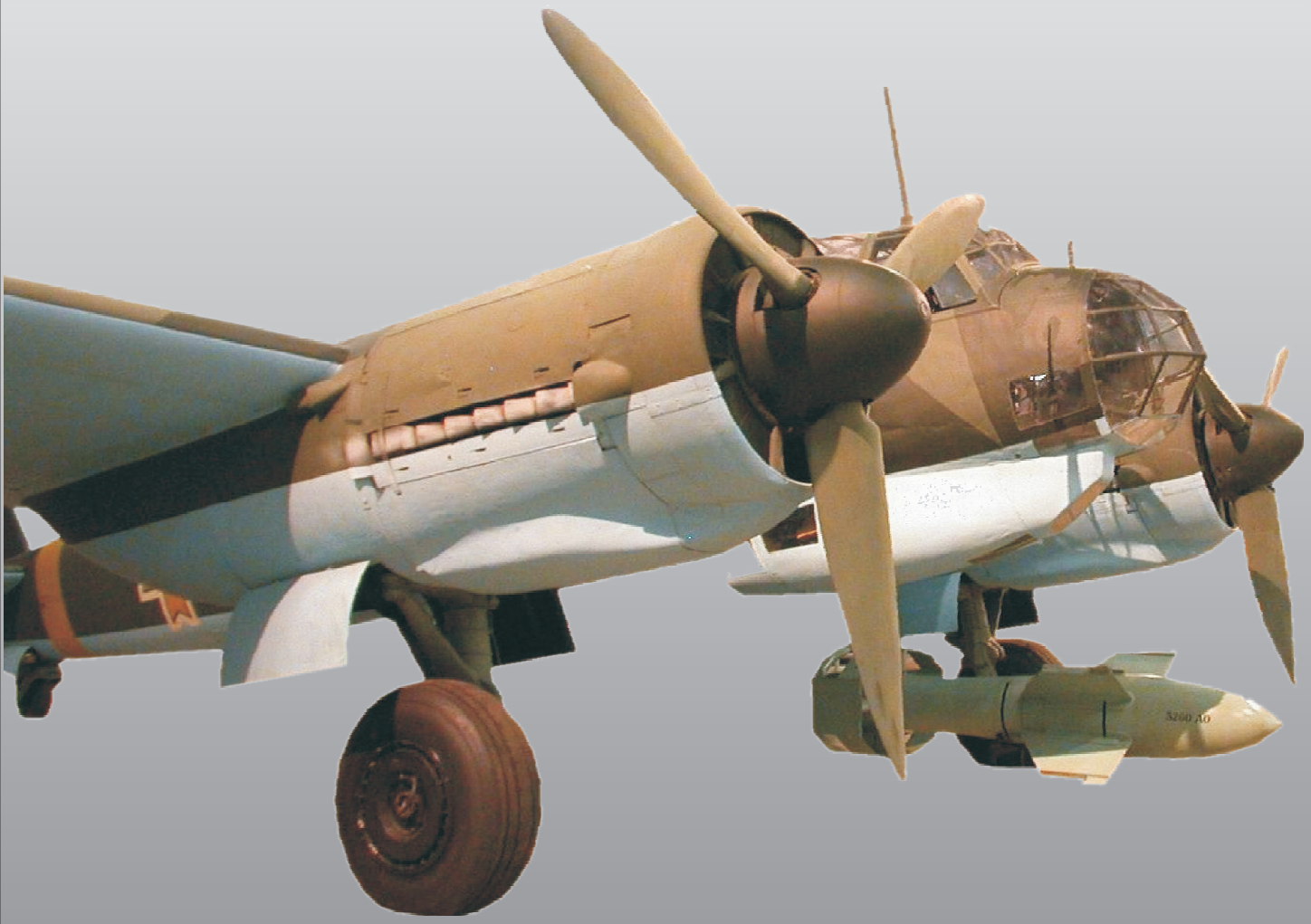
Wessex Archaeology

London Gateway Port: Strike and Track-plot Report

Preliminary Interpretation of Finds



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Summary

Wessex Archaeology (WA) has been commissioned by London Gateway Port Ltd to provide archaeological services in respect of marine works in the course of developing the London Gateway Port and its associated infrastructure.

The key objective of the project was to record and identify finds and anomalies of an archaeological or potentially archaeological nature, to meet the requirements of the regulator's advisor (English Heritage) in respect of cultural heritage and archaeology.

A total of 24 strikes have been recorded during the period April 2010 to May 2011. They included a variety of archaeological material and obstruction notifications (where an impact was recorded but no material was brought to the surface). Some of the material of archaeological interest has clear parallels with material from anomalies and sites already recorded or investigated. Others are likely to represent chance finds or stray items.

As a whole, the material represents a broad range of cultural heritage, dating potentially from the medieval period through to the conflict archaeology of World War II, represented by aircraft remains. It is therefore significant in attesting to the diversity, quantity and concentration of archaeology in the Thames.

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1. BACKGROUND

1.1.1. The Protocol for Archaeological Discoveries (LORDI 2011), initiated in March 2009 (and updated in March 2011), is designed to facilitate reporting and recording of finds of an archaeological nature, or anomalies of a potentially archaeological nature.

1.1.2. The protocol stipulates that if during the dredging process strikes on anomalies were encountered, then a notification procedure should apply, whether or not archaeological material was recovered.

1.1.3. The majority of the finds being reported are apparently isolated and are considered as finds only. However, some reports appear to indicate the presence of coherent material on the seabed - either directly or by virtue of a series of comparable finds being made and have been classed as 'strikes'.

1.1.4. The finds and anomalies in this report have been classed and reported as 'strikes' in line with the Protocol (*ibid*.) and sit within the context of previously recorded sites and anomalies (see **Figures 1** and **2**).

1.1.5. The aim of this document is to provide an assessment of archaeological remains, where recording of a discovery/impact as a 'strike' was considered to be appropriate in the specific circumstances of discovery, and in concurrence with the track-plots provided by Dredging, Environment & Marine Engineering (DEME) and their representatives.

1.1.6. For archaeological purposes, the assignation of 'strike' to an anomaly or find was considered appropriate where:

- a noticeable impact was encountered by the dredging vessel;
- material whose cultural importance is considered to be high was recovered;
- finds considered to indicate possible wreck locations were recovered; and
- finds whose position coincided with known sites or anomalies were recovered.

1.1.7. In particular, the intent is to compare the strike locations with track-plot data, and with known and previously investigated or identified sites or anomalies.

1.1.8. The purpose of this study is as follows:

- provide finds background and origin where possible;
- convey the extent of dredging operations;

- assess whether each track-plot has intersected known anomalies and sites, including those subject to Clearance Mitigation Statements (CMS), during dredging operations;
- where possible correlate track-plot data for finds with possible associations, such as date, origin and scale; and
- illustrate sites that have been intersected by possibly associated strike track-plots on separate occasions.

2. METHODOLOGY

2.1.1. A Protocol for Archaeological Discoveries has been put in place by London Gateway Port Limited (LPGL) and is operated by Wessex Archaeology under the requirements of *Maritime Archaeology Methods and Procedures* (LGPL document ref. LG-WSA-ENV-CEP-C7013-RPT-ARC-3013) hereafter referred to as MAM&P. The protocol is in operation between Zones 1 and 50 and Zones 102 to 109 (see **Figures 1** and **2**).

2.1.2. Notifications of discoveries are sent to Wessex Archaeology (WA) on a protocol proforma accompanied by photographs. The proforma is a Laing O'Rourke-Dredging International Joint Venture (LORDI JV) protocol guideline document that was prepared by LGPL's Marine Archaeological Contractor (WA) as part of the Protocol document (LORDI 2011). The recording forms are then acknowledged to LGPL on receipt.

2.1.3. In cases where the reported finds indicated coherent material of possible archaeological interest, *i.e.* ordnance, human remains, aircraft remains or wreck, these finds were given a Strike Number, beginning with 8000 and additional measures of recording and conservation were given by WA in consultation with LGPL.

2.1.4. When an object has been identified from the LORDI report as requiring a Strike Number, the date and vessel name are used to isolate the track-plot from the Telefleet website (http://app.telefleet.com/Home.html) provided by DEME. The track-plot spreadsheet contains a GPS date and timed position (approximately every five minutes) of each activity undertaken. The position is provided in decimal minutes, with a speed, heading and a dredge status. The terminology used in the dredge status column explains the exact activity: 'Dredging', 'Sailing Full', 'Discarding', 'Sailing empty' and 'Other' (which can mean the vessel operator lifting the dredge head while realigning the vessels course).

2.1.5. The track-plot coordinates were then converted to the WGS 84 UTM 31N format and a GIS shapefile was created.

2.1.6. Where possible, sections of the track-plots were selected to coincide with the areas in which the strike was reported. For example, for the track-plot for the date in which the MG15 machine gun was recovered, the vessel actively dredged within Zones 9 to 11 and 30 to 34. However the LORDI report recorded the artefact to have been recovered from within Zones 31 to 33. In this particular instance the track-plot could then be checked for specific periods between dredging and discharging. For future reporting, it is recommended

that a precise time of impact/discovery is reported to further aid in establishing the *in-situ* location of associated material.

2.1.7. The vessel track-plot positions provided by DEME are converted into polylines within the project GIS, demonstrating the vessel's course throughout the day in which a strike occurred. The exact position of the strikes is difficult to establish without a noticeable impact taking place, but the track-plots can be queried within the project GIS against existing anomaly datasets to indicate possible sources.

2.1.8. A 10m buffer was added to each track-plot. This buffering procedure highlighted those previously recorded anomalies in the vicinity of the drag-head, including those directly intersected by it. However, the track-plot spreadsheet only records the dredging vessel position every five minutes. As a result this only provides an estimated route from one recorded point to the next, assuming a straight line. Considering the manoeuvring limitations of a large dredging vessel and the environment and tidal flow within the Thames, the vessel's course, in reality, is unlikely to be a completely straight one. A buffer will help offset a less than straight vessel course and provide a more realistic coverage of potential anomalies and sites intersected by the drag-head.

2.1.9. An individual spreadsheet of all anomalies intersected was created to help interpret the possible relationship between the finds recovered and those recorded anomalies intersected by the track-plot.

2.1.10. Sites and anomalies are as identified in the course of earlier work for LGPL and held in a database and GIS. Sites and anomalies have been classed previously in terms of Mitigation Groups (See **Appendices I**, **II** and **III**). Some sites and anomalies were subject to further work, summarised in a series of clearance mitigation statements. These are referred to as 'CMS sites' in the text, tables and figures.

2.1.11. Where finds were considered to have a possible association with specific anomalies, the spreadsheets were cross-referenced to see if any patterns of anomalies emerged. The tables demonstrating these procedures are found in **Appendix I**: Strikes Including Artefacts of German Origin and **Appendix II**: 'Week 5' timber assemblages (**Strike 8009-8018**), Carronade (**Strike 8007**) and lead sounding weights (**Strike 8021**). Mitigation groups are covered in **Appendix III**.

3. STRIKES

3.1. STRIKE DEFINITION

3.1.1. The strikes listed below are in date order and relate to events of either the drag-head impacting with a seabed obstruction, or the recovery of an artefact or artefacts considered to be archaeologically significant. In some strike instances there is both an impact and recovered finds, although this is relatively uncommon. It is also difficult to be certain of the relationship between the

striking of an obstruction and the recovery of finds from the drag-head, as there is often some time before the drag-head is recovered and inspected.

3.1.2. In addition, where a large assemblage of timbers was recovered following a sustained period of dredging, this assemblage was subsequently analysed for potential similarities within the collected timbers. Where such similarities could be observed, the assemblage was divided into groups and assigned specific strike numbers. This occurred on only one occasion, where the sub-grouping of a large assemblage provided a greater degree of clarity considering the large area that was dredged.

3.1.3. A table of strike track-plots and anomalies and sites intersecting with each track-plot can be found at **Appendix I**, **II** and **III**.

3.2. STRIKE 8001: OBSTRUCTION

3.2.1. On 21st April 2010 the *Marieke,* whilst dredging in Zone 13, struck an obstruction with its drag-head damaging the drag-head in the process. It was reported under LORDI report 1377.

3.2.2. No finds were recovered as a result of the strike incident. Analysis of the track-plots indicates that the strike possibly took place in the vicinity of site **WA7360.** This anomaly was initially recorded in a geophysical survey in 2002, but was not encountered during the 2007 survey, and was downgraded from 'probable' to 'uncertain in 2008 (see **Appendix IV**). As far back as 2005 it was considered to be a geophysical 'reflection' from a passing vessel (see emails dated 21 November 2005 (WA to PLA) and 03 September 2010 (PLA to LGPL)).

3.2.3. The Port of London Authority (PLA) were requested by LGPL to carry out additional geophysical survey at this location, which at this stage has not been seen by WA.

3.3. STRIKE 8002: TIMBER ASSEMBLAGE

3.3.1. During a watching brief onboard the *Uilenspiegel* between the 4th and 7th of September 2010 a collection of nine timbers was recovered whilst dredging in the proposed shipping channel in Zones 32 to 34.

3.3.2. The timbers were found within dredged material, and were removed and reported following completion of the dredging run. The timbers were assessed by a marine archaeologist at WA and are considered to represent ship's timbers. They show features of ship construction including working, treenails and iron fittings. The timbers are similar in appearance, form and manufacture to a collection of 21 timbers previously recovered (WA_72435_1002) and it is possible that at least some of the timbers formed part of the same structure.

3.3.3. The items were subsequently brought to WA's offices at Salisbury for recording and analysis. Unfortunately the track-plot for this dredging operation was not kept by DEME. The recovered finds are considered to be of archaeological interest as a result of the potential age of the timbers (possibly 19th century or earlier) and due to the collection representing a possible shipwreck, or debris

from a shipwreck. However, without the vessel track-plot, it will be difficult to narrow down the original location of these timbers.

3.4. STRIKE 8003: SQUARE METAL PLATE AND TIMBER

3.4.1. A large metal square plate approximately 120mm thick was brought up with five worked timbers during a watching brief on 31st January 2011 aboard the *Lange Wapper*. It was reported under LORDI report 1590. The dredging took place throughout Zones 31 to 37.

3.4.2. The item is considered not to be of archaeological interest, and probably represents a relatively modern (20th century) stray item from a vessel, debris, or possibly a mooring block.

3.4.3. The timbers were recorded on board the *Lange Wapper* and given artefact numbers from 1097 to 1101; they displayed features representing various maritime functions. These timbers were subsequently brought to WA's facilities at Salisbury, analysed, interpreted and compared with the other timbers that were observed during the watching brief relating to **Strike 8004** and **Strike 8005** (see below).

3.4.4. The quantity of timbers, with many having corresponding dimensions and constructional similarities, meant the entire assemblage of timbers from Strike 8003 were assigned specific strike numbers between **Strike 8009** and **Strike 8018**.

3.4.5. During this day of dredging, 21 anomalies were intersected (see **Figure 3** and **Table 1** below).

Mitigation Group[1]	Zone 31	Zone 36	Zone 37
2.1.1			
2.1.2		7139	7369
2.1.3			
2.1.4a			
2.1.4b	7461, 7542	7559	
2.1.4c	7130	7138, 7225	
2.1.4d	7381		

Table 1: STRIKE_8003 anomalies or sites that were intersected by the drag-head with a 10m buffer. Only the zones in which these intersections occurred are included.

3.5. STRIKE 8004: OBSTRUCTION AND TIMBER

3.5.1. During a watching brief on 1st February 2011 on board the *Lange Wapper* an obstruction was struck by the drag-head of the vessel and an approximate position was given (WSG 84 UTM 31N 350420E, 5706520N). The track-plot shows dredging in Zones 30 - 37. When the drag-head was recovered to the deck 32 worked ship's and/or boat's timbers was identified. It is unclear

[1] For full descriptions see **Appendix IV**.

whether the obstruction and timbers are connected due to the length of the dredge run prior to recovery of the drag-head.

3.5.2. For the duration of the dredging, 43 anomalies were intersected (see **Figure 3** and **Table 2** below).

3.5.3. Although the relationship between the timbers and the obstruction is not certain, as previously noted, the range of timbers with corresponding attributes (recovered between January 31st to February 6th 2011) meant that during the recording process, they needed to be grouped into separate strike numbers (see below, **Strikes 8009 to 8012**) to help clarify their relationships.

3.5.4. The obstruction encountered is considered to be of archaeological interest, due to the subsequent recovery of a range of timber types, which are possibly connected with this strike. The finds related to the strike are discussed in more detail in **Section 3.10**.

Mitigation Group	Zone 30	Zone 31	Zone 35	Zone 36
2.1.1				
2.1.2		**7543**		
2.1.3			7476, 7477, 7544, 7547, 7586	
2.1.4a		7380		
2.1.4b	7382	7453, 7461, 7542	7466, 7467, 7470, 7545	7480, 7481, 7482
2.1.4c		7376		7137, 7138, 7225
2.1.4d		5157		

Table 2: STRIKE_8004 anomalies or sites (those subject to CMSs in bold) that were intersected by the drag-head with a 10m buffer.

