obs standing ourt of the bed in 578473 mE 181180 mN and 578477 mE 181210 mN . <br> HO's instruction of 1982, chart as \# remains in force 1998. <br> Re-examined 7 October 98 an isolated object standing 0.5 m above the bed with a slight scouring to the SE. Position 578476 mE 181181 mN least depth 13.1 m bed 13.6 m <br> Drawing 113-341-071 <br> HO Chart as \# in new position. <br> Rpt: 1HL/1982, 53/1998, |
| 5028 | 681 | Posn 587822 mE 181082 mN The 1985 report - this very small obstn is no longer detectable by E/S. It was never significant, no longer shown on 342 or 125 . Sonar contact No 13 of the Main Svy. is close SSW and is probably all that remains. <br> Retained for reference and information. <br> On 14 April 97 sounding 417 obstruction clearly visible in a scour. Search undertaken on 21 st and the area bottom swept to ensure no stray bits are standing up. The sweep was clear at 11.8 m , weep was collected at 12 m although no fouling of the bed was detected. The result of sounding shows top of obstruction at 12.8 m , scour 14.6 m bed level 11.6 to 12.4 m in the area. <br> H.O. This non dangerous obstruction was swept to ensure that nothing extended above least depth by E/S. This being so, it should be charted as \#. However due to its sensitive position, it should be re-confirmed at each annual 417 survey and properly re-examined after 5 years or when a 417 survey indicates significant change. <br> (October 98, original search report found in old file, this small obstruction found by sonar and verified by E/S 13 Oct. '81. Its scour hole is easily found 'UNLIKE THE OBJECT ITSELF'.) <br> Rpt Ob HS6/81, 9/85, 7/97, <br> **********NOTE PERIOD REDUCED TO 5 YEAR IN THIS SENSITIVE AEA************ |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5029 | 707 | * Name "Cannons" is pseudonym - real name unknown. <br> Reported as an unnatural looking feature 23/11/79. Salvage ops from Yantlet 3/9/80. Divers recovered 2 cannons. "No further salvage work anticipated. Area swept 7th November 1981 <br> Wreck Book 4/406 HSR 2/81 Rpt E2/90 |
| 5030 | 599 | Reference goes back to circa 1980 rpt. HS9 1980, When least depth 10.6 m bed 11.3 m . Small obstruction shown as \# on PLA 118. Search 12 Jan 88 position 575635 mE 180992 mN least depth 9.0 bed 11.0 scour 11.8 m previously charted as \# this survey shows it to be more significant with a scour. <br> Other comments to hand: firm base 1 m high with a 1.5 m wispy tail (equals 2.5 m from bottom of scour to top) <br> HO Chart as suggested 9.0 Obstn. <br> Rpt. HS9/80, HS 1 1/88, |
| 5035 | 583 | From HS Gunfleet F.V. Shepherd Lad fast to the bottom. PLA divers summoned to release nets from this snag. Reported as concrete with reinforcing rods similar to the recent findings at 7-6 Sea Reach. <br> No sign from recent Havengore survey in this position. Unfortunately Havengore working close by was not informed at the time. <br> Position 571746 mE 180077 mN <br> HO Attached to the report in this section the comment "Recovered by Salvage, no sign of remaining debris. <br> This record is entered into DB for historical information in case there is more debris present which later uncovers; no other action required for the present. <br> 21 September 1998, Admiralty Chart is still showing 9.5 obstn PA, a search undertaken to disprove this charted information. Nothing was found and area is considered clear. Drawing 113-340-031 <br> Rpt: 42/1993, 47/1998, <br> 22 July 1993, Bow section of Rustringen recovered from 571746 mE 180077 mN . This is the bit that dropped off while in transit from the Mid Blythe Area to Tilbury: did she have a cement box and re-inforcing in her forepeak? |
| 5038 | 766 | From records this unknown wreck appears to date from 1923 and then was not shown on charts from 1934. Retained on wreck sheet for information. |
| 5041 | 18 | An unknown obstruction fouled by fishermen April 1984 who described it as a 40 foot length of aircraft fuselage. A sonar search of the area and close E/S by Maplin located the obs. <br> 1991 search could not locate the obstruction- 12.9 depth is that in the charted position. H.O.- No action, include soundings in data base. Not disproved, continue charting as 11.9 obstn.- hope to disprove next time. Position 601411 mE 180242 mN . <br> Re-examined by Chartwell 6 April 98. No evidence of the previous wreck found. Area considered insonified with coverage at 5 m spacing. The bed was relatively smooth and shallow sloping over the area with no obvious sign of objects above the bedlevel. <br> HO This obstruction is now considered disproved. Leave in DB for future reference. <br> Drawing 113-201-164 <br> Wreck Bk 3/336 Rpt 1/84, 14/1991, 6/1998, |
| 5045 | 728 | This was located by sonar in the channel between Nos. 1 \& 2 <br> Sea Reach. Close E/S search indicated a small ridge which is considered to have given the soncon. Not charted but retained on file for future sonar identification. <br> Wreck Book 4/413 Rpt E21/90 |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5046 | 729 | Located by sonar, E/S search found 3 small obstructions and scour. The most significant is plotted - does not alter navigational depth but could be a problem to fishermen. <br> Wreck Book 4/414 Rpt E22/90 |
| 5049 | 699 | Located by Chartwell in the channel 2 km west of No 7 Sea Reach near the edge of the 15 m contour , described as a small obstruction standing 0.7 m above the bed. Likely to foul fishing gear being used in the vicinity. Least depth 15.4 m scour 16.5 m bed 16.0 m posn 579633 mE 181363 mN . H.O. Chart as \# . Rpt. 4/95, |
| 5050 | 698 | Found April 1995 by Chartwell during main svy what appears an obstruction standing 1 m proud of the immediate seabed. Least depth 14.0 m general bed level 14.5 m posn 580554 mE 181524 mN <br> H.O. Search <br> Examined July least depth 13.3 m nil scour bed 15 m posn 580542 mE 181527 mN - search showed evidence of a sizeable feature or wreckage on the river bed, the main part stands 1.5 m proud of the bed, measuring 30 by 10 mtrs in a $\mathrm{W} \times \mathrm{S}$ to ExN direction. <br> H.O. Sweep required. <br> Swept by Chartwell 11 April 96 Sweep cleared at 13.1 fouled 13.4, swept in mirror like conditions with little swell, sweep did not part when fouled, but weed present on. This was not resounded during this operation. <br> HO Chart as Swept 13.0 Obstn in position 580542 mE 181527 mN <br> Rpt. 26/95, 69/95,5/1996, |