3.6. STRIKE 8005: INITIAL TIMBER ASSEMBLAGES

3.6.1. This strike was recorded in conjunction with the LORDI strike report 1614, 'a collection of wooden planks' recovered onboard the *Lange Wapper,* during 'Week 5' of 2011 (January 31st to February 6th 2011). As explained in **Strike 8003** (**Section 3.4**) these timbers were subsequently brought to WA's facilities at Salisbury, where they were recorded and grouped together on the basis of corresponding dimensions and constructional similarities. These groups were assigned individual strike numbers between **Strike 8009** and **Strike 8018** (see -below).

3.6.2. The timber recording process revealed that the timbers recovered from LORDI strike report 1614 contained those worked ship and boat timbers observed during the watching brief on the **Strike 8003** and **Strike 8004** (the first two days of 'week 5' as documented within the LORDI strike report 1614).

3.6.3. The recovered finds are considered to be of archaeological interest due to the presence of ship's timbers. The corresponding track-plots (**Figure 3** and **Figure 4**) indicate intersection of the drag-head with a number of known sites and anomalies (see **Appendix I**).

3.7. STRIKE 8006: GERMAN MG15 MACHINE GUN

3.7.1. LORDI report 1641 recorded the discovery of a German MG15 machine-gun recovered on the 19th January 2011, as the vessel *Uilenspiegel* dredged in Zones 30 to 34 (see **Figure 5**). As the machine-gun was considered likely to represent part of the remains of a military aircraft crash site, which would be automatically protected under the Protection of Military Remains Act (PMRA) 1986, the find was allocated a strike number. The dredging track-plot demonstrated that the drag-head had intersected eight recorded anomalies, all of which were categorised as 'Uncertain'[2]. **Appendix I** below illustrates the anomalies intersected.

3.7.2. The discovery is considered to be of archaeological interest. The MG15 was utilised on 50 Luftwaffe aircraft types between 1934 and 1945, which included three Focke-Wulf (Fw) built aircraft, ten Heinkel (He) variants and eight Junkers (Ju) aircraft variants (http://www.wehrmacht-history.com/luftwaffe/armaments/7.92-mm-mg-15.htm). The bore of the ordnance was 7.92mm.

3.7.3. The current location of the find is at the cross bund store for disposal of ordnance, as there is still live ammunition trapped in the breech and, for this reason, it is not permissible for the item to be delivered to WA. However, discussions with the UXO contractor indicate that there may be the possibility that the machine-gun will not necessarily have to be destroyed during the process of making it safe.

3.7.4. These finds are considered worth further investigation, especially as it is possible that we are dealing with more than one military aircraft crash site in the dredging zones. If proven, military aircraft remains are automatically protected under the PMRA and it is an offence to disturb such crash sites.

3.7.5. **Figure 6** illustrates the proximity of the dredge track-plots to the MG15, the VDM Prop-hub (**Strike 8020**), and the Mauser C96 pistols (**Strike 8008**) - all potentially connected - with the location of CMS Site **7543** 'German Aircraft', overlain with multibeam bathymetry showing anomalies.

3.8. STRIKE 8007: CARRONADE

3.8.1. LORDI reported a 'carronade' (reports 1641/1691) recovered on 19th February 2011 by the dredger *Uilenspiegel* within Zones 29 to 36. The track-plot shows dredging activity throughout Zones 26 to 36 (see **Figure 7**).

[2] Used for anomalies and fouls, where there appears to be anomalous features on the seabed, but where the character of the anomalies is difficult to ascribe with certainty to any of the other categories, archaeological or non-archaeological.

3.8.2. The cast iron carronade discovered carries the admiralty or 'broad' arrow[3] on the upper surface of the gun between the trunnions. Other markings on the gun include the number '33' on the chase (upper face towards the muzzle) and some partial marking on the two trunnions of '?38' and '177?'. These are possibly dates, sizes or weights and naval gun numbers.

3.8.3. Carronades were squat, large bore, short range cannon that were first developed at the Carron Iron Company on the banks of the River Carron in Falkirk. Although lacking accuracy and range these guns were very effective during close quarter confrontations, splintering hulls and masts. They quickly earned the nickname 'Smashers'. Utilised for nearly a century from the 1770's, the carronade was eventually rendered obsolete with increased performance of breech loading ordnance (Blackmore 1976).

3.8.4. Trunnions on an Admiralty carronade are an early feature and probably suggest that this gun was cast before 1782/3, which is among the earliest carronades used on board Navy vessels. It may be difficult to establish whether this cannon came from a ship or from a smaller vessel, as many carronades placed aboard Naval vessels were not included in the gun lists. Carronades were also used aboard shallower draught vessels due to the small crew needed to fire them (Gardiner 1992).

3.8.5. The find clearly originated from an Admiralty vessel and is an early example of the weapon type, and is therefore of archaeological interest. The large extent of the dredging area covered means the track-plot passes closely and intersects 22 sites and anomalies (see **Table 3**), the majority of which are recorded as 'uncertain'. It is unlikely that the carronade was associated with **5230** 'Brick Barge', which is considered to be late 19th or early 20th century, or the '?Submarine Boom' **7547**.

3.8.6. The find does not appear to have been damaged in antiquity, which possibly eliminates the suggestion of it being purposely discarded. Although there are plausible explanations as to why it may have become a stray find, such as the jettisoning of the cannon from a vessel taking on water, It is more likely that it originates from a shipwreck site. It may be associated with timbers recovered from the dredge channel between January 31st to February 6th 2011, specifically large component timbers (indicating a large vessel) such as those within the assemblage for **Strike 8013**.

[3] The Admiralty Arrow or Broad Arrow was used to identify *materiel* belonging to the British Crown since at least the Tudor period and possibly earlier. The mark, also known as the 'crow's foot' was used on all types of government property, and later its use was extended throughout the British Commonwealth.

Mitigation Group	Zone 26	Zone 27	Zone 28	Zone 29	Zone 30	Zone 34	Zone 35
2.1.1							
2.1.2					**5230**, 7540		
2.1.3							7547
2.1.4a							
2.1.4b			7334,7430, 7534, 7535	7127, 7431, 7432, 7433, 7434	7384	7462	7545
2.1.4c	7329	7532	7428	7164			7134
2.1.4d			7332	7385			

Table 3: STRIKE_8007 anomalies or sites (those subject to CMSs in bold) that were intersected by the drag-head with a 10m buffer.

3.9. STRIKE 8008: MAUSER M30 (C96)

3.9.1. A collection of 15 Mauser M30 (C96) semi-automatic pistols and their original stocks (which doubled as storage cases) was recovered aboard the *Lange Wapper* on the 19th February 2011 after dredging operations in Zones 29 to 36 (LORDI report 1641). The dredging track-plot for this particular day indicated activity throughout Zones 27 to 36, but it is not possible to narrow the location further (see **Figure 8**).

3.9.2. The number of anomalies intersected on this occasion totalled 19 (see **Table 4** below). Of these anomalies, site **7139** 'Unknown (?Dovenby)' in Zone 36 is thought to be associated with CMS site **5010**/**5012** 'Dovenby' which includes a large debris field of anomalies in Zone 37.

3.9.3. As the Mausers were stored in their wooden stocks and stacked in pairs, this would suggest they were in storage during transit at the time of loss either within an aircraft or ship. Serial numbers on the weapons have been identified stamped upon the lock mechanism frame comprising of five and six figure numbers (26201, 40689, 76566, 321879, 32293?, 391???) and three digit numbers/letters on the hammer (04C, 06?). Such markings may possibly indicate manufacture before and possibly during the First World War (http://www.g6csy.net/).

3.9.4. The overall number of Mauser C96s that were manufactured between 1896 and 1937 is difficult to ascertain as it is believed all manufacturer and corporate records were destroyed at the central plant in 1945 by the U.S. Army.

3.9.5. It is known that in 1915 after the outbreak of war some 150,000 were ordered by the German Army. Collectors have since been cautious to assign dates to pistols with serial numbers as it is believed Mauser skipped serial numbers when sales dropped, in order to appear popular during market fluctuations (http://www.ai4fr.com/main/page_home.html).

3.9.6. Overall the current condition of the Mausers C96s is relatively good, although much of the thinner and softer metal has corroded away. X-ray analysis illustrated that one of the Mausers has a shorter barrel, approximately 100mm, than the other 14 pistols with a 140mm long barrel. Internet sources document

shorter (99mm) barrelled Mauser C96 as commonly attributed specifically to a contract for the Bolshevik's and named 'Bolo' because of this.

3.9.7. It has been suggested the 99mm barrel was the knock-on effect of the Treaty of Versailles restrictions on gun production within the newly formed Weimar Republic (http://www.ai4fr.com/main/page_home.html), which could provide a *terminus post quem* of around 1920. However some internet sources believe production for the Russian communists began as early as 1906, therefore expanding the range of provenance further (http://www.g6csy.net/).

3.9.8. The finds are considered to be of archaeological interest. It is possible that the pistols were part of a vessel's onboard magazine or armoury. The *Dovenby* was dispersed by explosives and later wire swept after it collided and sank in November 1914. The pistols could be associated with this vessel and any debris field resulting from the previous clearances.

3.9.9. The *Dovenby* was an ocean going commercial steel sailing barque. During a large scale world conflict and the subsequent lack of security at sea, an armoury of weapons were probably necessary in the various oceans in which ships like the *Dovenby* would have plied their trade.

Mitigation Group	Zone 28	Zone 31	Zone 34	Zone 35	Zone 36
2.1.1					
2.1.2					7139
2.1.3				7586	
2.1.4a					
2.1.4b	7334, 7427	7453, 7454, 7461	7463	7374, 7469, 7472, 7545	7481, 7482
2.1.4c		7130		7134, 7135	
2.1.4d	7332	5197			

Table 4: STRIKE_8008 anomalies or sites (those subject to CMSs in bold) that were intersected by the drag-head with a 10m buffer.

3.10. STRIKE 8009 TO STRIKE 8018: TIMBER ASSEMBLAGES

3.10.1. As noted above, a number of worked timbers were reported through LORDI report 1614 as being recovered during 'Week 5'. This assemblage was believed to have been recovered between the 31st January and 6th February 2011 with some elements observed during a watching brief on the 31st January and 1st February (see **Figures 3** and **4**). They were later picked up on the 24th February 2011 from LGPL. The timber assemblage exhibits attributes that may be from several different vessels, some of which may be of notable size and age. Therefore, where corresponding dimensions and constructional similarities were recorded, the timbers were grouped and assigned specific strike numbers between **Strike 8009** and **Strike 8018**. The corresponding strike numbers are as follows:

- **Strike 8009**: (Group A) – clinker floor frame and similar timbers.
- **Strike 8010**: (Group B) - slender frames of carvel construction.
- **Strike 8011**: (Group C) - planking approximately 60mm to 40mm thick.

- **Strike 8012**: (Group D) - various functional timbers with similar dimensions and treenails.
- **Strike 8013**: (Group E) - large components.
- **Strike 8014**: (Group F) - damaged timbers with worked features but unknown function.
- **Strike 8015**: (Group G) - possible pier/ jetty structure.
- **Strike 8016**: (Group H) - timber stumps.
- **Strike 8017**: (Group I) - assorted timbers.
- **Strike 8018**: (Group J) - artefacts, fixtures and fittings.

3.10.2. Within the assemblages, there are notable examples of both clinker and carvel construction, with functional components such as knees, a chock/buttress, breasthook, stringers and hull planks.

3.10.3. One timber in particular, a clinker floor timber, indicates the greatest potential for a vessel from the medieval period (**Strike 8009** (Group A), find number, 1127). It displays a tight angled conversion with an offset limber hole to one side that formed part of either the bow or stern. The timber has comparable moulded and sided dimensions to the medieval ship timbers that were discovered during excavations in Dublin in 1974-76, and is also similar in construction to those found in Newport in 2002 and Drogheda in 2006 (Holger Schweiter pers. comm. and Trett 2010). The timber is certainly from a vessel with the scantlings of that of a small ship (McGrail 1993). This makes the discovery of definite archaeological interest.

3.10.4. Many of the timbers demonstrate a mixture of environmental conditions in which they were deposited, with several showing excellent states of preservation consistent with an anaerobic conditions provided by deposits of alluvial or marine sediment, before they were broken clear of their associated assemblage. The clinker floor timber is no exception, with a forward/after face heavily eroded and eaten by borers indicating long periods of exposure, while the opposing side and outboard faces showing a relatively intact original surface, with tool marks clearly visible within rebates.

3.10.5. Attempting to narrow the location of such a large and mixed timber collection with the track-plots for the seven days of dredging has proved to be difficult. The track-plots show that dredging occurred predominately between Zones 28 and 36, with Zones 11, 9 and 10 also dredged on the 5th and 6th of February. During this week of dredging there were 103 occurrences when the track-plot intersected anomalies (see **Appendix II**) with some anomalies intersected as many as four times (see **Appendix III**).

3.10.6. Possible timber sites that may have been encountered included the group of anomalies of ‘probable’ archaeological nature, associated with CMS Site **5230** ‘Unknown (?Brick Barge)’ and described after geophysical surveys undertaken by WA in 2001 and 2002 as ‘possibly a large wreck’ and further site investigation by WA (Wessex Archaeology 2008a). Of the large amount of timbers recovered during this week it is possible some may be associated with the Brick Barge or another vessel wrecked in the vicinity and directly related to

these recorded anomalies. The site was cleared by the PLA in 2010 (Thames Discovery Programme 2010).

3.10.7. Of the six anomalies considered of 'possible' archaeological origin, **7476**, **7477**, **7544**, **7546**, **7547** and **7586**, all are associated with the CMS site 'submarine boom' (**5195**) and are therefore not associated with the large timber assemblages.

3.11. STRIKE 8019: OBSTRUCTION

3.11.1. On the 19th November 2010 during dredging operations in Zones 29 to 31 a piece of chain, possibly with an anchor still attached, was struck by the starboard drag-head of *HAM310*. The position was marked with an orange buoy, attached to the chain end. The location of the position was provided by the pilot as WSG UTM 31N 345560E and 5706341N.

3.11.2. The obstruction corresponds roughly with the position of WA 2013 in Zone 27. The PLA identified a linear anomaly during sidescan sonar survey in 2007, and later recovered approximately 45m of 'fishing net and trawl parts' which was disposed of.

3.11.3. On balance, and without any firm evidence, it is considered that the strike is not of archaeological interest. A Multi Beam Echo Sounder (MBES) survey has been undertaken. The strike will be reviewed in light of the results of an assessment of the MBES results in due course.

3.12. STRIKE 8020: PROPELLER HUB

3.12.1. On the 16th March 2011 an aircraft propeller hub was recovered aboard the *Lange Wapper* after dredging had taken place between Zones 31 and 36 (see **Figure 9**) and reported under LORDI report 1700. The dredging track-plot corresponded to the reported zones.

3.12.2. Through the interpretation of the track-plots, only two anomalies of 'uncertain' archaeological potential were intersected (see **Appendix I** and **Table 5** below). The complex manner in which aircraft wreckage can be dispersed (i.e. via impact or due to other kinetic effects) may mean that the propeller hub was lying outside of the main concentration of remains on the seabed (Wessex Archaeology 2008b). Therefore the process of querying the track-plot in the project GIS where it intersects known anomalies may not prove to be as reliable as with other cases of material discovered, such as with timber wrecks.

3.12.3. Further research into the manufacturer of the propeller hub and the type of aircraft that used it revealed it to be made by Vereinigte Deutsche Metallwerke (VDM), which translates as 'United German Metalworks'. It transpires that VDM produced variable-pitch propellers to work with a range of different engine specifications and manufacturers such as BMW, Bramo, Jumo and Daimler-Benz. 33 Luftwaffe aircraft utilised the VDM propeller on such aircraft as Dornier 17 models, Bf 109 and Bf 110 variants, Heinkel bombers and Junkers Ju 86 and Ju 88 models (Vereinigte Deutsche Metallwerke A-G 1941).

3.12.4. The discovery is of archaeological interest due to its indication of an aircraft crash site, and also due to interest in the conflict archaeology of World War II. In light of this, a full review was completed of all known or suspected aircraft anomalies positions in relation to the track-plot. A large Jumo 211 engine block was recovered during diving operations in 2007, CMS Site **7543**; although the track-plot does not pass directly over the centre point of the site it does pass 77m to the south (see **Figure 6**). Therefore the propeller hub cannot be discounted as possibly associated with the Jumo 211 engine recovered in 2007. Further work is also required to establish possible relationships of other aircraft related finds (see strikes **8006** and **8023** and discussed below, **Section 4**).

Mitigation Group	Zone 31	Zone 35
2.1.1		
2.1.2		
2.1.3		
2.1.4a		
2.1.4b	7454	
2.1.4c		7134
2.1.4d		

Table 5: STRIKE_8020 anomalies or sites that were intersected by the drag-head with a 10m buffer.

3.13. STRIKE 8021: LEAD SOUNDING WEIGHTS

3.13.1. Seven sounding leads were recovered aboard the *Uilenspiegel* on the 4th April 2011 from within Zones 9 and 10 (see **Figure 10**). The leads were between 150mm and 470mm in length. They were reported under LORDI report 1691.

3.13.2. Sounding leads were in common use on vessels, from antiquity to the last century, to establish the depth beneath the keel and also to indicate the type of seabed sediment - as an aid to navigation.

3.13.3. During this dredging operation nine anomalies were intersected, seven of 'uncertain' archaeological origin, and two of 'probable' archaeological potential, **7345** an 'unknown (disturbed area)' and **7404** a '60m feature' that were subject to CMSs (see **Appendix II**).

3.13.4. It is possible these artefacts may be associated with a timber wreck within these dredging zones and are likely to date from between the 17th and 18th centuries. There are comparable examples of relatively similar items discovered on dated wrecks, for example, from the Alderney Elizabethan wreck in the Channel Islands (Bound 2001). The finds are therefore of archaeological interest.

3.14. STRIKE 8022: OBSTRUCTION

3.14.1. LORDI report 1762, received on 4th May 2011, recorded an obstruction that was encountered by the vessel *HAM 310* at around midnight. An approximate

position was supplied by the pilot on duty as WSG UTM 31N 341737.587E 5707326.637N in Zone 27. No objects were recovered.

3.14.2. There appears to be no corresponding recorded anomalies less than 200m in any direction. The dredging status provided within the track-plot close to the given position and at the approximate time of the obstruction hit (between 0001hrs to 0010hrs) documents the vessel status as 'other', then changing course some 320°, and 'sailing empty'.

3.14.3. It is possible that the drag-head was submerged but not in the action of dredging over this time during which the obstruction was encountered, indicating an anomaly standing proud of the surrounding sediment. Because of the unknown status of the strike, it is considered to be of possible archaeological interest.

3.15. STRIKE 8023: AIRCRAFT LANDING GEAR

3.15.1. A single arm of a small aircraft's front landing gear was discovered on 6th April 2011, by the *Brabo* dredging vessel. LORDI report 1758 recorded the find from within Zones 35 and 36. The track-plot provided by DEME indicated the vessel had dredged throughout Zones 30 to 38 on the 6th of April 2011. Using the project GIS it was only possible to narrow the search to the Zones 32 to 38 (see **Figure 11**).

3.15.2. During the dredging run, 22 anomalies were intersected or passed closely by the drag-head, four of which occurred in Zone 35 that are recorded as '?Submarine boom', and including eight anomalies recorded as 'debris' (see **Table 6** below).

3.15.3. Due to its size, it is reasonable to assume that it is from a relatively small aircraft, probably a fighter. During closer inspection of the object the head of three bolts, fastening different components of the landing gear, has an English inscription, with the word 'ASSOCIATES' and a centrally placed six pointed star. Through correspondence with the resident aircraft technician from the RAF Museum at Hendon and his colleagues the object has been interpreted as that of a 1950's jet aircraft such as a De Havilland Vampire or a Hunter Sea Hawk (Andrew Simpson pers. comm.), both of which were actively used by the RAF and Fleet Air Arm respectively. The object is therefore not be connected with the other aircraft debris of German origin already discovered, such as the Jumo 211 engine block (CMS Site **7543**), the MG15 (strike **8006**) and propeller hub (strike **8020**) (see below).

3.15.4. The landing gear is also in a damaged condition, with right-angled leg to which the wheel was attached twisted 180° which possibly represents a high velocity impact with the water surface causing the aircraft to fragment and disperse over a large area. Due to interest in the aviation archaeology of World War II, the discovery is of archaeological interest and it also raises the potential that a site protected under the PMRA 1986 exists in the area.

3.15.5. As it is not associated with the Jumo 211 engine (CMS Site **7543**) this also raises questions as to the possibility of multiple crash sites.

Mitigation Group	Zone 34	Zone 35	Zone 36	Zone 37	Zone 38
2.1.1					
2.1.2					
2.1.3		7476, 7477, 7544, 7547			
2.1.4a					
2.1.4b	7464	7374, 7465, 7468, 7471	7482, 7484		7491
2.1.4c			7138	7141, 7142, 7145	7146
2.1.4d				7488	7147, 7495, 7550, 7553

Table 6: STRIKE_8024 anomalies or sites that were intersected by the drag-head with a 10m buffer.

3.16. STRIKE 8024: RECONNAISSANCE AIRCRAFT REMAINS

3.16.1. At approximately 0150 hours on 9th of August aboard the *Congo River*, 45 pieces of aircraft wreckage, much of it anodised aluminium, and a large tangle of coloured insulated electrical wire were recovered after dredging in Zone 105.

3.16.2. The track-plot provided by DEME indicated the vessel had dredged only within the northern half of Zone 105 between 2131 hours on 8th August 2011 to 0150 hours on 9th August 2011, during which no recorded anomalies were intersected.

3.16.3. Analysis of the wreckage illustrated different component elements of a reasonably heavily built aircraft. The five aluminium and steel framing pieces are up to 2m in length and approximately 10mm thick. In some instances the frames are fastened to a thinner outer layer - possibly the 'skin' of the aircraft - and an inboard layer 'T' shaped in section. Steel components of unknown function are fixed to aluminium framing pieces. Stamped close to the rivet fasteners are a sequence of serial numbers and manufacturing markers, they include: N.D.R 201 (within a triangle) and 88 513 0203, with a frequent sequence of stamped circled numbers, H145, H87 and H5, possibly indicating rivet sizes for factory machine operators. Recognition of the number sequence has resulted in identification of the aircraft as a Ju 88, a common 'workhorse of the Luftwaffe produced in their thousands, and in many variants, during the war. The number sequence referred to Aircraft type (88), the aircraft structural section (513) and the specific part (0203).

3.16.4. Riveted in a zigzag formation to the largest piece of aircraft framing is a thin sheet of aluminium ranging between 1mm and 3mm in thickness. Approximately 30 individual pieces of this same type of thin sheeting, with green and black paint evident in places, were found in a fragmentary and distorted condition. One such aluminium piece has provided a clear indication

of the wreckage being that of a World War II Luftwaffe reconnaissance aircraft. A plate fastened to it details German lens makers Carl Zeiss, the binocular lens manufacturer Busch Rathenow and inscribed the letters Fk.30 at the top. This relates to a specific aerial photographic reconnaissance system use by the Luftwaffe during World War II. This was the Riehenbildner RB 20/30, 50/30 or 75/30, Zeiss FK 30, using a lens with a focal length of 20, 50 or 75cm, and recording onto 30 x 30cm film. This system was used on a number of aircraft including the Dornier 215B-4, Dornier 217, Dornier Do 17Z-3, and the Junkers Ju 88D (Mondey 2006; John Delaney pers. comm.).

3.16.5. It is probable that the section recovered relates to the film cassette that would have housed the 30 x 30 cm large format photographic film for the system.

3.16.6. Aerial photographic reconnaissance was a fundamental part of the Nazi war effort, and it is believed that the Luftwaffe had begun gathering and collating aerial photographs of the United Kingdom as early as 1935, and by 1939 the majority of the British Isles had been covered by the 23 long range reconnaissance units piecing together a photographic mosaic (http://www.hitlersukpictures.co.uk). Over the next three years the aerial photographic operations intensified upon bombing targets and the coastal fortifications (*ibid*.).

3.16.7. It is probable that this aircraft was on operations during the war when it was shot down before, or after, reaching mainland England. Some puncture holes are apparent within the thin aluminium sheeting, which could be interpreted as ballistic in origin. The distorted and dispersed remains illustrate a high velocity impact which may represent a large area of wreckage dispersal within the northern half of Zone 105. Two anomalies known to exist outside of Zone 105 (7199 and 7200) may be connected with the aircraft as they are the nearest known anomalies and would therefore merit further investigation (**Figure 1** to **Appendix V**) .

4. DISCUSSION

Material of German Origin and Aircraft Parts

4.1.1. Owing to the military aircraft function and German origin it is plausible to assume some association between artefacts **Strike 8006** (German MG15 Machine Gun) and **Strike 8020** (VDM Propeller Hub). It is also possible that these artefacts are linked to CMS position **7543** (the Jumo 211 engine) and its potential outlying anomalies (see **Figure 6**).

4.1.2. The VDM *Ersatzteilliste* (*Spare parts list*) of 1941 lists the aircraft fitted with both the VDM propeller hub and CMS Site **7543** Jumo 211, all of which were used in long range bombing missions on targets in the British Isles during World War II. The Heinkel He 111E, H-1 and H-2 were fitted with Jumo 211A engines; the Heinkel He 111 H3 - H5 had Jumo 211D engines; and the Junkers Ju 88 was equipped with the Jumo 211B engine.

4.1.3. The size and specifications of the VDM propeller hubs documented is unclear, and it may be that a Jumo 211 engine was incompatible with the VDM propeller discovered here. It is also unclear whether the MG15 is likely to have been used with such an aircraft.

4.1.4. There are references to the Jumo 211 being used in early variants of the Messerschmitt Bf 109, but that it was quickly replaced by the Daimler-Benz (DB) 600 (WA 2007). Nevertheless, the fact that there is a MG15 used primarily on bomber and transport aircraft, a Jumo 211 used primarily on bomber aircraft and a British made landing gear indicative of a fighter aircraft would suggest at least three separate aircraft crash sites have been impacted to some extent by dredging operations.

4.1.5. There is however only a questionable association between the aircraft related strikes considering the number of Mauser C96s recovered. It seems likely that they may have been lost in a shipwreck or discarded from a vessel at the time of sinking.

4.1.6. **Appendix I** illustrates the anomalies and sites that have been intersected by track-plots for the strikes/finds of German origin and aircraft association (**8006**, **8008,** and **8020**). There is also a column that shows where these anomalies and sites have been intersected by more than one track-plot, representing those instances where a correlation has occurred.

4.1.7. **Appendix III** illustrates the four anomalies correlated; **7130**, **7134** and **7482** of 'uncertain – debris' recorded status **7461** of 'uncertain - ambiguous' recorded status.

4.1.8. There is a plausible relationship between the MG15 (**Strike 8006**) the propeller hub (**Strike 8020**) and the previously recovered Jumo engine (**7543**), insofar as the dredging activity track-plot in which the MG15 and propeller hub were recovered illustrated passes in the general vicinity of CMS Site **7543** (see **Figure 6**).

4.1.9. In the case of the MG15, the drag-head passed within 37m of the centre point of CMS Site **7543** on two occasions. In the case of the propeller hub the drag-head passed within 77m from CMS Site **7543**, though given the nature of air crashes, this is not especially large.

4.1.10. The closest relationship with CMS Site **7543** is for the Mausers, but for the reasons set out above it is thought likely that the Mausers originated from a ship rather than an aircraft.

4.1.11. As there does not appear to be a relationship between the aircraft landing gear and CMS Site **7543** and the propeller, it seems likely that material from more than one aircraft crash site has been recovered.

4.1.12. With the large radius in which aircraft material can sometimes be dispersed on impact with water, or due to other plausible kinetic effects, it is entirely possible that all three strikes (**8006**, **8020** and **8023**) are indicative of a greater field of buried and unburied material of more than one aircraft.

4.1.13. Strike 8024 offers a more cohesive aircraft wreckage structure and a site of further remains may be easier to locate through future work (See **Section 6**: Recommendations). The recorded wreckage illustrates an aircraft crash site that may have dispersed over a large area on impact with the water surface. Although more coherent than some previous aircraft finds, there still may be difficulty in the identification of further remains depending on their configuration on or in the seabed.

Timbers and Potentially Related Artefacts

4.1.14. There is also the possible relationship between **Strikes 8009** to **8018** timber and other artefact finds such as **Strike 8007** carronade and **Strike 8021** lead sounding weights. Timbers of larger dimensions illustrating traditional methods of fashioning and fastening would certainly have been the reliable platform from which to utilise heavy ordnance. The sounding weights were also a traditional form of navigation and a cluster of them possibly represent a ship's store of the objects. The lead sounding weights are of a typological form that is possibly consistent with the date range of some of the timber assemblage, and they may be associated. It is almost certain that the carronade and the lead sounding weights are not directly associated, due to the different zones covered by the dredger on the dates the artefacts were recovered (see **Appendix II**).

4.1.15. Within the timber assemblages **Strike 8009** to **8018** a number of individual timbers represent a cross section of regional and possibly international watercraft that have utilised the river possibly from the medieval period to the 20th century. The clinker floor timber has similarities with the Drogheda boat and Newport medieval ship, and is therefore a tantalising discovery and offers a great amount in research potential (Holger Schweiter pers. comm. and Trett 2010).

4.1.16. An area of considerable interest is illustrated in **Figure 12,** where a localised cluster of anomalies - **7128**, **7224** and **7540** - were intersected solely by a track-plot on 3rd February 2011 during the week where **Strike 8009** to **8018** were discovered. To the east of the 'Brick Barge' (CMS Site **5230**), **7128** was in 2001 interpreted as 'possibly a large wreck' (Wessex Archaeology 2008a) appearing as a elongated build up of sediment running parallel to the southern extent of the dredging channel, measuring approximately 138m long and 15m wide at its widest point. The same report also refers to a wreck at **7224**, whilst **7540** is noted as an area of debris.

4.1.17. One site subject to a CMS investigation - **5204** 'Pottery Wreck' - may, at first, appear to be another plausible candidate for having originated some of the timber assemblages. However, none of the track-plots recorded with strikes pass less than 20m to the north of the site. The site has been subject to limited clearance work by the PLA (Wessex Archaeology 2008c), and some debris from this work could have been scattered beyond the immediate locality of the site perimeter.

5. CONCLUSION

5.1.1. Where the data was available, every avenue was explored to narrow the possible area of provenance through corroborating and de-conflicting existing anomaly information and track-plot courses. This could often be a confusing process in such a large area of dredging activity and with so many anomalies to account for, sometimes clustered and sometimes isolated. It also cannot account for features that were not visible prior to the dredging procedure and which may only become apparent through strike reports.

5.1.2. The scale of the dredging is best represented by **Figures 3** and **4**, a week of dredging in which the timber assemblages **Strike 8009** to **Strike 8018** occurred. The number of anomalies which the drag-head intersected increased with the intensity of dredging. This was particularly apparent within Zones 30 to 36. This makes an assessment of a discovery's location on the seabed difficult at best, and a considerable amount of time and resource has to be spent narrowing the strike down against the list of known anomalies.

5.1.3. Where there is no clear indication of a discovery's origin, much of the initial investigation is underpinned by the LORDI report and the information provided. Small details relating to time or the exact Zones in which the item was recovered from can make a substantial difference in narrowing the process of investigation. Any inconstancies in the reporting method complicate the process of moving toward a reliable position and summary report for that discovery.

5.1.4. There can however be no doubting the significant nature of many of the finds discovered. On the whole the artefacts have certainly benefited from the environmental conditions in which they were deposited - i.e. the marine anaerobic deposits associated with Thames estuary - demonstrating the presence of buried material. The clinker floor timber recovered certainly reinforces the considerable potential that the Thames offers for the preservation of potentially important maritime archaeological resources.

5.1.5. The discovery of the carronade is another indication of the potential of the dredging operation. Whether a stray find or associated with a larger assemblage of material it represents a very important period in British naval craftsmanship and engineering expertise, at the heart of the Industrial Revolution - and is indicative of Britain's dominance of the seas afforded by technology in the late 18th and early 19th centuries (Gardiner 1992; Rodger 2005: 421).

5.1.6. The large amount of aircraft remains that have been recovered may also be an indication of a much greater potential for further finds of this nature being discovered during dredging operations, either associated with or separate to those already recorded. The indications point to at least three separate aircraft crash sites having been impacted by dredging to date, and more may follow.

5.1.7. From a management perspective, due to the variable amount of archaeological discoveries made during 2011, the project has benefited from more liaison

meetings, confirmation of correspondence and providing a succinct dialogue between stake holders.

5.1.8. Continued and more immediate feedback by WA to the Protocol for Archaeological Discoveries (LORDI 2011) in the form of discovery reports is also providing a clearer understanding for the staff at Dredging International of how their efforts are valued. Further to this an archaeological awareness programme lecture from experts in the field of marine and aviation archaeology is helping inform DI staff and stimulate a broader interest in archaeological remains and their potential significance.

6. RECOMMENDATIONS

6.1.1. A continued effort through all levels of the operation to shorten response times after a potential strike has occurred will help with management of the archaeology. It will enable artefacts to be assessed for archaeological potential and provide the necessary first aid conservation. This is helped by the collection of artefacts soon after discovery, and prevents a backlog of material awaiting pick up from London Gateway.

6.1.2. The strikes report illustrates the potential of the cultural heritage and archaeology in a number of zones. It has therefore been recommended that further survey takes place to explore the potential of the discoveries. This work is scheduled to take place in mid-November.

6.1.3. Work has been agreed with LGPL and a method statement has been prepared to manage the required outcomes of the work (**Appendix V**).

6.1.4. This will be achieved with targeted geophysical survey covering the area of the dredger track-plot for each instance of a Strike, with both sidescan sonar and magnetometer data acquisition (see **Appendix V**). Sidescan sonar guided in more than one direction can provide a clearer understanding of an anomaly's character, with 30m intervals between lines and adjacent lines completed in opposite directions reducing inaccuracies.

6.1.5. The strikes for investigation fall into four sets of zones, as follows:

- Zones 9,10,11 - 8003-4; 8009-18 timbers; 8021 sounding leads;
- Zones 26-29 - 8007 carronade; 8022 obstruction;
- Zones 30-36 - 8006 machine gun; 8020 propeller hub; 8023 undercarriage leg (8023 undercarriage leg might also be from 37 & 38, but these zones will be subject to watching brief);
- Zone 105 - 8024 reconnaissance aircraft (plus anomalies 7199 and 7200).