| 5051 | 592 | 25 april 1996 FV Dudley from Holehaven fouled her trawl, and whil still fast to the bottom Chartwell obtained a position fix. <br> The following search found an area 25 mtrs E/W by $20 \mathrm{mtrs} \mathrm{N} / \mathrm{S}$ with some spikey returns on the echo. <br> The Dudley confirmed there to be traces of rust on her gear when it was recovered. <br> The location is some 40 mtrs south of mid-channel, and close to an isolated 12 m sounding on the preceding survey, indicating the obstruction was in situ then. A divers inspection is considered worthwhile. <br> Position 576552 mE 181298 mN least depth 11.4 m <br> HO Chart as bed feature 11.4 m until proven otherwise, agree divers inspection. <br> 21 May 1996 divers inspected and found a collection of old timber, reinforced concrete and other debris protruding from the sand, thus indicating that the metre high mound is of some age. It does not resemble recent fly dumping, a suggestion as a possible cause, this being on the route of various demolition contrator's route to the Medway with barges of debris. <br> HO Show as \# symbol on 341 and 410 and allocate DB number. <br> Re-examined 7 October 98 as part of main survey 341 least depth 11.5 m bed 12.6 in position 576555 mE 181296 mN . <br> As this was previously fixed with gear attached, and as divers have been sat directly on it previous position is retained for charting. <br> HO Chart as \#. <br> Drawing 113-341-074 <br> Rpt: 6/1996, 22/1996, 57/1998, |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5148 | 581 | This is one of those classical Fisherman's Snags, frquently reported, investigated and nothing found. <br> Documentation on this one dates from 1991, probably reported even before then, when nothing could be found on the echo. <br> Early part of 1997 Chartwell received several reports of vessels with gear fouled in this vicinity. The sidescan was deployed, and a possible return passed to the Yantlet on 30th April. <br> On 1 May Yantlet ran lies at 4 m centres and an obstruction was found in the area identified. There is no scour. Obstn is approx 0.5 m above bedlevel. <br> Least depth 11.7 posiion 574743 Me 181037 mN <br> HO Chart as \# symbol on 340 and 409. <br> Rpt: 11/1997, |
| 5149 | 582 | 1st May 97 FV James Gary reported she was fast to an obstruction in the channel off Shellhaven. Yantlet in locality went alongside and fixed position then ran over the obstruction. <br> E/S return 12.4 in Position 573142 mE 180804 mN showed a small spike in a very slight scour. If the gear had not been attached, under normal sounding conditions such a return would not have been identified as an obstruction. <br> HO This 'snag' has no navigational significance. Chart as \# symbol (for the fishermen's sake) on chart 340 and 408. Rpt: 10/1997, <br> *********Good luck to whoever tries to locate this again !!! ${ }^{* * * * * * * * * * *}$ |
| 5150 | 591 | Located by Chartwell while sounding south of the south channel edge opposite the Gas Jetty Canvey a small obstruction at the bottom of the bank. <br> Position 578385 mE 181140 mN Fixing Microfix <br> HO: Enter in WIS so we don't lose track of it and chart as \# Rpt. 48/1993, |
| 5178 | 598 | First report found is dated 21 st Nov 80, a small obstruction not considered dangerous. <br> 12 Jan 88 close examination of the area revealed 2 very whispy signs of debris. 16.0 m at 578028 mE 181477 mN and 16.3 m at 578021 mE 181465 mN bed level 16.8 m <br> HO Chart as \#. <br> \# Mark on charts to disprove in position 578020 mE 181472 mN . Examined 7 October 1998 when no obstruction was observed within 15 mtrs of the charted position, but two bed features are apparent. <br> Drawing 113-341-070 <br> H.O. There being no sign of any debris in this area the \# is no longer to be charted. Maintain in DB for record pyurposes. Rpt. 52/1998, |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5181 | 602 | 25 November 1980 report HS $13 / 80$ position 576290 mE 181062 mN least depth 9.2 bed 0.4 scour 9.7 m Small obstruction shown on PLA 118 (now 409). DIFFICULT TO FIND. <br> Very small obstruction standing a half metre proud of the cant edge 100 mtrs outside the channel. <br> Possn 576290mE 181062mN <br> H.O. Chart as \#. <br> Rpt. HS 13/80,HS9/88, <br> MAIN SURVEY 1998 <br> Drawing 113-341-075 <br> H.O. There being no sign of any debris in this area the \# is no longer to be charted. Maintain in DB for record purposes. <br> Rpt. 58/1998, |
| 5183 | 614 | Posn given as 581189 E 181136 N , information given as having been a small unknown obstn. least depth 11.1 scour 11.9 bed 11.6 under 1980 report. In 1985 not located; complete insonification of 37 mtr radius nothing found. Obs considered disproved, \# symbol will no longer be shown on charts 341/342 <br> Rpts OB HS4/80, 7/85, <br> Retained for information. |
| 5189 | 594 | South fo the south channel edge opposite the Scars Elbow Buoy, report of 14 Oct 81 records position 578910 mE 181050 mN least depth 11.3 scour <br> 14 bed 13.2 m , : this obstruction is of no navigational significance adn is shown as \# on PLA chart 120. <br> Echo record indicates a substantial spike protruding out of the bed. <br> HO Chart as \# symbol. |
| 5190 | 610 | Very close sounding finally revealed very slight evidence of this small obstruction first found during periodic channel survey. It is not considered worthy of inclusion on either 342 or 120. <br> Posn 580342 m 181017 m least 8.9 bed 9.1 scour 9.3 m . <br> H.O Agreed. <br> It is not charted by PLA yet is shown by the Admiralty on 1185 as foul hatch symbol. <br> Re-examined main svy 95 , search revealed a 9 m shoal patch some 15 mtr round 35 mtrs NNW of the charted foul symbol. No evidence of an obstruction. Least depth 9 m scour $10.5($ ?) bed level 9.3 m posn 580324 mE 181052 mN . <br> Existense or otherwise of obstn not disproved. <br> Rpt. 12/95, |
| 5191 | 615 | Found in 1980 during an interim dredging survey and confirmed as an obstn Oct ' 80 - posn 581306E 181047N least depth 9.2 bed 10.4 m . <br> In 1985 posn 585272E 181047 N least depth 9.6 scour 10.2 bed 10.0 m . Very close sounding reveals more than one piece of wreckage in this area. <br> All are small without significant scour, largest piece found 32 mtrs from previous reported posn. A small circle 'Foul' inserted on 342 (says the report!) <br> Charting: Admiralty have not shown as covered by $342 / 2$. Nothing shown at all on 342 printed copy! <br> Re-examined 95 main svy least depth 9.9 m bed 10.4 m posn 581284 mE 181060 mN - reported as a small area of fragmented debris lyign on a flat river bed prior to the bed shelving to the south. <br> H.O. Chart as \# . <br> Rpt HS5/80, 11/85, 68/95, |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5193 | 791 | 49/99 sounded by Yantlet 28/10/99 investigating channel move <br> See also $343 / 50$ which close by- the two to be searched. <br> 62/99 21/12/99-chart as 11.2 obstruction. <br> The \# 343/50 to be sterilised - this new object to be charted as 11.2 obstn (see drawing 113-343-028) |
| 5195 | 794 | Newob 52/99 - discovered during sounding 28-10-99 <br> Search 61/99 21/12/99 - found obstruction in scour <br> HO: this obstruction is another on the line of the old boom - it is only <br> 40 m south of the S channel edge and so will need to be swept before the channel may be moved south as is proposed. Chart as \# (see 113-343027) |
| 5196 | 733 | A small obstruction on the cant edge to the south side of the channel between $3 \& 4$ Sea Reach. Not investigated closely but charted as hazzard to fishermen. <br> Position 591675 mE 180150 mN depth 6.7 m . <br> Re-examined 25Mar 98 The examination confrimed previous findings but depth improved to 7.4 m Position 591675 mE 180151 mN bed 8.0 H.O. Chart as \#. <br> Wreck Book 4/419 Rpt EO3/90, 32/98, |