6.1.6. The geophysical survey data will ideally identify new anomaly positions together with providing fresh imagery allowing for the comparison between previous anomaly positions. This may illustrate changes in site formation or anomaly dimensions. Anomalies of certain or probable archaeological potential

could then be recommended for visual inspection through HSE diver operations or ROV. The PLA will also be informed of any potential debris and hazardous material, which could be investigated further by geophysical or diver survey. This would also potentially mitigate against further impacts to archaeological remains.

6.1.7. In terms of active research, the clinker floor is of special interest and may provide a greater understanding for a period of maritime history that is only marginally represented within the archaeological record. Radiocarbon dating and hull form interpretation, through the process of digital recording methods, could provide a comprehensive record for such a rare find. Although as yet there is no identified site for this artefact, previous International Journal of Nautical Archaeology articles for stray individual discoveries have been useful to the archaeological community.

6.1.8. It may also be advised to seek more specialist advice on the aircraft remains. Considering those artefacts of German origin and the lack of UK based specialists on Luftwaffe aircraft, it would be a recommendation to contact and correspond with overseas institutions to help identify the remains.

6.1.9. In regard to future works, the extensive range of archaeological material of clear maritime and aviation origin recovered highlights the pivotal role the River Thames has played through the ages as a navigational course to and through the capital, as a draw for commerce and as a navigational reference for enemy activity.

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APPENDIX I: STRIKES INCLUDING ARTEFACTS OF GERMAN ORIGIN.

This table illustrates the anomalies and sites, including those subject to CMSs, that were intersected within a range of 10m by the drag-head during dredging only.

Trackplot	**19/01/2011**	**19/02/2011**	**16/03/2011**	Total Match
Strike	**8006**	**8008**	**8020**	
Zone	MG15	Mauser C96	Propeller	
30	7378, 7382, 7383, 7451			
31	7461, 7542, 7130, 7381	7130, 7453, **7543** 7454, 7461, 5197	**7543**, 7454	7461, 7130, **7543**, 7454,
34		7463		
35		7586, 7134, 7135, 7374, 7469, 7472, 7545	7134	7134
36		7139, 7481, 7482		
37				
38				

The column to the right (Total match) illustrates those anomalies and sites, including those subject to CMSs (in bold), intersected more than once.

The red highlighted WA numbers are anomalies or sites, (those subject to CMSs in bold), that have been intersected on more than one occasion during the week the timber assemblage Strike 8009 to Strike 8018 were recovered.

APPENDIX II: 'WEEK 5' TIMBER ASSEMBLAGES (STRIKE 8009-8018), CARRONADE (STRIKE 8007) AND LEAD SOUNDING WEIGHTS (STRIKE 8021).

This table illustrates the anomalies and sites, including those subject to CMSs, that were intersected within a range of 10m by the drag head during dredging only.

Track-plot	31/01/2011	01/02/2011	02/02/2011	03/02/2011	04/02/2011	05/02/2011	06/02/2011	19/02/2011	04/02/2011	Total match
Strike	**8003**	**8004**						**8007**	**8021**	
Artefacts	Timber	Timber	Timber	Timber	Timber	Timber	Timber	Carronade	Sounding Leads	
Zone										
9 & 10						7528, 7405	7528, 7174		7174, 7175, 7176, 7220, 7221, **7345**, **7404**, 7405, 7528	7405, 7528
30				7128, 7224, 7540, 7452	7451	7383		**5230**, 7540, 7384		7540
31	7461, 7542, 7130, 7381	**7543**, 7380, 7453, 7542, 7461, 7376, 5197		7453, 7454, 7456, 7458, 7542, 7130, 7376, 7380, **7543**	7376, 7460, 7461, 7542, **7543**, 7380, 5197	7130, 7376, 7453, 5197	**7543**, 7542, 5197			7461, 7542, 7130, 5197, 7376, 7453, 7380, 7376
33			7375	7375		7375				7375
34		7462, 7463				7463, 7464				
35		7476, 7477, 7544, 7547, 7586, 7466, 7467, 7470, 7545	7134	7374, 7466, 7468, 7471, 7476, 7477, 7544	7546, 7547, 7470, 7134	7544, 7547, 7586, 7465, 7467, 7545, 7135	7544, 7135	7547, 7545, 7134		7134, 7134, 7135, 7544, 7547, 7547, 7470, 7466, 7476, 7545, 7545
36	7138, 7139, 7225, 7559	7480, 7481, 7482, 7137, 7138, 7225		7137, 7480	7225	7481, 7484, 7559, 7483, 7548, 7225, 7139	7559, 7226			7137, 7138, 7139, 7225, 7480, 7481, 7559
37	7369									

The column to the right (Total match) illustrates those anomalies and sites, including those subject to CMSs (in bold), intersected more than once.

The red highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected on more than one occasion during the week the timber assemblage Strike 8009 to Strike 8018 were recovered.

The blue highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected when both timbers, Strike 8009-9018 and the Carronade, Strike 8007, were recovered.

The green highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected when both timbers, Strike 8009-9018 and the Carronade, Strike 8007, were recovered.

APPENDIX III: MITIGATION GROUPS OF ANOMALIES INTERSECTED DURING STRIKES.

This table illustrates the anomalies and sites, including those subject to CMSs, that were intersected more than once at separate times within a range of 10m by the drag head from Appendix I and Appendix II and their mitigation status.

Finds	**Certain**	**Probable**	**Possible**	Uncertain			
				Uncertain - ?bed feature	**Uncertain - ?debris**	**Uncertain - ambiguous**	**Uncertain - ?archaeological feature**
	2.1.1	2.1.2	2.1.3	2.1.4a	2.1.4b	2.1.4c	2.1.4d
	… clearly of archaeological interest, with remains present on the seabed that are likely to be considered of high importance.	… certainly remains present which are likely to be considered at least moderately important, plus sites where the presence of remains is less certain, but if present the remains will be considered moderately-highly important.	… certainly remains present, where those remains may be of low to moderate importance, or important to a specific sector … largely comprises known wrecks lost in WWI and WWII … level of importance will depend on the details of the site …	… seem likely to be bed features (sand banks, sand waves, disturbance to bed caused by trawling, anchoring etc.) …	… artificial, i.e. of human origin, but are more likely to be 'modern' than of archaeological origin or interest …	… can't ascribe to another group. They may prove to be of archaeological importance, but they may prove to be modern, or even natural, in origin.	… reasonably likely – on the basis of currently available data – to have an archaeological origin …
Weights and Timber					7528		7405
Carronade and timber		7540	7547		7545	7134	
Timber		7139	7544, 7547, 7476	7380	7461, 7542, 7453, 7470, 7466, 7545, 7480, 7481, 7559	7130, 7376, 7376, 7134, 7135, 7137, 7138, 7225	5197, 7375
Artefacts of German origin					7454, 7461	7130, 7134	

The red highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected on more than one occasion during the week the timber assemblage Strike 8009 to Strike 8018 were recovered.

The blue highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected when both timbers, Strike 8009-9018 and the Carronade, Strike 8007, were recovered.

The green highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected when both timbers, Strike 8009-9018 and the Carronade, Strike 8007, were recovered.

The black highlighted numbers are anomalies or sites (those subject to CMSs in bold) that have been intersected by two or more artefacts of German Origin, Strike 8006 MG15 machine gun, Strike 8008 Collection of Mauser C96 and Strike 8020 VDM propeller hub.

APPENDIX IV: FULL DEFINITIONS AND KEY TO MITIGATION GROUPS.

The following definitions and symbols (for figures) have been ascribed for sites to Mitigation Groups.

The first group are those features that are of little or no archaeological interest in the context of the dredge plan as follows:

1.1	No symbol*	Feature of no archaeological interest	Predominantly moorings for navigational buoys, or items for which a non-archaeological origin can be given on the basis of existing evidence.
1.2	No symbol*	Site clear	Either reported as lifted by PLA, or geophysics shows no evidence of the presence of a previously recorded feature, implying it has already been recovered.
1.4	No symbol*	Site below dredge depth	As noted above, the current dredge line includes areas that are already deeper than the desired depth, so no further dredging is required. Sites in these areas have been allocated to 1.4, unless they (might) include upstanding elements within the dredge depth.
0.1	No symbol*	Duplicates	Some sites within the dataset are clearly duplicates of others, with minor differences in position. As far as possible, these duplicates have been integrated, leaving a set of 'sites' that are duplicates.
			*These sites and anomalies have not been highlighted in this report.

Table 7: Definitions for features of little or no archaeological interest or relevance

The 'archaeological' Mitigation Groups were originally ascribed to three subdivisions - certain, probable and possible - above and below Sea Reach 1 (see report of 07/10/05). Subsequently they have been split 'possible' into 'possible' and 'uncertain', and further sub-divided 'uncertain' into four. They have been used as follows:

2.n.1		Certain	Used for the small number of sites that are clearly of archaeological interest, with remains present on the seabed that are likely to be considered of high importance.
2.n.2		Probable	Used for sites where there are certainly remains present which are likely to be considered at least moderately important, plus sites where the presence of remains is less certain, but if present the remains will be considered moderately-highly important. It is fair to say that the level of importance of sites like the *Dovenby* and Brick Barge is open to debate.

2.n.3		Possible	Generally used for sites where there are certainly remains present, where those remains may be of low to moderate importance, or important to a specific sector. This category largely comprises known wrecks lost in WWI and WWII, plus debris relating to the submarine boom. As above, the level of importance will depend on the details of the site, and may be debated.
2.n.4	See below	Uncertain	Used for anomalies and fouls, that is to say sites where there appears to be anomalous features on the seabed, but where the character of the anomalies is difficult to ascribe with certainty to any of the other categories, archaeological or non-archaeological. The 'uncertain' therefore include sites which may prove to be of archaeological origin/interest, but which may not.

Table 8: Main archaeological mitigation groups (where n = 1 for sites upstream of Sea Reach 1, and 2 for sites seaward of Sea Reach 1)

The ‘Uncertains’ grouping was further sub-divided as follows:

2.n.4a		Uncertain - ?bed feature	On the basis of the sidescan images, these sites seem likely to be bed features (sand banks, sand waves, disturbance to bed caused by trawling, anchoring etc.). This interpretation draws on the form of the anomaly and the character of the surrounding seabed.
2.n.4b		Uncertain - ?debris	These can be reasonably interpreted as artificial, i.e. of human origin, but are more likely to be 'modern' than of archaeological origin or interest. This group includes linears (?lost chains and cables) and generally isolated single items. It should be noted that some of these isolated items may prove to be quite old and of some archaeological interest, but as they seem to be isolated depositions they will not have much in the way of context. It should also be noted that the features identified as debris may need to be cleared to facilitate dredging.
2.n.4c		Uncertain - ambiguous	These are features that can’t adequately be ascribed to another group. They may prove to be of archaeological importance, but they may prove to be modern, or even natural, in origin.

2.n.4d		Uncertain - ?archaeological feature	These seem reasonably likely – on the basis of currently available data – to have an archaeological origin, or at least to be a class of anomalies that includes features of archaeological origin and importance. They can be reasonably interpreted as being artificial, and are either more extensive than 'debris' or are made up of several elements. This classification does not consider the level of importance that might apply – i.e. some of these features may prove to be of archaeological origin, but of low importance. However, some of the may prove to be of high importance. These attributions have been made while bearing in min that some of the most important sites (Medieval, Roman, Prehistoric) may be very ephemeral.

Table 9: 'Uncertain' mitigation groups (where n = 1 for sites upstream of Sea Reach 1, and 2 for sites seaward of Sea Reach 1)

APPENDIX V: METHOD STATEMENT FOR GEOPHYSICAL INVESTIGATION

Introduction

Survey will be conducted over the agreed areas (**Figure 1** to **Appendix V**) using the PLA survey vessel Verifier, using a multibeam, sidescan sonar and magnetometer.

The surveys will be carried out to a single datum and co-ordinate system, UTMz31, WGS84. All survey data – including navigation (position, heading and velocity) - will be acquired digitally in industry-standard formats. Track-plots will be corrected for layback (including catenary effects) and made available in digital (GIS) form.

Sidescan Sonar Survey Methodology

Sidescan sonar survey will be carried out by WA staff using a Klein 3900 sidescan sonar system operating at a frequency of 900kHz with a range setting of 50m or less and should therefore be capable of resolving all objects that are 0.5m and above throughout the survey area.

The line spacing will be equal to or less than the effective range in order to ensure that the seabed is ensonified at least twice (from different directions), enhancing object recognition and ensuring coverage directly beneath survey lines. Known sites and anomalies of apparent archaeological potential will be 'boxed' by at least two and preferably four lines along and across the principal axis of the anomaly. These lines will be offset so that the anomaly does not lie immediately beneath the fish, and run at optimal frequency and range settings for imaging the anomaly.

Towfish height and speed will be carefully monitored during the survey to maintain optimum data quality and resolution. In practice this is likely to mean that the fish will be kept as close to the seafloor as possible, at a height of 3-5m above the seafloor.

Sidescan sonar data will be recorded in the form of raw, un-mosaiced files in xtf format.

Magnetometer Survey Methodology

Magnetometer survey will be carried out by WA staff using a Geometrics G882 caesium vapour magnetometer which is capable of resolving anomalies of 5 nano Teslas (nT) and above.

The magnetometer towfish will be towed as close to the seafloor as possible and operated with a sample rate of at least 4Hz. Where possible the magnetometer will be towed from the sidescan sonar in order to allow for a direct correlation of survey results from the two sensors.

Lines will be run in conjunction with the sidescan sonar where possible (i.e. on the same line spacing and orientation) but provision will be made to run additional lines and cross-lines across known sites and anomalies of apparent archaeological potential as indicated by desk-based information or any of the other sensors.

Magnetometer data will be recorded as text files containing easting, northing and field strength for each line.

Multibeam Survey Methodology

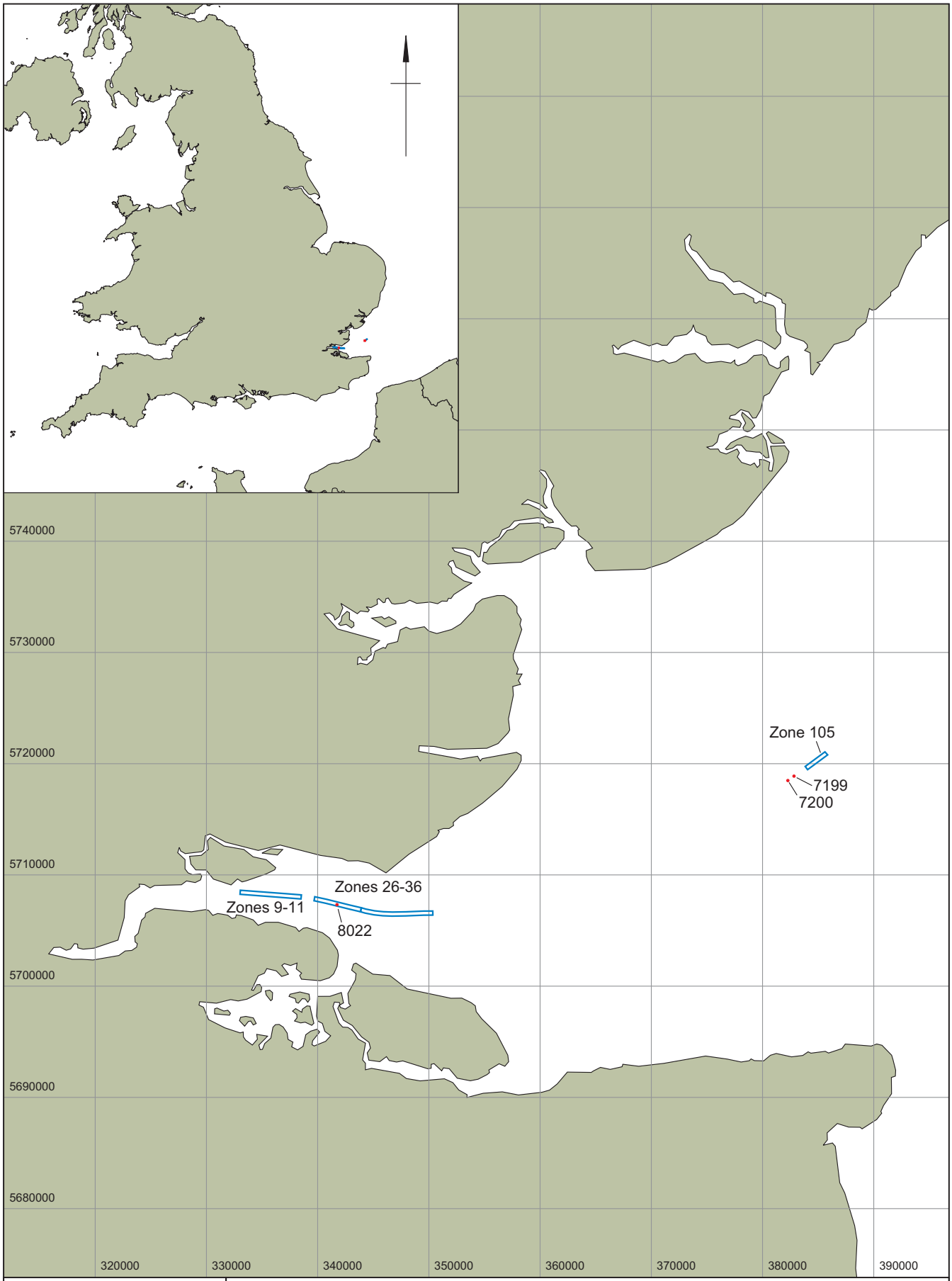
The multibeam survey will be carried out by PLA staff using a Reson Seabat 7101 system. This is a beam-forming multibeam sonar system with a nadir beam size of 1.5° x 1.8° and a ping rate of up to 40Hz.

Where an anomaly of apparent archaeological potential is identified, a single slow pass will be carried out at the highest possible ping rate.

The multibeam data will be acquired as hs2 files for initial processing by PLA hydrographers and made available as de-spiked and tidally-corrected text (x, y and z) files for each line, in addition to any gridded/rendered surfaces.

Areas for investigation
Those areas and individual anomalies for which geophysical investigation will be undertaken are as follows:

Zones 9 -11
Zones 26 - 36 (with detailed survey at the point of Strike 8022)
Zone 105
Detailed survey at the point of anomaly 7199 and 7200 (to the south-west of Zone 105)



Projection WGS84 UTM Z31N

- Selected anomaly
- Selected Survey Area (Dredge Zone)

Wessex Archaeology

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Selected anomalies

Figure 1

A.

Zone 51
Zone 50
Zone 41
Zone 42
Zone 43
Zone 19
Zone 1
Zone 52
Zone 22
Zone 16
Zone 18
Zone 2
Zone 21
Zone 23
Zone 13
Zone 14
Zone 15
Zone 24
Zone 46
Zone 47
Zone 6
Zone 25
Zone 5

5185
Ancient Wreck

5051
Wreck - Mid Blyth

0 1 km

B.

Zone 7

5050
Aircraft - coal dump

7404
60m Feature

Zone 45
Zone 44
Zone 11
Zone 9

0 1 km

C.

7345
Unknown - planking

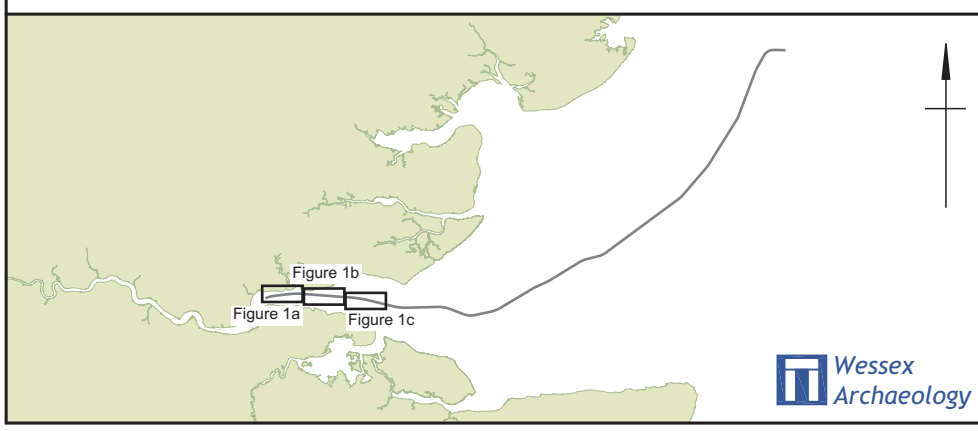
Zone 10
Zone 12
Zone 26
Zone 27
Zone 28
Zone 29

5020
Iron Bar Wreck

5019
London ('King')

5029
London

0 1 km



Wessex Archaeology

Channel centre line
Channel toe lines
Dredging zones
Sites subject to CMS

Anomalies:
2.1.1 - Site of certain archaeological interest
2.1.2 - Site of probable archaeological interest archaeological interest
2.1.3 - Site of possible archaeological interest
2.1.4a - Uncertain - ?bed feature
2.1.4b - Uncertain - ?debris
2.1.4c - Uncertain - ambiguous
2.1.4d - Uncertain - ?archaeological feature

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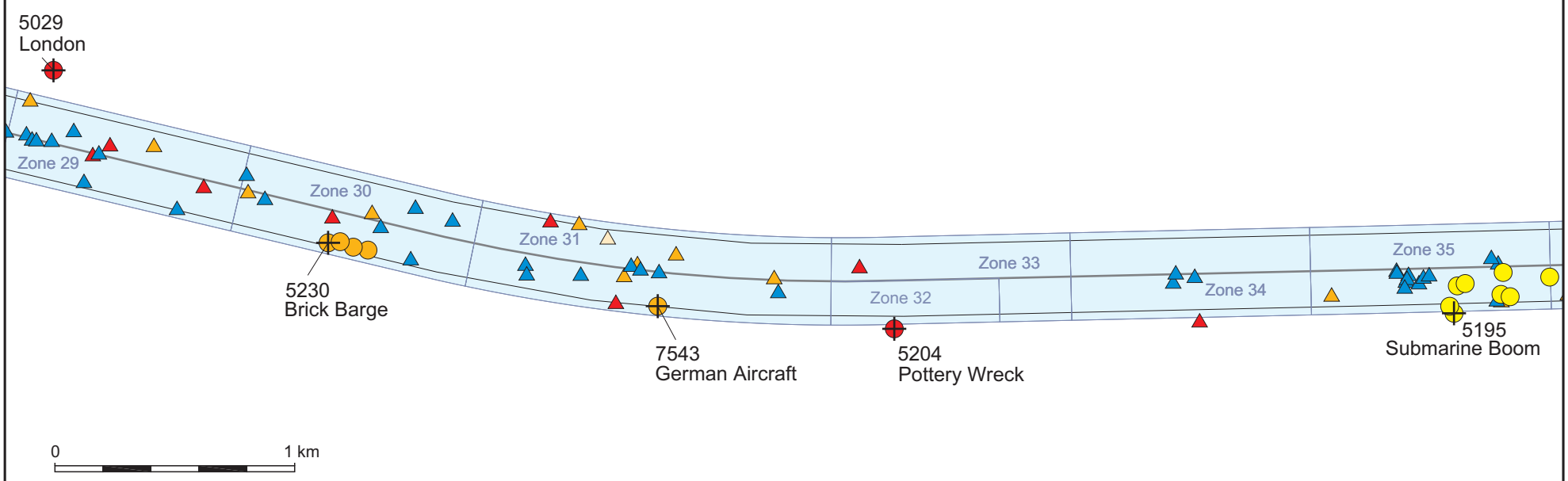
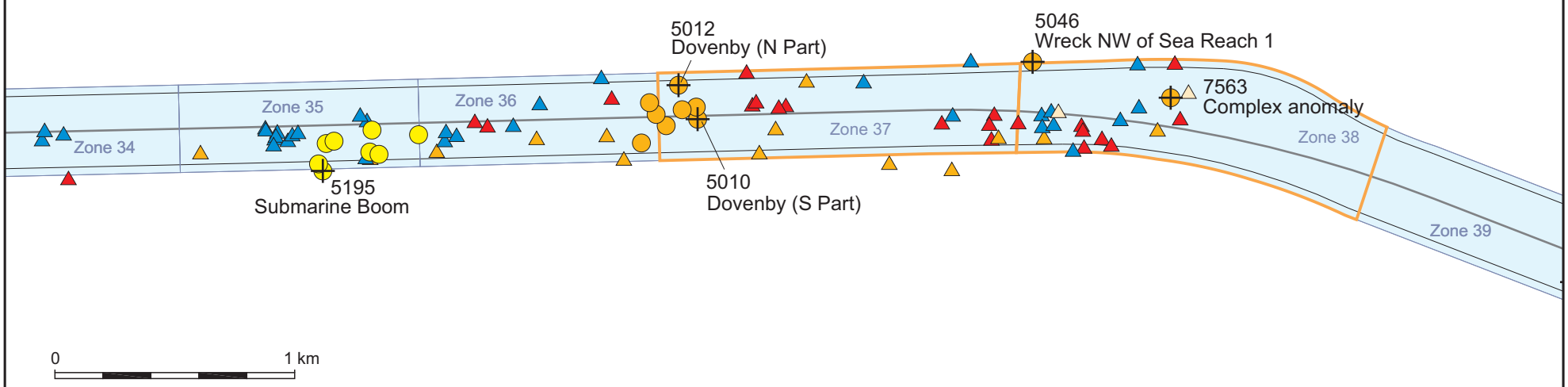
Known wrecks and anomalies: Zones 1-2, 5-7, 9-12, 3-16, 18-19, 21-29, 41-45, 46-47, 50-52

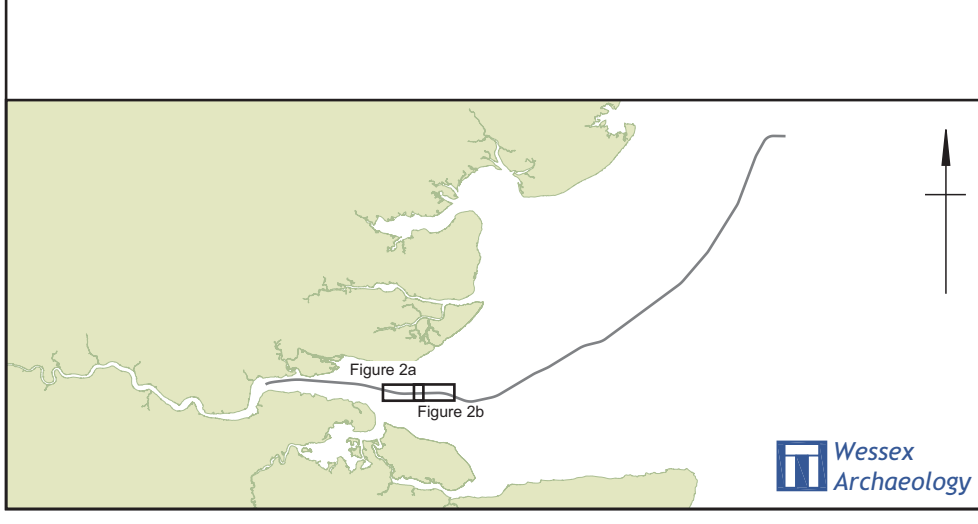
Figure 1

A.



B.





Channel centre line
Channel toe lines
Dredging zones
Sites subject to CMS

Anomalies:
- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

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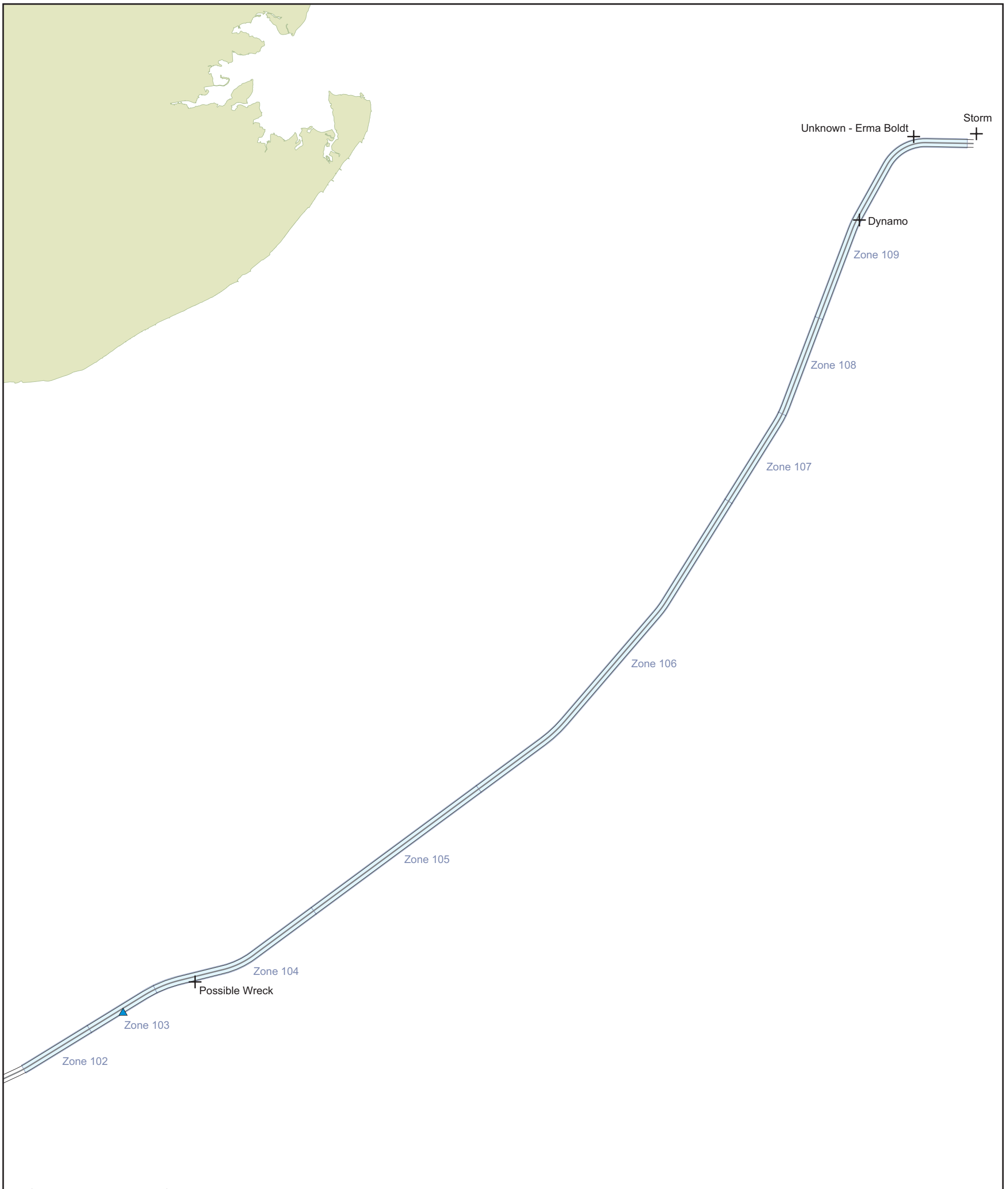
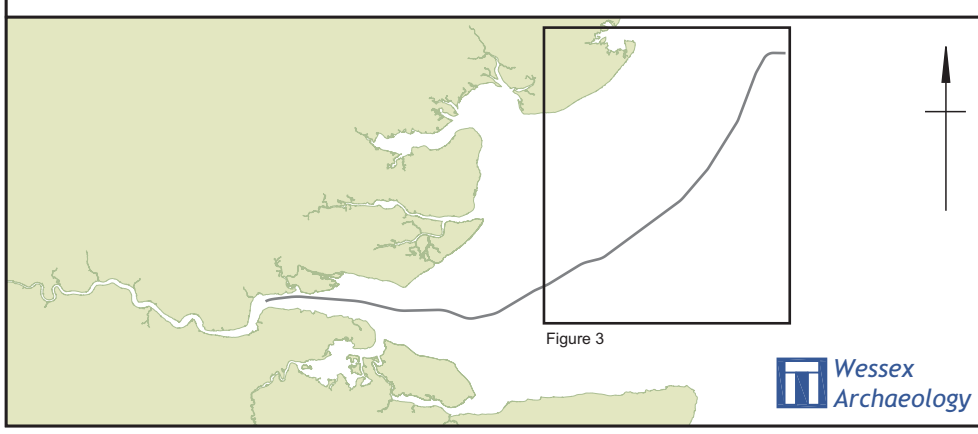
Wessex Archaeology

Known wrecks and anomalies: Zones 29-40

Figure 2





Channel centre line
Channel toe lines
Dredging zones
Sites subject to CMS

Anomalies:

- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

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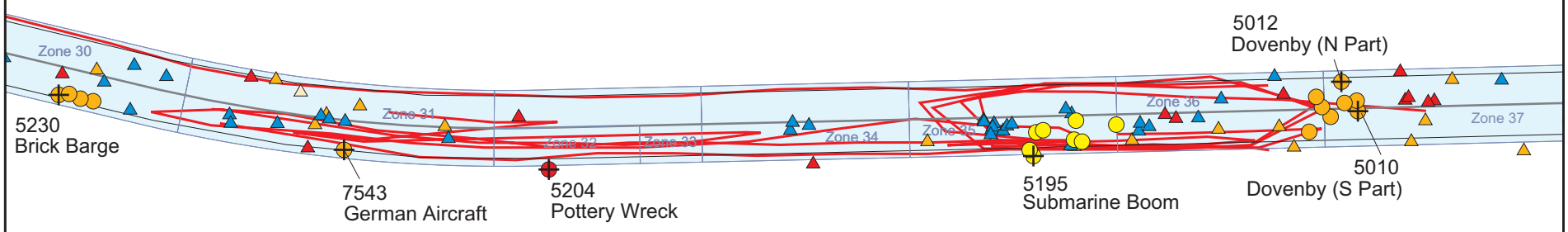
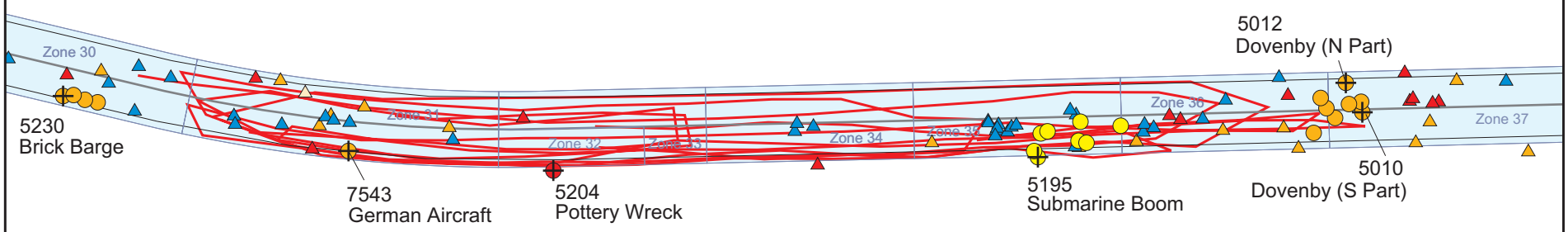
Known wrecks and anomalies: Zones 102-109