| 5197 | 785 | Located by Chartwell during routine survey of $4-3$ Sea Reach on 18th March 97. <br> Divers inspection on 14 th May found an object approx 8 m long standing some 0.7 m above bed, descibed as a spar/wire 100 mm dia. looping up and down in the mud. An eyebolt was retrieved, this having the wire leading through it. The obstruction would appear to require further investigation and salvage retrieval. <br> H.O. This debris might be part of boom defences. Although it is only 38 mtrs clear of the channel it does not pose any threat to surface navigation. Ideally it would be removed, but this can hardly be considered economic. Chart as \#. No action for the time being. <br> Confirmed during sounding for possible channel extension to south $8 / 10 / 99$ ('NEWOB 52/99) least depth 10.2 . If the channel is to be moved this will need to be lifted |
| 5198 | 784 | Located initially by Chartwell while sounding 3-2 S.R. on 24th July 96, clear of the southern fairway. <br> Further exmination 30 July posn 595126 mE 180240 mN least depth 10.2 m scour 11 bed level 10.7 m The obstn. is 10 mtrs in area, possibly Nore <br> Fort debris and an ideal target for the local fisherman to get hooked on when they seasonly work the area. <br> H.O. Chart as 10.2 Obstn. <br> Rrpt. 24/96, 32/96, |
| 5201 | 714 | Located by Maplin, a small obstruction considered to be part remains of the boom. <br> October 98 original Obs report located in old file: located 11 Sep ' 81 least depth 9.2 bed 10.4 scour 10.8 m , similar echo to roll of wire found in this area previously. <br> HO Chart as \#. <br> Rpt OB HSR3/81 |
| 5202 | 746 | Foul bed not charted but retained on wreck sheet. Close to 343/42. Wreck Book 4/432 Rpt EO16/90 |
| 5203 | 743 | The bed is foul in this locality. It has not been charted but retained on wreck sheet for record purposes. Wreck Book 4/429 Rpt EO13/90 |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 5204 | 793 | Found by Yantlet during channel extension survey 28/10/99 <br> Rept 51/99 - Investigate further <br> 21-12-99 close sounded by Chartwell 113-343-029. Confirmed 10.1 in 10.5 plus 2 more minor obstructions with have bee logged at $343 / 95$ \& 96 |
| 5208 | 742 | A small obstruction which could be a problem to fishermen-charted as an obstruction. Wreck Book 4/428 Rpt EO12/90 |
| 5220 | 735 | Debris on bed which is retained for records. Noted on wreck sheet but not charted. Wreck Book 4/421 Rpt EO5/90 |
| 5221 | 796 | Another of the many obstructions in this area of wartime defence debris. Found during the serach for 343/93 (113-343-029) HO chart as \# |
| 5222 | 736 | A small scour to the south of the fairway. Not charted but retained on wreck sheet for record purposes. Wreck Book 4/422 Rpt EO6/90 |
| 5229 | 637 | Svy rpt 12/85:- Previously chated unknown obstn could not be located within a 50 mtr radius. Deleted from charts. Retained for information. <br> Rpt. 12/85, |
| 6595 | 26 | Located by Maplin on sidescan - close search showed a lump with signs of a scour yet no signs of wreckage. Considered to be a bed feature. Least depth 14.0 m , Posn 602786 mE 180078 mN . <br> Re-examined by Chartwell $30 / 11 / 93$ posn 602777 mE 180075 mN least depth 14.2 scour 16.3 bed 15.0 m .; it is a hard target with a considerable scour, stands 2 m from the bottom of the scour. It covers an area $30 \times 15 \mathrm{mtrs}$ in an E/W direction, scour runs ESE/SW. See drawing No. 113-201123. <br> H.O. Consider as bed feature chart now at 14.2 m . <br> Wreck book 3/357 Rpt SR27/83,69/93, |
| 7129 | 803 | Found during Periodic survey SR3-4, divers inspection requested 8/7/02 Rpt 1/02 |
| 7213 | 588 | 17 October 1995 report of a fishing vessel snagged on iron? Position 573404 E181095N <br> In July 99 FV KALISTO was fast to the bottom on the ebb. Search on 1 September 99 found a scour of 3 mtrs deep when run east/west with signs of apparent debris in bottom of scour. Just below bed level on the west side opf the scour is evidence of further debris, and it is assumed this is what the nets were caught on. The suggested area of debris is less than 10 mtrs . The position is some 35 mtrs west of the fixed position of the $F$ Vsl's stern. <br> HO There is very little evedinece of an obstruction associated with this snag, which is located right on the edge of the the Thameshaven anchorage and some 80 mtrs to the north of the North Channel Edge. It should be included in the database but not charted. <br> Retained for record and information [purposes. <br> Rpt .42/99; |
| 7214 | 595 | Uncharted obstruction. No other information. |
| 7215 | 606 | Position 576872 mE 181151 mN on 12 Jan 88 Rpt HL2A/88 search HL2 was extended 57 mtrs ESE. No further evidnece of obstructions was found and it is considered disproved. <br> H.O. Delete from chart. <br> No other reference is quoted with the report.The inference therefore that a second obstruction charted close to $341 / 6$ must be assumed. Information retained for reference and information. |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 7216 | 613 | Information obtained from the 1986 wreck sheet which shows Obstn. Divers reported as lump of concrete - charted as a sounding. No report found and the posn 581257E 181310E is taken from the wreck sheet. <br> Retained here for information. |
| 7217 | 619 | Report HS $1 / 81$ - posn 581718 E 181305 N least depth 9.8 scour nil bed 11.0 m shoal sounding which latterly gained the appearance of an obstruction. Defied dredging by "GEOPOTES $\vee$ ". Divers awaited. <br> Nov 81 -Divers report a very hard lump of concrete like material with evidence of dredging close by. <br> 13 Sept ' 85 Posn 581715 E 181315 N least depth 10.2 scour nil bed 10.9 m - This obstn has been searched for at each 2500 survey since it was first discovered. At first it was easy to find, then it got deeper and became less obvious, until about 2 years ago it could not be found. <br> Now close sounding reveals the least water in the vicinity to be a 10.2 m shoal sounding 12 mtr NNW of former posn. On H.O.'s instructions it has never been designated and obstn. on 121 (2500 svy of area then). However it has defied dredging once soon after its discovery and could so do again. <br> Re-examined during 1995 main survey 342 posn found 581750 mE 181311 mN least depth still 10.2 m bed level 10.8 m Applying new examination criteria, this is at dredging depth for the area, examine every 5 yrs. <br> H.O. Chart as 10.2 m sounding. <br> Rpt. 14/95 <br> Rpt OB HS $1 / 85,6 / 85$, |