Figure 3

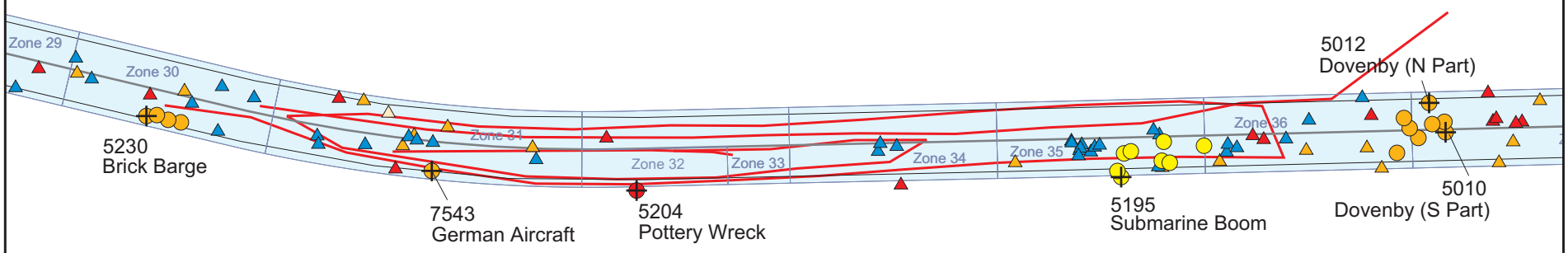
A. 31/01/11 (Strike 8003)



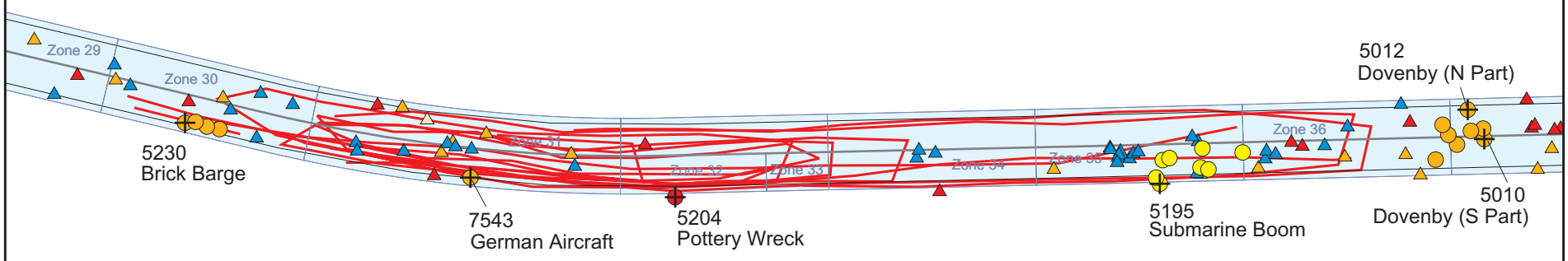
B. 01/02/11 (Strike 8004)



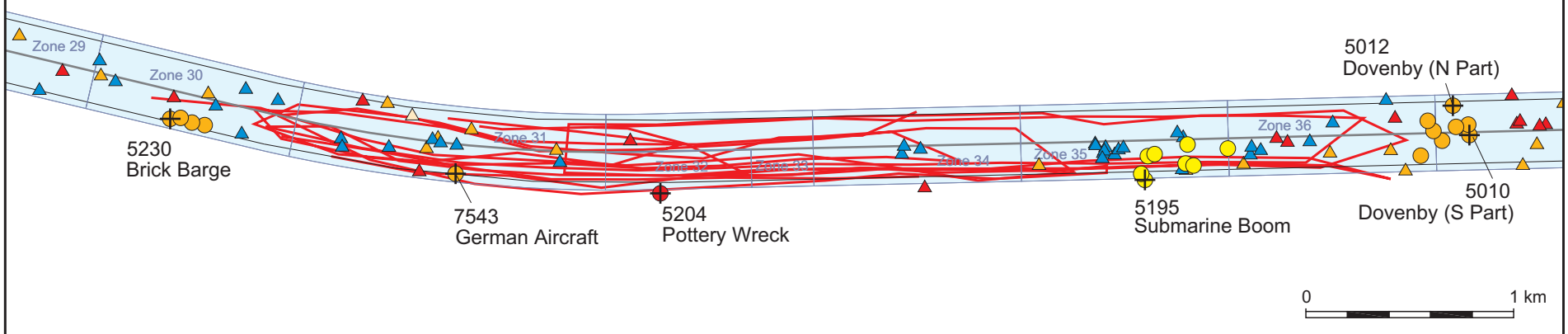
C. 02/02/11

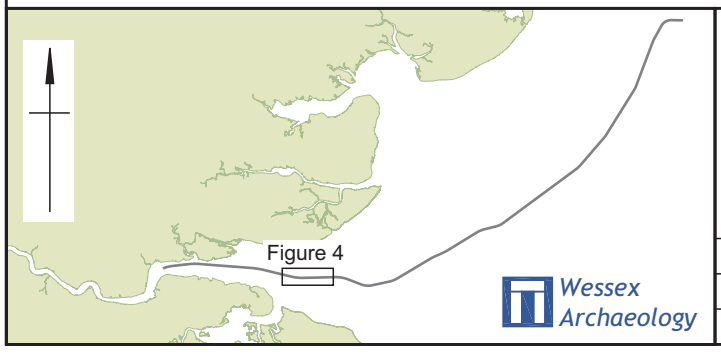


D. 03/02/11



E. 04/02/11





Channel centre line
Channel toe lines
Dredging zones
Strike_8009_to_8018_ Timber_Assemblage (31/01/11 to 04/02/11)
Sites subject to CMS

Anomalies:
2.1.1 - Site of certain archaeological interest
2.1.2 - Site of probable archaeological interest
2.1.3 - Site of possible archaeological interest
2.1.4a - Uncertain - ?bed feature
2.1.4b - Uncertain - ?debris
2.1.4c - Uncertain - ambiguous
2.1.4d - Uncertain - ?archaeological feature

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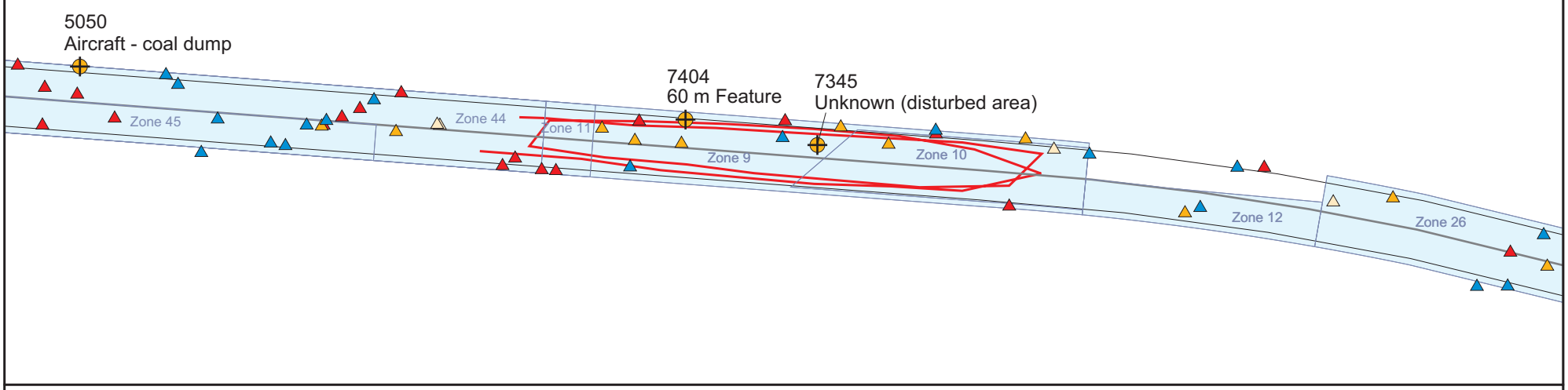
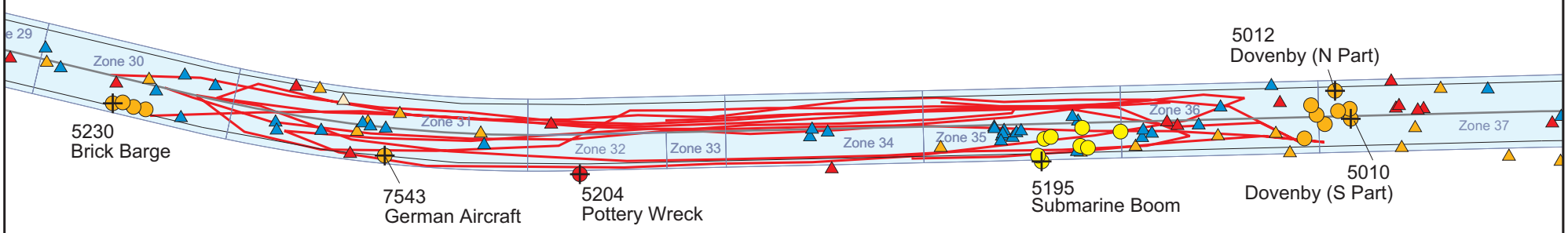
Known wrecks and anomalies with track-plot STRIKE_8009_to_8018_Timber_Assemblage (31/01/11 to 04/02/11)

Figure 4

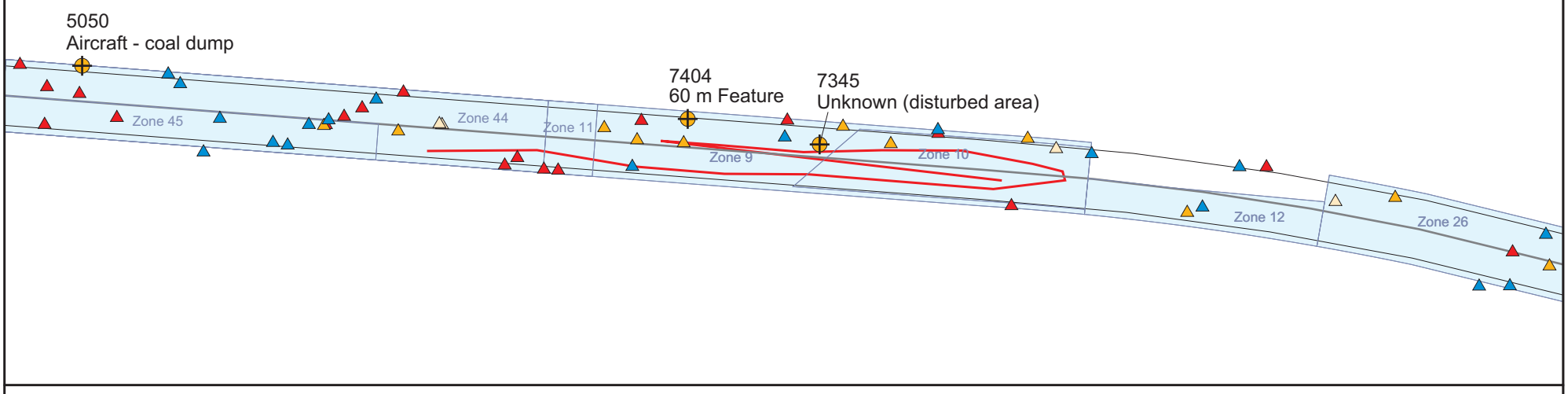
A. 05/02/11



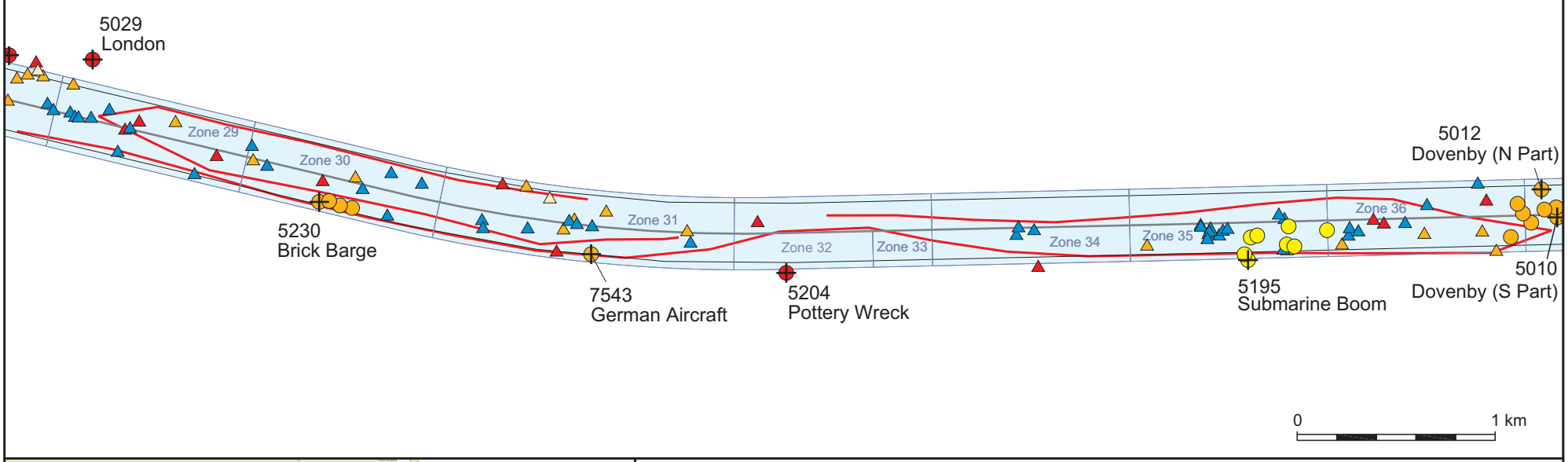
B. 05/02/11

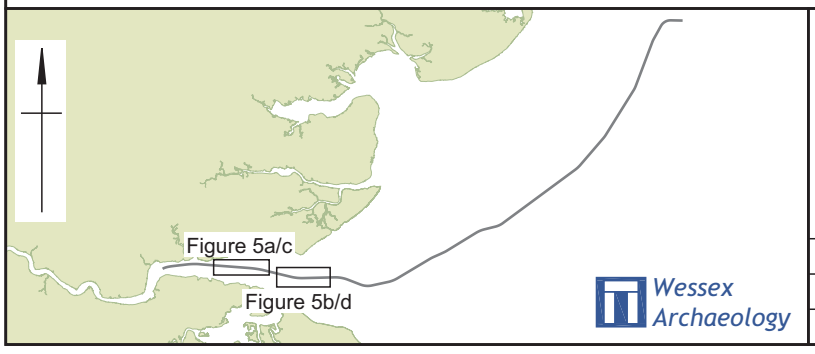


C. 06/02/11



D. 06/02/11





Wessex Archaeology

Channel centre line
Channel toe lines
Dredging zones
Strike_8009_to_8018_Timber_Assemblage (05/02/11 to 06/02/11)
Sites subject to CMS

Anomalies:
2.1.1 - Site of certain archaeological interest
2.1.2 - Site of probable archaeological interest
2.1.3 - Site of possible archaeological interest
2.1.4a - Uncertain - ?bed feature
2.1.4b - Uncertain - ?debris
2.1.4c - Uncertain - ambiguous
2.1.4d - Uncertain - ?archaeological feature

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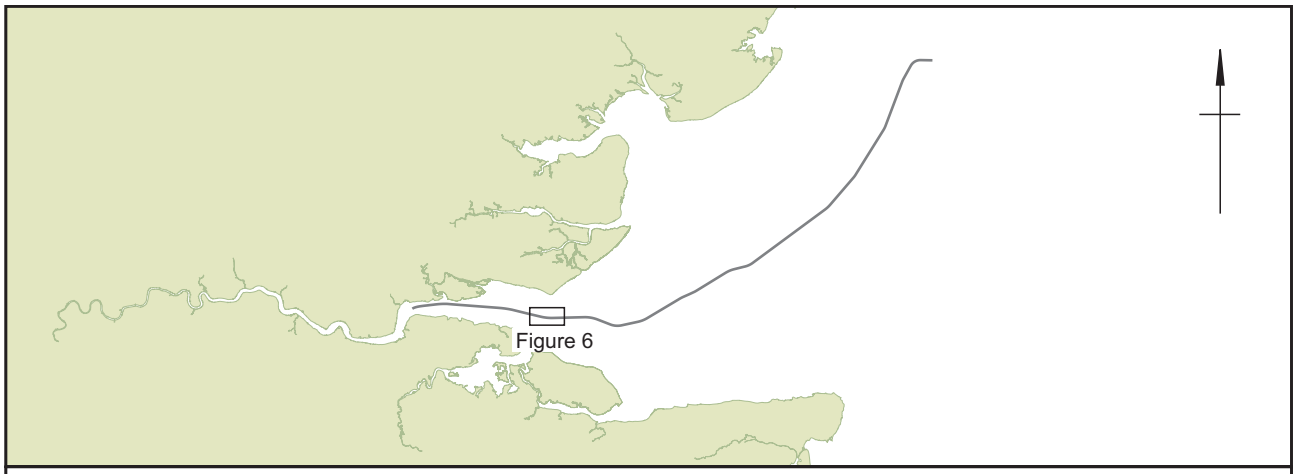
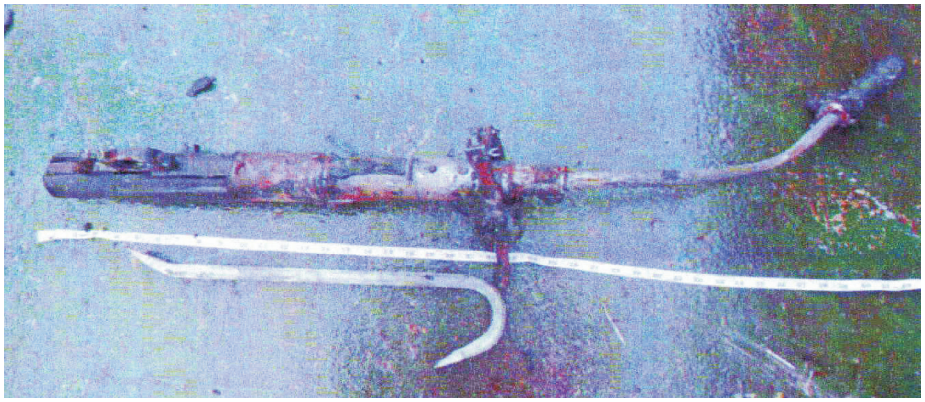
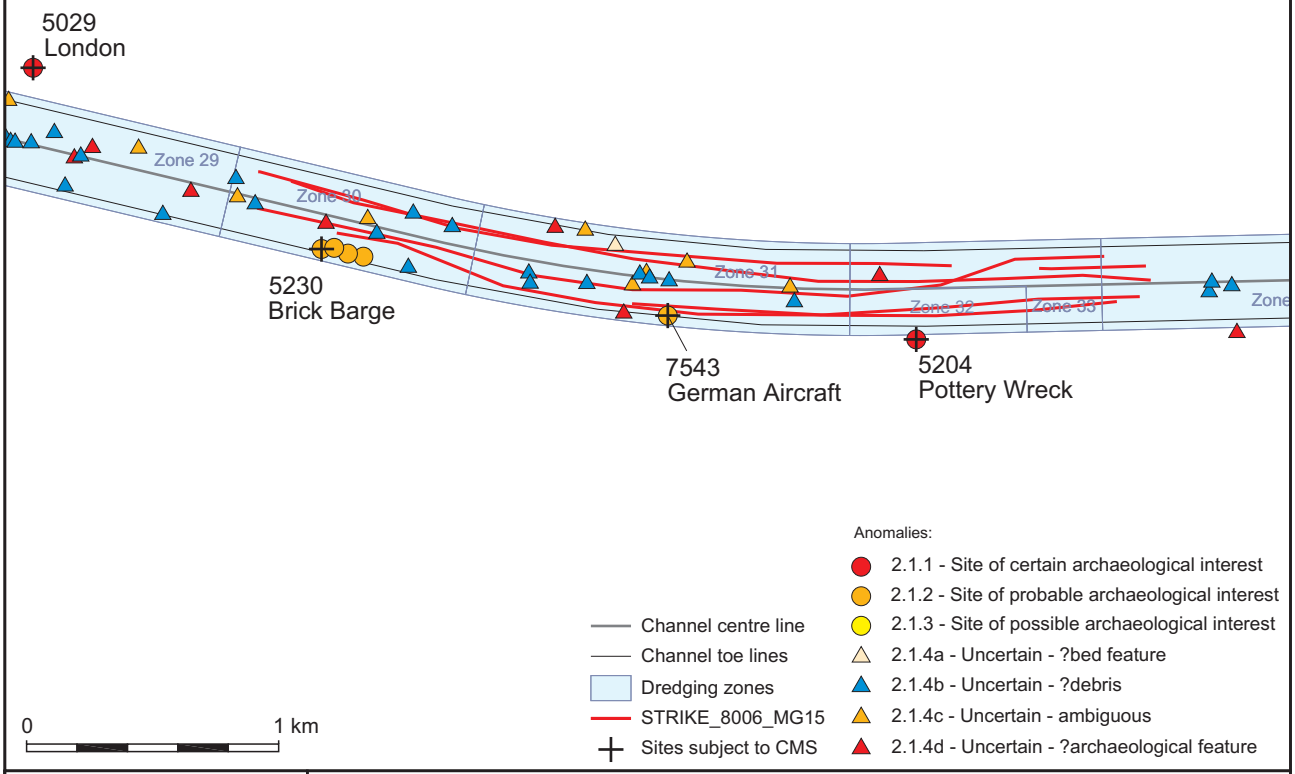
Known wrecks and anomalies with track-plot STRIKE_8009_to_8018_Timber_Assemblage (05/02/11 to 06/02/11)

Figure 5



19/01/2011





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Path:	W:\Projects\London Gateway\London Gateway 2011\Drawing Office\Report figs\72436\Dredging WB		

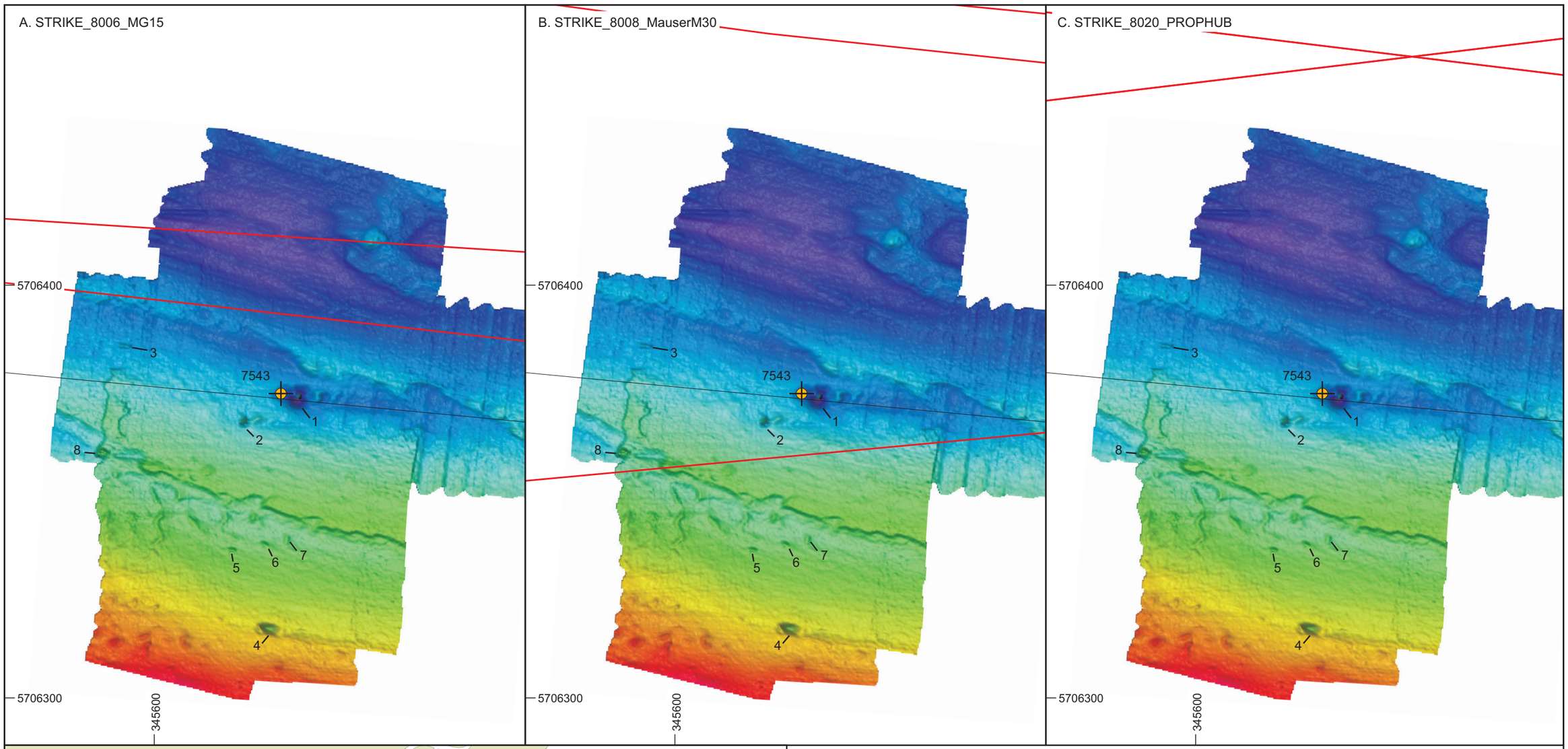
Wessex Archaeology

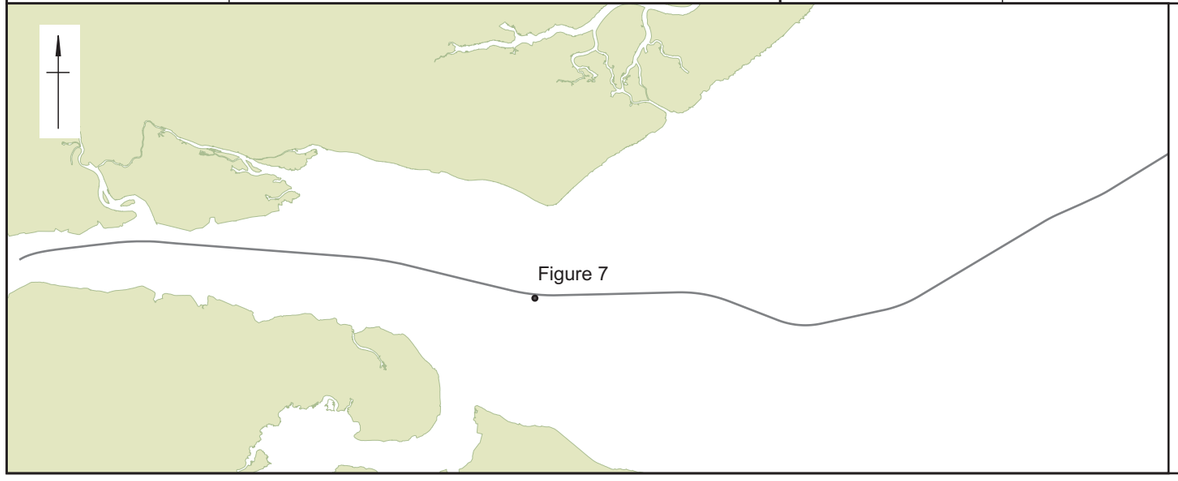
Known wrecks and anomalies with track-plot STRIKE_8006_MG15 Figure 6

A. STRIKE_8006_MG15

B. STRIKE_8008_MauserM30

C. STRIKE_8020_PROPHUB





- Channel centre line
- Channel toe lines
- Strike track-plots
- Sites subject to CMS

Anomalies:

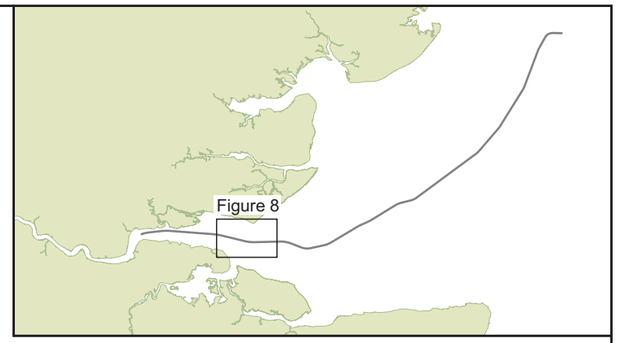
- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

Wessex Archaeology

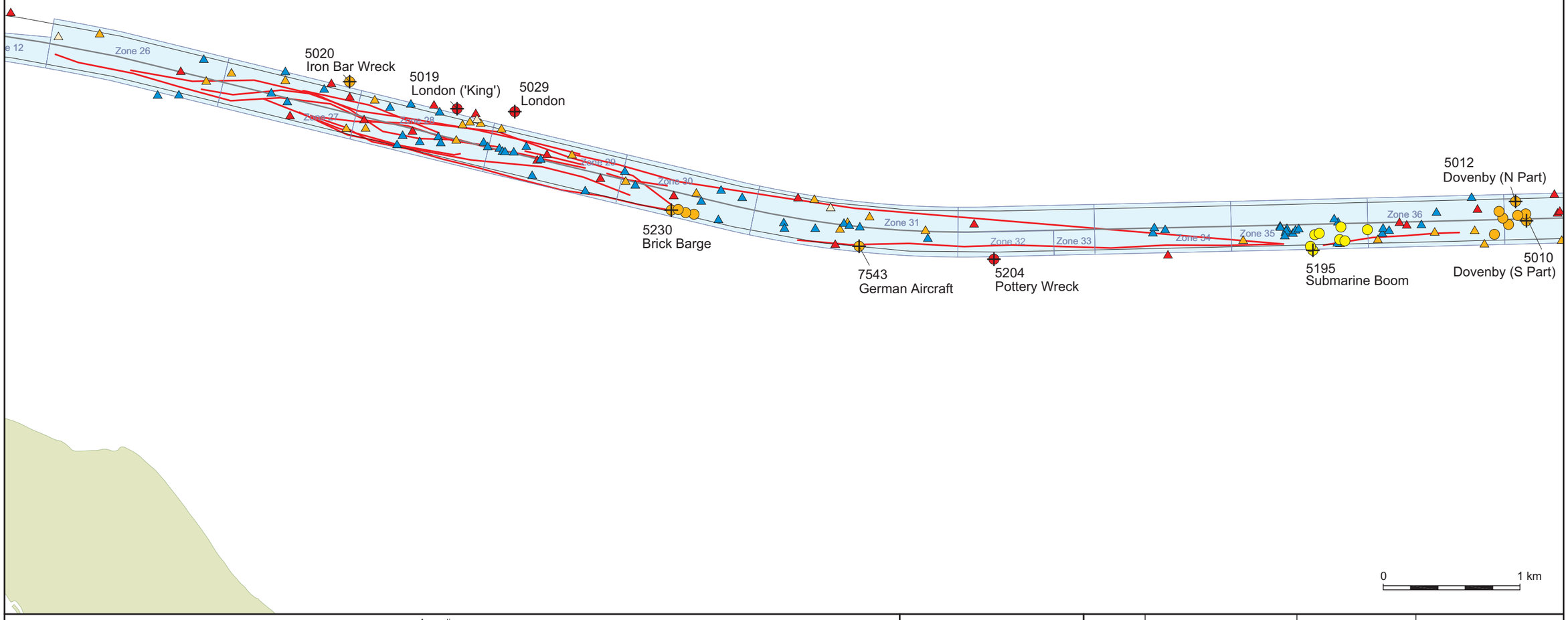
Projection: UTM WGS84 z31N

Date:	07/06/11	Revision Number:	0
Scale:	1:250,000 1:1000 @A3	Illustrator:	KJB
Path:	W:\Projects\London Gateway\LG 2011\Drawing Office\Report figs\72436\WB		

Location and Multibeam data for Site 7543



19/02/2011



Wessex Archaeology

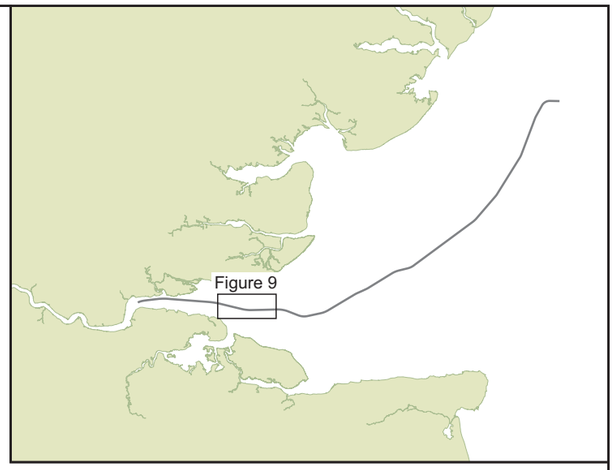
Channel centre line
Channel toe lines
Dredging zones
STRIKE_8007_Carronade
Sites subject to CMS