| 7218 | 702 | 16 July 1991 FV Twilight Star picked up a girder 6"x6"×20' and lost 150 yds NE of No 7 Sea Reach. Info retained for reference. |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 7219 | 694 | A bed anomaly was first detected in June 1989. It was further investigated on subsequent periodic surveys and was finally completly insonified on $25 / 6 / 90$. Divers investigated from HOOKNESS on 1/8/90. A mound of ballast or similar was reported, and it was charted as a 9.3 m sounding. <br> A periodic survey dated 25/2/92 again revealed signs of debris. Divers again went down. This time a 6.7 mtr long concrete pile weighing 2 tons was recovered on 27/4/92. The area was swept on 10/4/92 at 9.2 m just 7 mtrs south of the south channel edge.Swept posn 582791 mE 181167 mN . <br> Re-investigation $8 / 12 / 94$, least depth 9.8 m , wreckage covers area 30 by 20 mtrs , which depict small bits of debris. Bed level $10 / 11 \mathrm{~m}$. <br> H.O. Re-sweep please. <br> Swept by Chartwell 23/6/94 Posn 582965 mE 181168 mN clear 9.6 foul 9.7 bed 10 to $11 \mathrm{E} / \mathrm{S} 9.8 \mathrm{~m}$ There were no definate fouls of the sweep, numerous times weed was brought to the surface. A sounding lead deployed fouled debris at 10.2 m . Consider the 9.2 m charted depth disproved. <br> H.O. Chart as 9.6 m swept. <br> In October the dredger JETSED worked this area with the aim of trying to improve the depth on this area of debris. The post dredge survey of 30 th <br> October 95 found least water of 10.2 m nil scour bed level 10.4 m . A search report was not created for this work. Drawing 113-414-021 <br> Re-swept by Chartwell 11 April 96, swept in mirror like conditions with very little swell. Sweep parted at 10.3 fouled at 10.1 and cleared with no indication of touching at 10.0 although weed was present on the sweep. Position 582965 mE 181168 mN . <br> HO Chart as swept 10.0 <br> Re-examined 24 September 98 least depth 10.0 m but position found to be 582981 mE 181166 mN . <br> H.O. This area of debris currently charted as swept 10.0 m . It wsa improved from 9.6 m by Jetsed in October 1995. It may be assumed that some siltation has now occurred. However it would be prudent to re-sweep the new high spot to test for snags. Re-sweep when C'well has completed refit. <br> Rpts: Search 4/90, diver's rpt 1/8/90, search 28/92, diver's rpt 30/4/92 (with photos.) sweep 41/92, 40/94, 41/94, 3/1996, 46/1998, <br> 24/99: Reswept - remains as clear at 10 m |
| 7220 | 802 | 9th April 2001 fishing boat fouled nets on this small obstruction in the area of SR6. Divers inspection requested March 2002 Divers found 7T anchor - recovered. Area now considered clear Rpt 2/01 |
| 7221 | 697 | An obstruction recorded as being located in 1989 searched for during 1995 Main Survey of 342 Least depth 11.6 m had been reported in 584650 mE 181414 mN <br> This search found nothing of any significance on a gently sloping bed. <br> H.O. No further action. <br> Rpt. N. Ob.9/89, 53/95, <br> Retained in WIS for future reference only. |
| 7222 | 652 | Information from the 1985/6 wreck sheet: 1967 Divers reported Granite Sets. The 1986 main svy, there was no evidence on sonar. Posn 585125E 181485N. <br> Retained for information - not charted |
| 7223 | 797 | This shoal sounding discovered on a periodic survey 70 m to the N of N channel edge was searched by Chartwell HO: It is not shown on either 342 or 343. Issue CCA and include in database |
| 7224 | 806 | Found during Periodic survey SR3-4, divers inspection requested 8/7/02 Rpt 2/02 |


| WA | PLA | PLA History of Feature |
| :---: | :---: | :---: |
| 7225 | 753 | Located on the south side of the fairway below No 2 SR this is a very small obstruction on the bed and only charted as it is in the channel. Wreck Book 4/439 Rpt EO23/90 <br> 28/10/99 another obstruction traced at 596638180432 - the two to be searched <br> 21/12/99 Search confirmed 343/91 but disproved this one - see drawing 113-343-028 <br> HO - DELETE ALL REFERENCES ON CHART $24 / 12 / 99$ |
| 7226 | 792 | Minor obstruction discovered during channel extension investigation Rept 50/99 <br> Database for future reference |
| 7227 | 136 | Fixed by Chartwell 2-10-92 after FV twilight star had fouled her trawl What appeared to be a bight of 6 cm power cable was slipped. <br> It is logged for information and remains uncharted |
| 7596 | 587 | South of the channel abreast D Jetty Shellhaven a suspected obstruction investigated 24 July 91 nothing found. H.O. Noted. <br> Retained for reference and information. |
| 7597 | 584 | As part of the the Main Survey a charted 3.1 m obstruction in position in 573565 mE 180507 mE is shown on the Admiralty Chart, was examined on <br> 21 September 1998 . Result of the search - nothing found and considered disproved. <br> Drawing 113-340-032 <br> HO Noted. <br> Rpt. 48/1998, <br> This information logged to the data base for reference and information purposes only. <br> Following the foregoing subsequently found previous report of 10th May 1989 - Position 573551 mE 180503 mN least depth 3.1 bed 3.8 scour 3.9 m small obstruction standing at the top of the cant edge. <br> HO. Chart as 3.1 Obstn, divers report required. <br> 16th May 89 Divers report old fishing gear which was not recovered. <br> Rpt. OB4/89 |
| 7598 | 589 | Report of an Obstn close west of W. Blythe Buoy, could be mooring? Retained as info and record purposes. |
| 7599 | 585 | Obstruction located in the vicinty of D Jetty depth 5.8 , bed 7.2 m position 572873 mE 181416 mN , apparently removed 18 December 1989, no other details recorded. <br> Rpt OB 10/89, |
| 7600 | 586 | A small obstruction located 120 mtrs SSE of E Jetty in 1988 and relocated during the 1989 main survey, least depth 8.8 m bed 9.3 scour 9.6 m Position 573174 mE 181347 mN . <br> HO. Make a note to close sound the area at the next Channel survey - if it is still there then chart as \#. Dated 7-3-89. <br> Rpt. SR1/88, 1/340/116/89, <br> Not shown on either 240 or Admiralty chart, retained for reference and information. |
| 7601 | 703 | Found during a turn on a 415 periodic further investigated Area $65 \times 30$ see 113-342-053. |

see 113-343-029

## APPENDIX III: 2001 SIDESCAN ANOMALIES FROM THE SURVEY AREA

| WA | Target | Description |
| :---: | :---: | :--- |
| 5007 | 88 | Anomaly |
| 5010 | 40 | Large rectangularr target with associated scour plume with linear debris to the east |
| 5012 | 91 | Ship wreck - upstanding anomaly. A large plume of coarse material is apparent to the east of the northern end of the target |
| 5019 | 98 | Large thin rectangular shaped anomally |
| 5020 | 99 | Linear anomaly two hard reflective edges in the along track direction |
| 5021 | 124 | Position corresponds to site 5021 - single point reflector |
| 5023 | 125 | Position corresponds to site 5023 very faint small target with other potential debris that may correspond to the description of foul ground- right <br> on the fish track |
| 5035 | 3 | 3 targets joined by a cable - 40m between the targets position is middle tgt |
| 5046 | 90 | Large feature with associated sediment plume - targets to the south west |
| 5051 | 123 | Position corresponds to site 5051 Faint impression on seabed in sand wave area |
| 5185 | 116 | Strong reflector with associated plume |
| 5185 | 117 | Linear cable like reflector |
| 6595 | 87 | Anomaly with shadow |
| 7101 | 1 | Dimensions taken to the centre of triangular outline - possible cables on the bed |
| 7102 | 2 | Dredging or trawl scars bed type sand or gravel |
| 7103 | 4 | Area of heavy scaring remains of furrows causing patches of bright reflectors - the seabed changes to courser material as proceed eastwards - |
| 7104 | 5 | many potential targets |
| 7105 | 6 | Furrow ridge with potential relief |
| 7106 | 7 | Anomaly with scour plume |
| 7107 | 18 | Enomaly with scour plume |
| 7107 | 8 | Anomaly |
| 7108 | 9 | Anomaly with scour plume |
| 7109 | 10 | Anomaly with scour plume plume |
| 7110 | 10 | Shadow coming from centre of target single spike |
| 7111 | 10 | Shadow from point within target |
| 7112 | 11 | Strong reflector with no shadow and radiating plume |
| 7113 | 12 | Rectangular shaped target with strong leading edge |
| 7114 | 13 | Ephemeral elliptical impression on the seabed |
| 7115 | 14 | Anomaly - first of a series potential cable radiating from it |
| 7116 | 15 | Small rectangular shaped target no leading edge |
| 7117 | 16 | Rectangular shaped target blob3 with strong leading edge with 20m cable type of lead in - single line reflector running towards the centre line |
| 7118 | 17 | Faint target in centre of ephemeral debris |
| 7120 | 19 | Two cables likw features crossing |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7121 | 20 | Ridge like image with associated anomaly potential area of interest |
| 7122 | 21 | Small linear target - strong reflector |
| 7123 | 22 | Ephemeral patch encompassing small distinct reflectors |
| 7124 | 23 | Area of small distinct reflectors at end of trawl/dredge scar |
| 7125 | 120 | Anomaly with shadow |
| 7125 | 24 | Target long with reflectors at each end |
| 7126 | 25 | Linear reflector in the along track direction with pronounced reflectors at each end and an associated plume of courser material |
| 7127 | 26 | Group of linear reflectors possibly cable |
| 7128 | 27 | Long drawn out elliptical shape with associated anomalies at the western end - may well be a large wreck |
| 7129 | 28 | Target with associated shadow in front and behind with a 70m linear tail running along track to the west possibly cable |
| 7130 | 29 | Very small target with shadow |
| 7133 | 32 | Scallop impression on the seabed |
| 7134 | 33 | Ephemeral outline |
| 7135 | 34 | Linear target |
| 7136 | 35 | Strong reflector with no shadow |
| 7137 | 36 | Elliptical impression on the seabed |
| 7138 | 37 | Anomaly |
| 7139 | 38 | Area encompassing several features in close proximity position centred on the strongerst reflector |
| 7140 | 39 | Anomaly with thin ridges or spurs eminating from the epicentre - possibly cable |
| 7141 | 41 | Single small anomally with associated linear reflectors eminating to the west - There is also linear debris or feature in the visinity to the south east |
| 7142 | 42 | Large ephemeral target |
| 7143 | 43 | Position of the western point of an ephemeral outline puntuated with strong reflectors at the nodes - encompasses 150 m radius and contains |
| 7144 | 44 | many small anomalies |
| 7145 | 45 | Sinear anomaly |
| 7146 | 46 | Small strong reflector possibly anchor |
| 7147 | 47 | Small strong point reflector with associated plume |
| 7148 | 48 | Linear target on the speckled reflectors forming a cluster with other similar anomalies in the area |
| 7149 | 49 | Linear target with shadow |
| 7150 | 50 | Parallel hard reflectors |
| 7151 | 51 | One in a pair of small reflectors |
| 7152 | 52 | Second small reflector |
| 7153 | 53 | Large anomaly, unclear in nature |
| 7154 | 54 | Small anomaly with scour |
| 7155 | 55 | Small anomaly |
| 7156 | 56 | Line reflector |
| 7157 | 57 | Two anomalies with associated scour |
| 7158 | 58 | Rectangular linear target scour and shadow with an associated anomaly 5m to the east (wreck) |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :---: |
| 7159 | 89 | Linear reflector with possible associated debris |
| 7160 | 92 | Long cable like anomaly |
| 7163 | 94 | Islolated anomaly |
| 7164 | 95 | Isolated anomaly |
| 7165 | 96 | Isolated anomalies |
| 7166 | 97 | Small anomally centre of group |
| 7167 | 100 | Cable like target |
| 7169 | 102 | Boat shaped impression in sand waves |
| 7170 | 103 | Ephemeral linear target |
| 7171 | 104 | Anomaly |
| 7172 | 105 | Cable like anomaly with a small coherent reflector at the western end |
| 7173 | 106 | Bright reflectoer on a ridge |
| 7174 | 107 | Ephemeral rectangular impression |
| 7175 | 108 | Group of small point targets |
| 7176 | 109 | Faint target on featureless seabed |
| 7177 | 110 | Point target with ephemeral outline |
| 7178 | 111 | Isolated anomaly with a sediment plume to the north west other small anomalies to the south east |
| 7179 | 112 | Target to the south west - large depression in the seabed |
| 7180 | 113 | Cable like anomaly possible dredge scar |
| 7181 | 114 | Small linear reflector |
| 7182 | 115 | Point anomalies in a group |
| 7183 | 121 | Series of discreet reflectors with evidence of scour - vessel turning |
| 7184 | 122 | Anomaly |
| 7394 | 101 | Small linear target |
| 7457 | 31 | Rectangular linear target |
| 7543 | 30 | Group of linear reflectors |
| 7582 | 93 | Islolated anomaly |

## APPENDIX IV: 2002 SIDESCAN AND MAGNETOMETER ANOMALIES

| WA | Target | Description |
| :---: | :---: | :---: |
| 5010 | 289 | Wreck corresponds to 716 WA 5010 - the wreck of the Dovenby (northern part) |
| 5010 | 415 | Eastern part of the Dovenby. Mag high, max reading 276nT. |
| 5012 | 288 | Wreck corresponds to PLA 717 WA 5012 - the wreck of the Dovenby |
| 5019 | 524 | King same orientation as the 100 KHz good comparison |
| 5019 | 369 | Image of the King WA 5019 position of the first anomaly with linear sides must be offline 11 at this point and on line 14 on a loop. Mag hit 45 m to the south east. |
| 5019 | 314 | Wreck of the King WA 5019 |
| 5020 | 318 | Group of anomalies not clearly defined possible other targets in the vicinity corresponds to PLA 686 (wooden vessel - iron bars recovered) and WA5020. Mag high 9 m to the south Max 3 nT . |
| 5021 | 448 | Anomaly with shadow - corresponding to PLA 596 (Obstructions) |
| 5026 | 297 | Anomaly corresponds with PLA 712 WA5026-possible submarine boom |
| 5028 | 239 | Target with shadow and scour associated debris in the viscinity corresponds to PLA 681 WA 5028 and WA 5589. Very high mag over target- pos high-low anomally. |
| 5035 | 209 | Area coinciding with Emu 2001 WA 5035 and in the viscinity of pla 583 (Concrete with reinforcing rod) no object observed - area of mobile sediment sand waves in mega ripples in the viscinity |
| 5039 | 299 | Blank area of seabed at the point of WA5039 MTB106 |
| 5040 | 388 | Two point reflectors joined by ephemeral outline |
| 5046 | 513 | Corresponds to PLA 729 (obstruction located by echosounder) WA 5046/5842 and Emu 2001 target 90 wreck shaped object with associated anomalies in the area |
| 5050 | 337 | Ephemeral outline on the seabed corresponding to PLA 698 WA 5050 (Obstruction 1m high) |
| 5051 | 221 | Strong reflector no height corresponds to PLA 592 WA 5051. High 15m to the east near PLA target Max 2.7nT. |
| 5148 | 218 | Target diamond shaped coincides with PLA 581 and WA 5148 |
| 5185 | 214 | No distinct objects - the area coinciding with Emu 2001 WA 5185 evidence of the scour scars from the 2001 image |
| 5529 | 452 | Linear target with other associated debris in an area of prominent seabed features - corresponds to WA5529 PLA 593 (Obstruction) |
| 7101 | 212 | Block on the bed with associated cables coincides with Emu 2001 WA 7101 - West Blythe Buoy |
| 7106 | 275 | Ephemeral outline in the seabed corresponds to Emu 2001 WA 7106 |
| 7106 | 219 | Large ephemeral outline on the seabed - disturbed seabed in the same area as Emu 2001 WA 7105-7108 (no objects found at these positions) |
| 7107 | 274 | Ephemeral shape in the seabed corresponding to Emu 2001 WA 7107 |
| 7109 | 211 | Long rectangular target approximately coinciding with Emu 2001 WA 7109 |