Anomalies:
2.1.1 - Site of certain archaeological interest
2.1.2 - Site of probable archaeological interest
2.1.3 - Site of possible archaeological interest
2.1.4a - Uncertain - ?bed feature
2.1.4b - Uncertain - ?debris
2.1.4c - Uncertain - ambiguous
2.1.4d - Uncertain - ?archaeological feature

Date:	28/04/11	Revision Number:	0
Scale:	1:30,000 @A3	Illustrator:	KJB
Path:	W:\Projects\London Gateway\LG 2011\Drawing Office\Report figs\72436Dredging WB		

Known wrecks and anomalies with track-plot STRIKE_8007_Carronade

Figure 8



19/02/2011

Zone 26
Zone 27
Zone 28
Zone 29
Zone 30
Zone 31
Zone 32
Zone 33
Zone 34
Zone 35
Zone 36
Zone 37

5020
Iron Bar Wreck

5019
London ('King')

5029
London

5230
Brick Barge

7543
German Aircraft

5204
Pottery Wreck

5195
Submarine Boom

5012
Dovenby (N Part)

5010
Dovenby (S Part)

0 1 km

Wessex Archaeology

Channel centre line
Channel toe lines
Dredging zones
STRIKE_8008_Mauser
Sites subject to CMS

Anomalies:
2.1.1 - Site of certain archaeological interest
2.1.2 - Site of probable archaeological interest
2.1.3 - Site of possible archaeological interest
2.1.4a - Uncertain - ?bed feature
2.1.4b - Uncertain - ?debris
2.1.4c - Uncertain - ambiguous
2.1.4d - Uncertain - ?archaeological feature

Date:	28/04/11	Revision Number:	0
Scale:	1:30,000 @A3	Illustrator:	KJB
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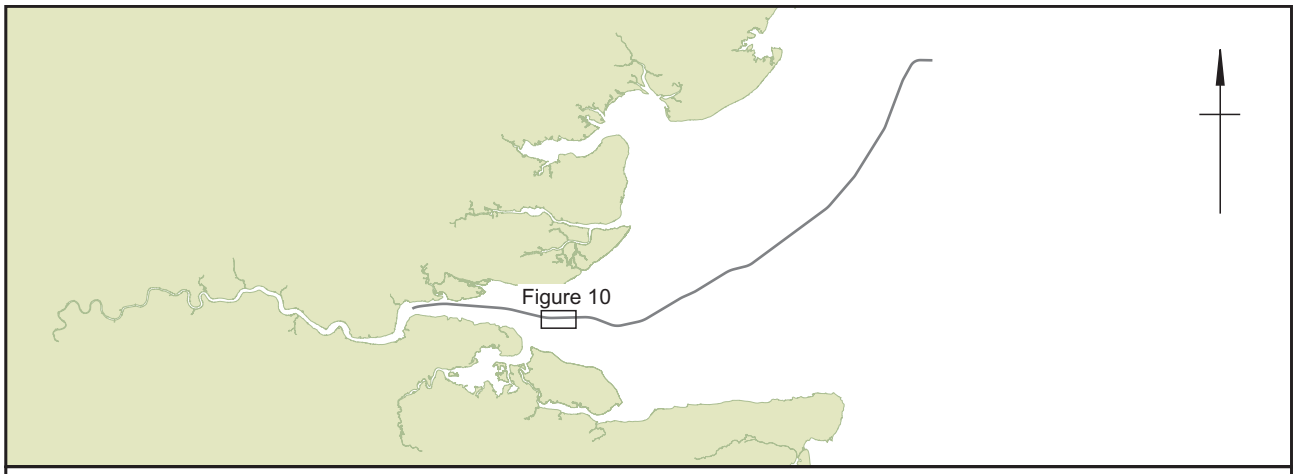
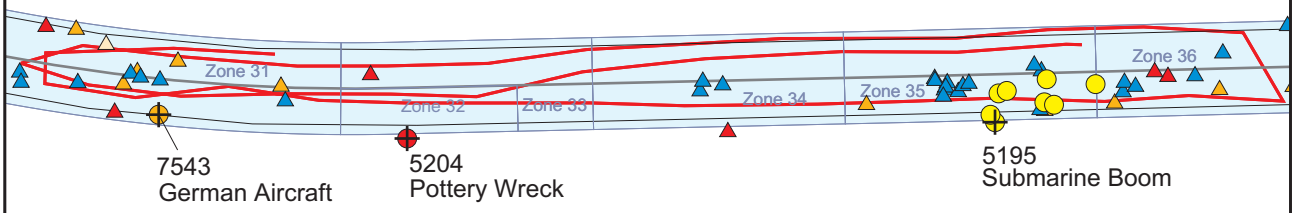
Known wrecks and anomalies with track-plot STRIKE_8008_Mauser

Figure 9



16/03/2011



Anomalies:
- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

Channel centre line
Channel toe lines
Dredging zones
STRIKE_8020_PROPHUB
Sites subject to CMS

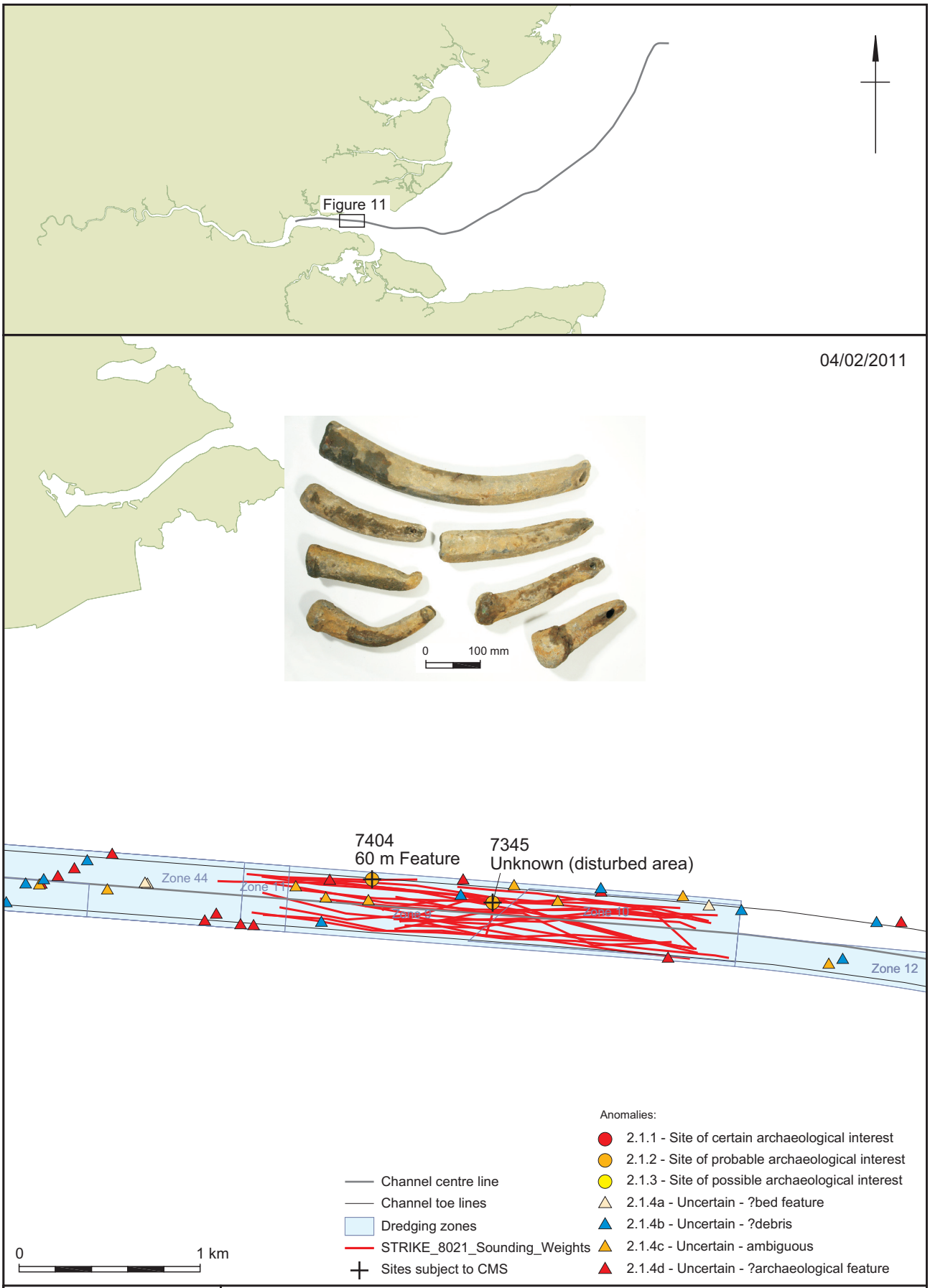
0 1 km

Date:	13/05/11	Revision Number:	0
Scale:	1:30,000 @A4	Illustrator:	KJB
Path:	W:\Projects\London Gateway\London Gateway 2011\Drawing Office\Report figs\72436\Dredging WB		

Wessex Archaeology

Known wrecks and anomalies with track-plot STRIKE_8020_PROPHUB

Figure 10

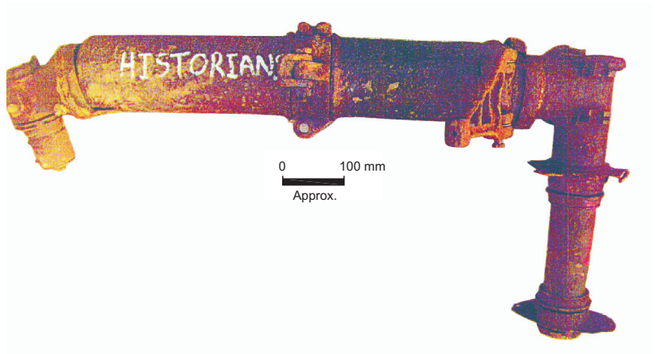


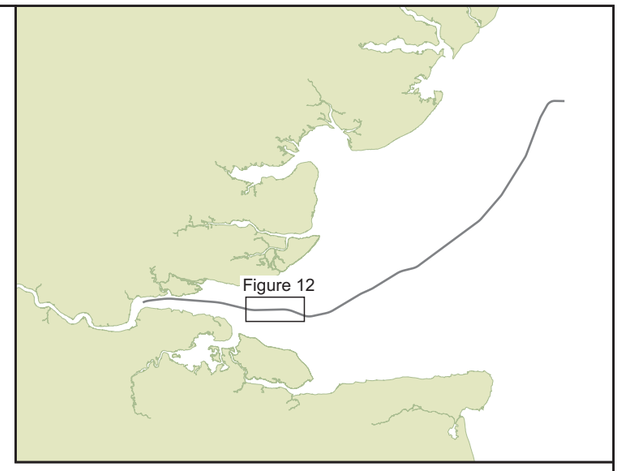
Date:	18/05/11	Revision Number:	0
Scale:	1:30,000 @A4	Illustrator:	KJB
Path:	W:\Projects\London Gateway\London Gateway 2011\Drawing Office\Report figs\72436\Dredging WB		

Wessex Archaeology

Known wrecks and anomalies with track-plot STRIKE_8021_Sounding_Weights

Figure 11





06/04/2011

5029
London

Zone 29
Zone 30
Zone 31
Zone 32
Zone 33
Zone 34
Zone 35
Zone 36
Zone 37
Zone 38
Zone 39

5230
Brick Barge

7543
German Aircraft

5204
Pottery Wreck

5195
Submarine Boom

5012
Dovenby (N Part)

5010
Dovenby (S Part)

5046
Wreck NW of Sea Reach 1

7563
Complex anomaly

0 1 km

Wessex Archaeology

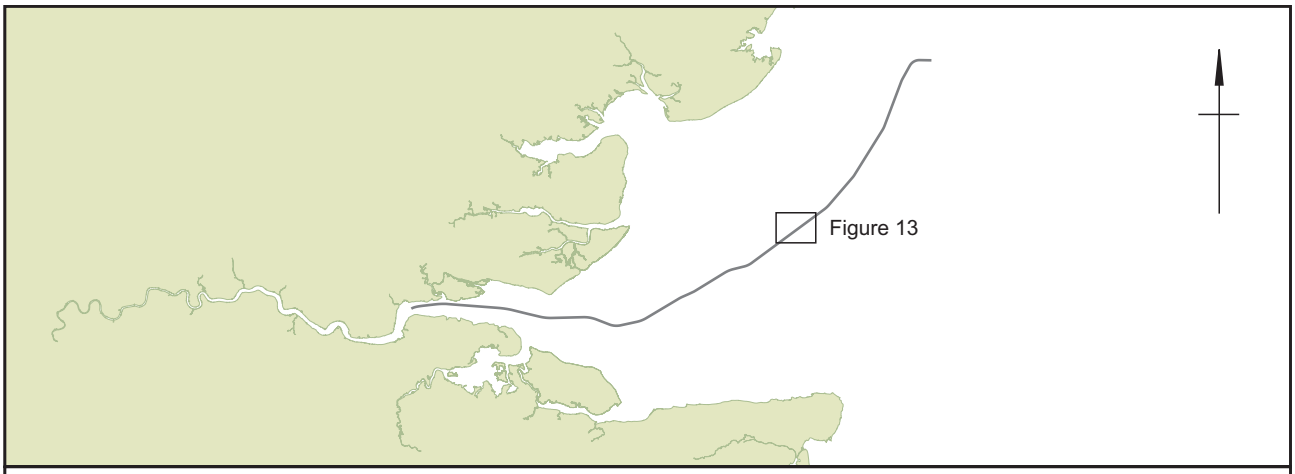
- Channel centre line
- Channel toe lines
- Dredging zones
- STRIKE_8023_Aircraft landing gear
- Sites subject to CMS

Anomalies:
- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

Date:	04/07/11	Revision Number:	0
Scale:	1:30,000 @A3	Illustrator:	KJB
Path:	W:\Projects\London Gateway\LG 2011\Drawing Office\Report figs\72436\11-05-12		

Known wrecks and anomalies with track-plot STRIKE_8023_Aircraft landing gear

Figure 12



Date:	26/09/11	Revision Number:	0
Scale:	1:30,000 @A4	Illustrator:	KJB
Path:	W:\Projects\London Gateway\London Gateway 2011\Drawing Office\Report figs\72436\Dredging WB		

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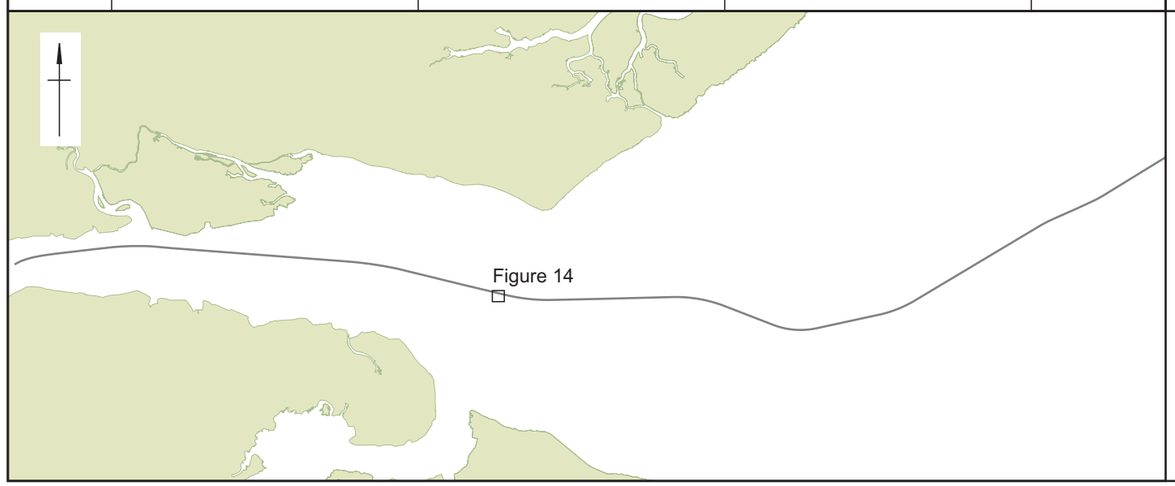
Known wrecks and anomalies with track-plot STRIKE_8024_Reconnaissance_Aircraft

Figure 13

A. Multibeam data

B. Sidescan sonar data mosaic

7451
7452
7378
5706700
5706600
5706500
5230
Brick Barge
7540
7224
7128
344200
344300
344400
344500



Channel centre line
Channel toe lines
STRIKE_8009 to 8018
Sites subject to CMS

Anomalies:
- 2.1.1 - Site of certain archaeological interest
- 2.1.2 - Site of probable archaeological interest
- 2.1.3 - Site of possible archaeological interest
- 2.1.4a - Uncertain - ?bed feature
- 2.1.4b - Uncertain - ?debris
- 2.1.4c - Uncertain - ambiguous
- 2.1.4d - Uncertain - ?archaeological feature

Wessex Archaeology

Projection: UTM WGS84 z31N

Date:	07/06/11	Revision Number:	0
Scale:	1:250,000 1:2000 @A3	Illustrator:	KJB
Path:	W:\Projects\London Gateway\LG 2011\Drawing Office\Report figs\72436\WB		

Multibeam and sidescan sonar data for STRIKE_8009 to 8018

Figure 14

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