| 7113 | 449 | Area of disturbed seabed group of small anomalies - corresponds to Emu 2001 WA 7113 although not similar signature |
| 7124 | 233 | Linear object with attched cable like feature corresponding to Emu 2001 WA 7124 |
| 7126 | 311 | Block shaped object with linear reflector eminating from its centre - mooring block - coincides with Emu 2001 WA 7126 - other debris in the area |
| 7128 | 475 | Long flat elliptical anomaly with a hard defined edge. No shadow - low profile to bed. Associated debris to the west. Corresp. to Emu 2001 7128 |


| WA | Target | Description |
| :---: | :---: | :---: |
| 7136 | 294 | Block with cable like feature - mooring tackle corresponds to Emu 2001 WA 7136 sea reach No. 2 |
| 7136 | 408 | Large block shaped anomaly with cable like linear feature - possible block for navigation buoy |
| 7140 | 414 | Wreck of the Dovenby Emu 2001 WA 7140 large associated debris scatter second section to the east |
| 7150 | 431 | Strong block reflector with associated cable like feature - Sea Reach No. 1 |
| 7150 | 489 | Reflector with cable like feature - Sea Reach Nol associated with 431430 Emu 2001 WA 7150 |
| 7150 | 430 | Strong reflector with shadow - main feature in a cluster of targets Very high mag, max 242nT 24 m to the north of SR1. |
| 7158 | 494 | Corresponds to Emu 2001 WA 7158.Linear reflector scour and shadow at the eastern end defined anomaly |
| 7167 | 320 | Long linear feature |
| 7171 | 261 | Rectangular shape in the seabed with associated scour and sediment plume to the west- other associated debris in the area - corresponds to Emu 2001 WA 7171 |
| 7171 | 265 | Block with cable corresponds to emu 2001 WA 7171 |
| 7171 | 260 | Area of ephemeral outlines on the seabed corresponding to Emu 2001 WA 7171 |
| 7174 | 257 | Ephemeral outline in the seabed corresponds to Emu 2001 WA 7174 |
| 7175 | 258 | Large area of disturbed seabed with single point reflectors corresponding to Emu 2001 WA 7175 |
| 7176 | 259 | Target in megaripples with ephemeral outline corresponding to Emu 2001 WA 7176 |
| 7181 | 279 | Ephemeral reflector corresponding to Emu 2001 WA 7181 |
| 7182 | 208 | Area coinciding with Emu 2001 WA 7182 no object observed - area of mobile sediment sand waves in mega ripples in the viscinity |
| 7213 | 206 | Ephemeral target with scour coincides with PLA 588 WA 7213 ( Fishing vessel snagged on iron) |
| 7213 | 207 | Target with scour coincides with PLA 588 WA 7213 approx |
| 7217 | 232 | Disturbed seabed corresponding to PLA 619 WA 7217(obstruction area has been dredged) |
| 7220 | 329 | Small reflector corresponding to PLA 802 WA 7220 (fishing boat foul) |
| 7301 | 200 | Debris scatter with navigation pile |
| 7302 | 201 | Strong reflector with scatter or associated debris |
| 7303 | 202 | Small reflector with associated debris |
| 7304 | 203 | Small reflector with scour plume |
| 7305 | 204 | Ephemeral heart shape could be cable with an associated strong reflector |
| 7306 | 205 | Ephemeral shape on the seabed |
| 7307 | 210 | Target in amongst course bedforms |
| 7308 | 213 | Elongated target with posible scour plume |
| 7309 | 215 | Small discreet target with shadow |
| 7310 | 216 | Small target possibly sinker with cable |
| 7311 | 217 | Linear target adjacent to a depression in the seabed - plumes at either end. Mag high 35m to the south east, max 5.4nT. |
| 7313 | 220 | Cable like anomaly |
| 7314 | 222 | Small anomaly - proud of the seabed. Mag high 15m to the north 4.3nT. |
| 7315 | 223 | Anomaly with shadow |
| 7316 | 224 | Linear anomaly with shadow |
| 7317 | 225 | Debris scatter with bright targets. Mag 5m to the north, max 1.5nT. |
| 7318 | 226 | Small reflector with shadow |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7319 | 227 | Cable within an area of strong seabed features |
| 7320 | 228 | Strong reflector with shadow |
| 7321 | 229 | Reflector in area of disturbed seabed |
| 7322 | 230 | Debris field - linear reflectors. Mag high 12 m to the north. |
| 7323 | 231 | Anomaly with shadow and scour |
| 7324 | 234 | Single reflector - no height |
| 7326 | 236 | Box shape section with either plume or cable like feature eminating to the north west - anomalies at regular intevals 80m apart to the east |
| 7327 | 237 | Small area of shadow with surrounding debris |
| 7328 | 238 | Linear impression on the seabed - cable |
| 7329 | 240 | Area showing some form of drag scars with numurous small targets. Mag 50m to the east small descreet mag hit covering distance of 10 m. |
| 7330 | 241 | Semi circular cable like object with other cable like debris to the north |
| 7331 | 242 | Small anomaly with shadow and scour |
| 7332 | 243 | Linear cable like reflectors with strong reflective nodes - features to the north and to the east |
| 7333 | 244 | Cable or edge structure forming open rectangular outline on the seabed |
| 7334 | 245 | Cable like reflector with shadow |
| 7335 | 246 | Block with cable - Sea Reach No.4 buoy |
| 7336 | 247 | Cable like amomalies forming a triangular shaped impression on the seabed |
| 7337 | 248 | Small anomaly with shadow and scour |
| 7338 | 249 | Debris field with potential targets |
| 7339 | 250 | Small target with shadow |
| 7340 | 251 | Linear reflector |
| 7341 | 252 | Three point reflectors joined by a semi circular linear impression on the seabed |
| 7342 | 253 | Block with associated cable like structure |
| 7343 | 254 | Small object with scour ( or sharp edge of a sand wave) |
| 7344 | 235 | Linear cable like reflector |
| 7344 | 255 | Block with associated cable - mooring tackle position corresponds to 235 in a debris field with small strong reflectors |
| 7345 | 256 | Large area of debris or linear target - disturbed seabed - high potential |
| 7346 | 262 | Ephemeral impression on the seabed |
| 7347 | 263 | Linear impression on the bed |
| 7348 | 264 | anomaly with scour possible debris /disturbed seabed 40m to the north |
| 7349 | 266 | Target or cluster of targets - debris field stretching north east |
| 7350 | 267 | Line of posts - joined by depression |
| 7351 | 268 | anomaly with associated scour and shadow |
| 7352 | 269 | Bright reflector with shadow and scour |
| 7353 | 270 | Area of disturbed seabed containing strong reflectors |
| 7354 | 271 | Area of disturbed seabed - debris field |
| 7355 | 272 | Strong reflector with scour. Mag high 23m to the north max 3.0nT. |
| 7356 | 273 | Linear reflector most probably cable |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7357 | 276 | Strong reflector with shadow |
| 7358 | 277 | Anomaly |
| 7359 | 278 | Ephemeral rectangular impression on the seabed with a raised tail to the north |
| 7360 | 280 | Large trapezoidal outline on the seabed with a bright outline and a sediment plume to the west. Mag high 40m to the north, max 6.3nT. |
| 7361 | 281 | Anomaly in homogeneous seabed |
| 7362 | 282 | Bright reflector with shadow and scour to the front |
| 7363 | 283 | Bright reflector with shadow and scour to the front |
| 7364 | 284 | Reflector with cable like features - mooring tackle |
| 7365 | 285 | Ephemeral rectangular impression on the seabed |
| 7366 | 286 | Block like structure with cable - mooring tackle |
| 7367 | 287 | Streak of disturbed seabed |
| 7368 | 290 | Block shaped object associated with the wreck of the Dovenby. Mag high-medium, max 4.7nT. |
| 7369 | 291 | Eastern extent of long linear feature. Mag high, mMax4.7nT. |
| 7370 | 292 | Western extent of long linear feature |
| 7371 | 293 | Elliptical anomaly. Mag high. |
| 7373 | 295 | Block with faint cable like features eminating east and west |
| 7374 | 296 | Small block with cable like feature eminating to the east |
| 7375 | 298 | Elliptical shape on the seabed no shadow or scour associated debris to the north east |
| 7376 | 300 | Ephemeral anomaly with shadow |
| 7377 | 301 | Anomaly on the seabed ( block in character) in two parts |
| 7378 | 302 | Anomaly |
| 7379 | 303 | Anomaly mooring block in character with chain/wire associated |
| 7380 | 304 | Area of seabed features of a curious nature. Scallop pattern on the seabed with well defined edges. Detritus also appears in the tiff to the |
| 7381 | 305 | south |
| 7382 | 306 | Sine of two groups of three posts with impressoin of third set of posts lying opposite |
| 7383 | 307 | Small anomaly - no shadow |
| 7384 | 308 | Small anomaly with shadow |
| 7385 | 309 | Small anomaly ver distinctive edges in area of well defined sand waves |
| 7386 | 310 | Small refector with shadow with two linear impressions eminating from the reflector |
| 7387 | 312 | Area of disturbed seabed |
| 7388 | 313 | Two small anomalies with shadow indicative of a hollow in the bed |
| 7389 | 315 | Small target with shadow other small targets in the vicinity. No mag anomaly. |
| 7390 | 316 | Small target with shadow |
| 7391 | 317 | Streaky type anomaly no shadow - possibly seabed or thick cable like object |
| 7392 | 319 | Group of ephemeral linear targets shadow possibly associated |
| 7394 | 321 | Linear reflector with shadow associated debris at each end |
| 7395 | 322 | Linear reflector with shadow to the west a continuation of the linear reflector 321 |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7396 | 323 | Ephemeral rectangular outline on bed with possible plume |
| 7397 | 324 | Reflector with sediment build up to the west associated disturbance in the seabed to the south and a cable like feature to the north west |
| 7398 | 325 | Linear reflector with shadow other less prominent objects in the area |
| 7399 | 326 | Reflector with shadow in area of prominent sand waves |
| 7400 | 327 | Area of disturbed seabed in region of prominent sand waves |
| 7401 | 328 | Area comprising many targets including long linear feature and prominent targets with shadow |
| 7403 | 330 | Box shaped reflector |
| 7404 | 331 | Large rectangular feature with associated artefacts extending to a 60m across track dimension |
| 7405 | 332 | Large rectangular feature with associated artefacts extending to a 60m across track dimension. Mag high 30m to the north, max 5nT. |
| 7406 | 333 | Area of disturbed seabed two reflectors with shadow |
| 7407 | 334 | Small liner target with cable like feature eminating to the east |
| 7408 | 335 | Well defined area of shadow no strong reflector delineating edges |
| 7409 | 336 | Small strong reflector with shadow |
| 7410 | 338 | Strong linear reflector in large debris field comprising many targets. Mag high 30m to the south east, 2.8nT. |
| 7411 | 339 | Small reflector |
| 7412 | 340 | Cable like reflector |
| 7413 | 341 | Cable like reflector |
| 7414 | 342 | Reflector and associated small items of debris in area of sand wave activity |
| 7415 | 343 | Small reflector with some shadow |
| 7416 | 344 | Reflector with some small targets to the north |
| 7417 | 345 | Ephemeral linear target with shadow |
| 7418 | 346 | Ephemeral elipse on seabed |
| 7419 | 347 | Group of small targets with shadow on crest of sandwave |
| 7420 | 348 | Linear reflector in area with sand waves and many possible small targets |
| 7421 | 349 | Strong linear target with some shadow. Mag high 6m to the south Max 5.9nT. |
| 7422 | 350 | Small reflector |
| 7423 | 351 | Group of linear targets. Possilbly another target on the starboard channel |
| 7424 | 352 | Circular reflector - possible targets/debris to the west |
| 7425 | 353 | Strong reflector with shadow and scour |
| 7426 | 354 | Reflector - probably mooring block with associated chain |
| 7427 | 355 | Rectangular outline with shadow debris in the surrounding area |
| 7428 | 356 | Group of anomalies |
| 7429 | 357 | Small reflector |
| 7430 | 358 | Box shaped reflector with shadow other scattered debris on the tiffs in the viscinity of sea reach No.4. Mag high 13 m to the north west. |
| 7431 | 359 | Anomaly with associated cable like features |
| 7432 | 360 | Anomaly |
| 7433 | 361 | Small strong reflector with shadow |
| 7434 | 362 | Small strong reflector with shadow |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7435 | 363 | Two small long linear reflectors forming an indicative rectangular pattern |
| 7436 | 364 | Small anomaly |
| 7437 | 365 | Anomaly with cable like feature |
| 7438 | 366 | Small linear reflector |
| 7439 | 367 | Small linear target |
| 7440 | 368 | Small target |
| 7441 | 370 | Linear target on the seabed with shadow. No magnetic anomaly. |
| 7442 | 371 | Strong reflector with shadow. No magnetic anomaly. |
| 7443 | 372 | Ephemeral large elliptical outline |
| 7444 | 373 | Linear target |
| 7445 | 374 | Group of linear reflectors |
| 7446 | 375 | Large linear anomaly with cable like feature - other linear targets to the south |
| 7447 | 376 | Anomaly with cable like feature - mooring tackle |
| 7448 | 377 | Ephemeral shape in an area of disturbed seabed with other smaller targets |
| 7449 | 378 | Small target other small targets in the area |
| 7450 | 379 | Target with shadow. |
| 7451 | 380 | Anomaly with scour and a smaller anomaly to the west |
| 7452 | 381 | anomaly with shadow ephemeral shape 15m to the east |
| 7453 | 382 | Group of small refectors |
| 7454 | 383 | Small reflector in an 40mxi00m area of sand waves with other small targets |
| 7455 | 384 | Small target |
| 7456 | 385 | Small target with shadow |
| 7457 | 386 | Target with cable like features - navigation buoy |
| 7458 | 387 | Small reflector with shadow |
| 7460 | 389 | Group of 2 small reflectors with shadow in a line |
| 7461 | 390 | 3 reflector with shadow in line with 389 |
| 7462 | 391 | Small reflector with shadow Mag passed over target no hit. |
| 7463 | 392 | Small reflector |
| 7464 | 393 | Small reflector |
| 7465 | 394 | Small ephemeral reflector |
| 7466 | 395 | Small reflector with some scour |
| 7467 | 396 | Small reflector with shadow |
| 7468 | 397 | Small reflector with shadow |
| 7469 | 398 | Small reflector with shadow in a line with 397 |
| 7470 | 399 | Small reflector in a line with 397 and 398 |
| 7471 | 400 | Strong reflector with shadow |
| 7472 | 401 | Target with shadow |
| 7473 | 402 | Target with shadow |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7474 | 403 | Small anomaly with linear appendage |
| 7475 | 404 | Large block shaped anomaly with scour and shadow |
| 7476 | 405 | Large linear grouping of reflectors with scour and shadow |
| 7477 | 406 | Large block shaped anomaly with scour and shadow |
| 7478 | 407 | Anomaly comprising three points with linear cable like feature with scour - other smaller targets in the area |
| 7480 | 409 | Small reflector |
| 7481 | 410 | Small reflector |
| 7482 | 411 | Small refector with shadow other small anomalies in the area |
| 7483 | 412 | Anomaly with scour and shadow. Mag high Max reading 12nT. |
| 7484 | 413 | Anomaly with scour |
| 7485 | 416 | Anomaly with shadow |
| 7486 | 417 | Cable like feature |
| 7487 | 418 | Group of point reflectors |
| 7488 | 419 | Linear target in area of sand waves and general disturbance |
| 7489 | 420 | Circular outline |
| 7490 | 421 | Cable like feature |
| 7491 | 422 | Reflector with shadow |
| 7492 | 423 | Cable like feature |
| 7493 | 424 | Cable like feature |
| 7494 | 425 | Box shaped target with shadow |
| 7495 | 426 | Small refelctor with shadow in an area of disturbed seabed |
| 7496 | 427 | Anomaly $2 \times$ reflectors with shadow joining them ( box shaped) |
| 7497 | 428 | Small reflector |
| 7498 | 429 | Anomaly with four small anomalies to the north |
| 7500 | 432 | Strong target in a area of disturbed seabed with associated anomalies - debris scatter |
| 7501 | 433 | Irregular shaped anomaly evidence odf scour and shadow to the east 2other strong smaller targets |
| 7502 | 434 | Anomaly with associated anomalies to the east |
| 7503 | 435 | Group of three targets with scour |
| 7504 | 436 | Cluster of four anomalies with a cable like anomaly running to the east |
| 7505 | 437 | Close group of three strong targets with shadow |
| 7506 | 438 | Area of disturbed seabed forming an ephemeral outline |
| 7507 | 439 | Row of three anomalies |
| 7508 | 440 | Block shaped anomaly with associated cable like feature - mooring block for navigation buoy |
| 7509 | 441 | Linear reflector - outcropping geology |
| 7510 | 442 | Linear reflector - outcropping geology |
| 7511 | 443 | Anomaly with shadow |
| 7512 | 444 | Anomaly with shadow |
| 7513 | 445 | Linear reflectors |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7514 | 446 | Closely grouped anomalies with features to the North |
| 7515 | 447 | Mooring block with cable - navigation buoy |
| 7517 | 450 | Long linear anomaly - cable |
| 7518 | 451 | Long linear anomaly - cable |
| 7519 | 453 | Linear target running parallel to the track |
| 7520 | 454 | Long linear anomaly in an area of prominent seabed features |
| 7521 | 455 | Area of disturbed seabed |
| 7522 | 456 | Long linear anomaly with shadow with a cable like feature to the north |
| 7523 | 457 | Strong reflector with shadow and small sediment plume |
| 7524 | 458 | Strong reflector with shadow and small sediment plume |
| 7525 | 459 | Strong target in area of linear features. Mag L/M 55m to the east. |
| 7526 | 460 | Area of disturbed bed with linear targets. Mag L/M 50m to the north. |
| 7527 | 461 | Strong linear target with other debris in the area |
| 7528 | 462 | Strong parallel linear features |
| 7529 | 463 | Anomaly with shadow |
| 7530 | 464 | Cable like anomaly |
| 7531 | 465 | Area of anomalies. High mag on top, possibly 2 nd mag target over 85m span. |
| 7532 | 466 | Anomaly |
| 7533 | 467 | Circular anomaly with scour |
| 7534 | 468 | Linear double parellel reflector - possible pipe |
| 7535 | 469 | Long linear reflector - cable |
| 7536 | 470 | Small anomaly with similar anomaly to the west and east 40m |
| 7537 | 471 | Small mooring block with cables |
| 7538 | 472 | Anomaly with linear cable like feature |
| 7539 | 473 | Anomaly with cable like feature running to the south east |
| 7540 | 474 | Small reflector with shadow associated with 475 |
| 7541 | 476 | Small anomaly with cable like feature. |
| 7542 | 477 | Small reflector with shadow with cable |
| 7543 | 478 | Cluster of small anomalies |
| 7544 | 479 | Confused area of anomalies with shadow. Other smaller targets to the north. Mag high 6m to the north, max 2.17nT. |
| 7545 | 480 | Linear cable like anomaly |
| 7546 | 481 | Tight cluster of three reflectors with shadow. Mag high 13 m to the south, max 2.44nT. |
| 7547 | 482 | Anomaly. Mag high 6 m to the south, max -3.18nT. |
| 7548 | 483 | Area of many small anomalies dimensions less than $2 \mathrm{~m} \times 2 \mathrm{~m}$ |
| 7549 | 484 | Two ball shaped anomalies in close proximity with shadow possibly partly submerged. With partially buried cable running tot the east |
| 7550 | 485 | Small reflector with possible scour |
| 7551 | 486 | Linear reflector |
| 7552 | 487 | Reflector with shadow. |
|  |  |  |


| WA | Target | Description |
| :---: | :---: | :--- |
| 7553 | 488 | Ephemeral shape surrounded by point reflectors |
| 7554 | 490 | Area of disturbed seabed |
| 7555 | 491 | Small reflector with shadow |
| 7556 | 492 | Small reflector |
| 7557 | 493 | Small reflector |
| 7558 | 495 | Cable like anomaly |
| 7559 | 496 | Anomaly with shadow |
| 7560 | 497 | Target with shadow other target to the west and east. Mag high, concentrated area. |
| 7561 | 498 | Anomalous linear target |
| 7562 | 499 | Linear target or group of two targets |
| 7563 | 500 | Anomaly covering large area of seabed - defined linear feature to the south west |
| 7564 | 501 | Cable like reflector |
| 7565 | 502 | Two anomalies corresponds to 281.the eastern target has shadow the western target is a bright linear reflector |
| 7566 | 503 | Group of two small targets with shadow |
| 7567 | 504 | Ephemeral boat shaped impression in the bed |
| 7568 | 505 | Area of disturbed seabed |
| 7569 | 506 | Group of anomalies in line with targets to the east and west |
| 7570 | 507 | Linear anomalyt with associated scattered targets 20m to the west |
| 7571 | 508 | Pair of anomalies |
| 7572 | 509 | Two small reflectors with shadow other debris in the vicinity |
| 7573 | 510 | Disturbance in the pattern of sand waves causing a 50 m sediment plume - other targets In the area |
| 7574 | 511 | Bright linear reflector. Mag high, max 1.7nT $24 m$ to the south west. |
| 7575 | 512 | Mooring block with cable |
| 7576 | 514 | Anomaly or group of two anomalies with scour and a cable like feature |
| 7577 | 515 | Small reflector |
| 7578 | 516 | Cluster of point reflectors forming a patch on the seabed |
| 7579 | 517 | Linear reflector with shadow in area of disturbed sediment with other targets in the vicinity of the Dovenby |
| 7580 | 518 | North section of the Dovenby with associated debris to the Mnorth note the plume from the obstruction. Mag high. |
| 7581 | 519 | Small box shaped anomaly. Mag anomaly to the east. |
| 7582 | 520 | Mooring block corresponds to the SE Leigh navigation marker buoy |
| 7583 | 521 | Cluster of point anomalies |
| 7584 | 522 | Small bright linear cable like reflector |
| 7585 | 523 | Small anomaly |
| 7586 | 525 | Anomaly position corresponds to Sea Reach No.2. Mag anomally 30m to the north in the vicinity of SR. |
| 7587 | 526 | Linear anomaly with scour |
| 7588 | 527 | Anomaly with scour |
| 7589 | 528 | Anomaly with scour |
| 7590 | 529 | Anomaly corresponds to the dolphin |
|  |  |  |


| 7592 | 531 | Anomaly H shaped |
| :--- | :--- | :--- |


| 7593 | 532 | Small linear anomaly with shadow |
| :--- | :--- | :--- |
| 7 |  |  |


| 7594 | 533 | Bright reflector with cable like appendage |
| :---: | :---: | :---: |


| 7595 | 534 | Small linear reflector with other targets in the vicinity |
| :--- | :--- | :--- |

